Green Infrastructure and Low Impact Development Evaluation and Implementation Plan

Final Report

Prepared for the Town of Webster, NY

November 2011

GHD

STEARNS & WHELER
CLIENTS | PEOPLE | PERFORMANCE

GENESEE/FINGER LAKES
Regional Planning Council

PROJECT MANAGER

Genesee/Finger Lakes Regional Planning Council
50 West Main Street, Suite 8107
Rochester, NY 14614
www.gflrpc.org

Brian C. Slack, AICP – Senior Planner
Jayme Breschard – Senior Planner
David S. Zorn – Executive Director

PROJECT CONSULTANT

Stearns and Wheler GHD
One Remington Park Drive
Cazenovia, NY 13035

Gregory S. Liberman, CPESC – Environmental Designer
John J. Lagorga, P.E., BCEE – Senior Project Manager, Infrastructure
Liz Moran, Ph.D., EcoLogic, LLC

This project has been funded by the American Recovery and Reinvestment Act with support from the New York State Department of Environmental Conservation and New York State Economic Recovery and Reinvestment Cabinet. For more information, please visit: www.recovery.gov, www.dec.ny.gov or www.recovery.ny.gov.

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 Webster. These findings are intended for use by the Town of Webster 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 Webster 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 Webster. 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:

- Focus on decreasing stormwater and loads to the Shipbuilder's Creek watershed, a 303(d) waterbody
- Further the Town's compliance with NYS stormwater regulations and improve its local stormwater program
- Local demonstration projects to educate DPW 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 identified in Webster by G/FLRPC staff and Town staff:

1. Town hall
2. Finn Park
3. Friar Tuck Lane
4. Empire Boulevard

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

Shipbuilder's Creek and Mill Creek. 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.

The following four sites were reviewed:

1. **Town Hall.** There are a few areas of erosion and scour along the creek at the Town of Webster Town Hall, adjacent to Webster Park. The creek, a tributary to Irondequoit Bay, runs between the parking lots and the athletic ball fields and has been scoured during recent storm events. The Town has been able "patch" the scoured area with stone and armour to prevent additional erosion. However, a complete bank stabilization project would be effective to reduce long-term erosion and scour and limit the need for ongoing maintenance.

   The retrofit project includes the construct bank stabilization on approximately 250 linear feet of eroded bank on the east side of the creek. The work would involve regrading the steep eroded bank to a more stable grade. The surface of the regraded bank would be stabilized with a stone toe. The upper banks would be protected with either stone or a bioengineered practice, such as vegetated geolifts. Effort should be made to coordinate aesthetics of the park with the final appearance of the stabilized bank. The stabilized bank could result in substantial local water quality improvements by reducing total suspended solids (TSS) in the Irondequoit Bay.

2. **Finn Park**. The Town of Webster has a storm easement over multiple acres adjacent to a tributary of Irondequoit Bay. This area is comprised of wooded and open meadow areas. This portion of the Creek is largely untreated runoff from a predominantly developed (paved) upstream watershed.

   The purpose of the retrofit includes construction of a stormwater wetland system northwest of the tributary to provide low-flow water quality treatment for a portion of diverted flow. The system would require a low flow diversion from the north bank. This could be as simple as a 12-inch diameter inlet pipe set at a low flow elevation, near bankfull elevation. Flow from the system would meander through a constructed 50,000 square foot constructed wetland allowing for biological uptake of nutrients and sediment deposition. A controlled outlet structure would be located at the end of wetland system discharging back to the creek. In addition to water quality improvements, the wetland system would provide opportunities for habitat enhancement and potential flood storage.

3. **Friar Tuck Lane**. The existing stormwater wetland associated with the low-density residential neighborhood at Friar Tuck Lane has become silted in and filled with an aggressive stand of Common Reed (Phragmites australis). There is an existing area of open water, the depth likely ranges from 1' to 3' deep, and the system has an existing outlet structure which discharges to a nearby storm system.

   The proposed retrofit includes the rehabilitation of the stormwater wetland to provide a robust one acre wetland system designed to current NYS Stormwater standards. This includes more area for open water, shallow vegetated shelves, and controlled release of runoff. The wetland will be planted with native species in order to facilitate biological uptake of nutrient and filter sediment.

4. **Empire Blvd.** The existing movie theatre on Empire Blvd. was selected as an opportunity to provide stormwater treatment for a highly developed area. Two options at the Empire Blvd. site were developed. These include retrofitting an existing mowed drainage swale to function as a vegetated bioswale with an underdrain and check dams, as well as the construction of a parking lot bioswale installed between parking bays.

   The site is separated from Empire Blvd. by an existing 20-foot swath of mowed lawn swale maintained by NYSDOT. This area could be retrofitted to function as a roadside bioswale with vegetation, permeable planting medium and underdrains in order to provide water quality and runoff reduction from the roadside runoff. Additionally, the parking lot near the movie theatre is expansive and could fit an internal bioswale retrofit between parking bays. This system would be approximately 6 feet wide and would treat runoff from the surround parking area. An underdrain system would connect to the nearest storm drain. Both options would improve water quality and would reduce runoff from this highly developed watershed**.**

Webster Town Hall – Bank Stabilization *Benefit Assessment Worksheet*

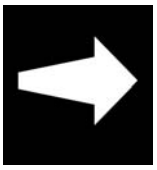
The retrofit project includes the bank stabilization on approximately 250 linear feet of eroded bank on the east side of the watercourse at the Webster Town Hall Facility. The work would involve regrading the steep eroded bank to a more stable grade and protecting with stone or bioengineering. The stabilized bank could result in substantial water quality improvements by reducing total suspended solids (TSS) in the Irondequoit Bay.

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 anticipated soils to be protected, the **estimated pounds of TN and TP prevented from entering tributary of Irondequoit Bay is removed per year is 70.2 and 18.7**, respectively.

TSS Removal

Baseline TSS contributed to the stream from this site is approximately 46,800 lbs/year based on estimated field measurements and estimated volume of erosion (cubic foot) multiplied by 78 pounds per cubic foot. Anticipating a 100 percent removal rate based on the proposed stabilization, the **estimated pounds of TSS prevented from entering tributary of Irondequoit Bay per year is 46,800.**



Nutrient Export To Impaired Waters

The project site discharges to a tributary of **Mill Creek, which is listed as an impaired water.**

Constructability/Maintenance

The constructability of the bank stabilization is **Moderate-Low**, since it is likely to require upfront engineering and environmental permitting. Also, the work may result in potential sequence issues relative to the area recreational uses. Project is not likely to require extensive routine maintenance, but may require annual monitoring.

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 (250 feet) for a probable construction cost of $50,000, resulting in an anticipated **cost per Pound of nutrients (TN and TP) and TSS prevented from entering stream of $560 and $1, respectively.**

Other Benefits

The project's proximity to a high-use recreational area creates **substantial opportunities for public education and interpretation**. Effort should be made to coordinate aesthetics of the park with the final appearance of the stabilized bank.

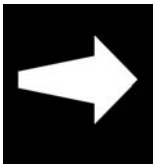
The purpose of the retrofit is to construct a stormwater wetland system to provide water quality treatment for a portion of diverted flow from a tributary to Irondequoit Bay. The system would require a low flow diversion, meandering wetland complex, and controlled outlet structure discharging flow back into the tributary. In addition to water quality, the wetland system would provide opportunity for habitat and potential flood storage.

Nutrient Removal

Nutrient loading based on a percentage of watershed, correlated to size of low-flow diversion. Baseline TN and TP are approximately 132.5 and 13.4 lbs/year, respectively. Anticipating 30 percent and 50 percent removal rate based on a stormwater wetland system, the **estimated pounds of TN and TP removed per year is 66.0 and 5.3**, respectively.

TSS Removal

TSS loading based on a percentage of watershed correlated to size of low-flow diversion. Baseline TSS for this site is approximately 1,800 lbs/year. Anticipating 80 percent removal rate based on a wetland system, the **estimated pounds of TSS removed per year is 1,500.**



Nutrient Export To Impaired Waters

The project site discharges to an existing stormwater system, which ultimately discharges to **Shipbuilder's Creek, which is considered an impaired water**.

Constructability/Maintenance

The construction of the stormwater wetland at Finn Park will require significant engineering and permitting prior to construction. Also, the project requires flow-diversions, structures, and extensive earthwork. Because of this, the constructability for this practice is considered **Low.** In addition, the project is likely to require significant long-term maintenance and monitoring.

Probable Construction Costs

A unit value of $10 per square foot for a stormwater wetland within an open area was multiplied by the conceptual size of the retrofit practice (50,000 square feet) for a probable construction cost of $500,000. This results in an anticipated **cost per Pound of nutrients (TN and TP) removed of $7,000** and **Cost per Pound of TSS removed of $330.**

Other Benefits

In addition to water quality improvement, this project could also provide for **enhanced wildlife habitat and additional flood storage**.

Webster Friar Tuck Stormwater Wetland

Benefit Assessment Worksheet

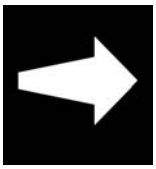
The proposed retrofit includes the rehabilitation of a stormwater wetland to provide a one-acre wetland system designed to current NYS Stormwater standards. This includes more area for open water, shallow vegetated shelves and controlled release of runoff. The wetland will be planted with native species in order to facilitate biological uptake of nutrient and sediment removal.

Nutrient Removal

Baseline TN and TP are approximately 38.6 and 3.9 lbs/year, respectively. Anticipating 30 percent and 50 percent removal rate based on a stormwater wetland system, the **estimated pounds of TN and TP removed per year is 11.6 and 2.0**, respectively.

TSS Removal

TSS for this site is approximately 525 lbs/year. Anticipating 80 percent removal rate based on a wetland system, the **estimated pounds of TSS removed per year is 420.**



Nutrient Export To Impaired Waters

The project site discharges to an existing stormwater system, which ultimately discharges to **Shipbuilder's Creek, which is considered an impaired water**.

Constructability/Maintenance

The construction of the stormwater wetland at the Friar Tuck Lane will require significant engineering and permitting prior to construction. Also, the project requires additional piping, structures, and extensive earthwork. Because of this, the constructability for this practice is considered **Low.** In addition, the project is likely to require significant long-term maintenance and monitoring.

Probable Construction Costs

A unit value of $10 per square foot for a stormwater wetland within an open area was multiplied by the conceptual size of the retrofit practice (40,000 square feet) for a probable construction cost of $400,000. This results in an anticipated **cost per Pound of nutrients (TN and TP) removed of $29,500** and **Cost per Pound of TSS removed of $950.**

Other Benefits

In addition to water quality improvement, this project could also provide for **enhanced wildlife habitat and additional flood storage.**

Webster Empire Blvd.

Benefit Assessment Worksheet

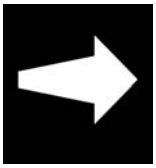
The existing movie theatre on Empire Blvd. was selected as an opportunity to provide stormwater treatment for a highly developed area. Two options at the Empire Blvd. site were developed. These include retrofitting an existing mowed drainage swale to function as a vegetated bioswale with an underdrain and check dams, as well as the construction of a parking lot bioswale installed between parking bays. The estimates listed below anticipate installation of both treatment options.

Nutrient Removal

Baseline TN and TP are approximately 64.0 and 7.1 lbs/year, respectively. Anticipating 55 percent and 60 percent removal rate based on a linear filtering bioretention design sized for the water quality volume, the **estimated pounds of TN and TP removed per year is 25.6 and 4.3**, respectively.

TSS Removal

Baseline TSS for this site is approximately 1,700 lbs/year. Anticipating an 85 percent removal rate based on a linear bioretention sized for the water quality volume, the **estimated pounds of TSS removed per year is 1,400.**



Nutrient Export To Impaired Waters

The project site discharges to an existing stormwater system, which ultimately discharges to **Shipbuilder's Creek, which is considered an impaired water**.

Constructability/Maintenance

The construction of the bioretention facilities will require some level of advanced effort for engineering and permitting. Work will need to be coordinated with NYSDOT and property owner. Constructability is considered **Moderate**. In addition, these projects are likely to require a substantial level of routine maintenance and management.

Probable Construction Costs

A unit value of $17 per square foot for a linear bioretention retrofit adjacent to existing facilities was multiplied by the conceptual size of the retrofit practice (7,700 square feet) for a probable construction cost of $130,900. This results in an anticipated **cost per Pound of nutrients (TN and TP) removed of $4,400** and **Cost per Pound of TSS removed of $95**.

Other Benefits

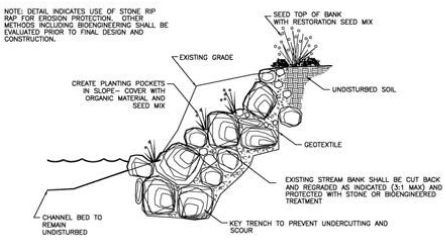
The developed watershed contains significant hot spots such as auto mechanics, and water quality enhancements at this location could provide a unique opportunity for water quality benefits. Both alternatives are proposed at a high visibility location with an urban corridor. Therefore, there is a **modest potential for public education and interpretation.**

CALLOUT AREA A
TOWN OF HALL

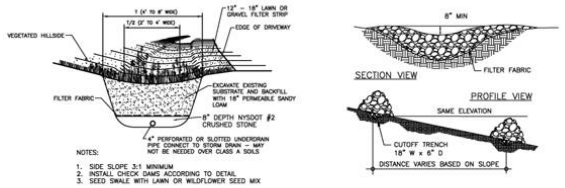
CALLOUT AREA B
EMPIRE BLVD SITE

CALLOUT AREA C
FINN PARK

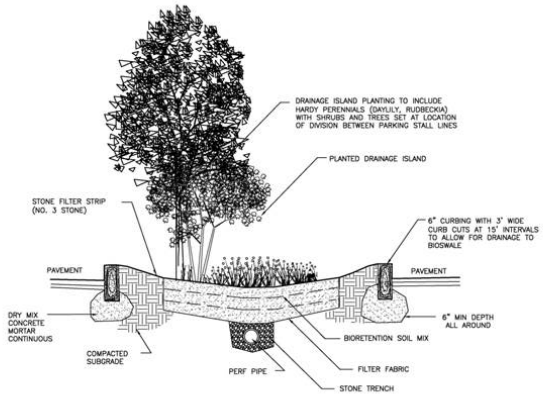
CALLOUT AREA D
STORMWATER WETLAND AT FRIAR TUCK LANE



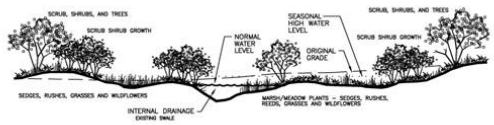
1 A BANK STABILIZATION DETAIL
DETAIL PROPORTIONAL, BUT NOT TO SCALE



1 B BIOSWALE (VEGETATIVE DRY SWALE) WITH CHECK DAMS
DETAIL PROPORTIONAL, BUT NOT TO SCALE



2 B PARKING LOT BIOSWALE
DETAIL PROPORTIONAL, BUT NOT TO SCALE



1 C.D CONSTRUCTED STORMWATER WETLAND
DETAIL PROPORTIONAL, BUT NOT TO SCALE

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

CONCEPTUAL

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

This project has been funded by the American Recovery and Reinvestment Act with support from the New York State Department of Environmental Conservation and New York State Economic Recovery and Reinvestment Cabinet. For more information, visit www.recovery.gov, www.dec.ny.gov or www.regionalcouncils.org

GHD CLIENTS | PEOPLE | PERFORMANCE
GHD Consulting Engineers, LLC
One Remington Park Drive, Cazenovia NY 13035 USA
T 1 315 679 5800 F 1 315 679 5853
E cazmail@ghd.com W www.ghd.com

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 WEBSTER, NEW YORK

Original Size: Ansi D
Drawing No:
Rev: A

Plot Date: 4 August 2011 - 9:07 AM Plotted by: Gregory S Liberman/United States/GHD/AU Cad File No: G:\86\14591\CADD\Drawings\Civil\86145\91 WEBSTER.dwg

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 Webster
Total: 54

Strengths:
- Section 11: Open Space Design
- Section 15: Open Space Management
- Section 20: Tree Conservation
- Section 21: Land Conservation Incentives
- Section 22: Stormwater Outfalls

Weaknesses:
- Section 6: Parking Ratios
- Section 12: Setbacks and Frontages
- Section 17: Buffer Systems
- Section 18: Buffer Maintenance

Areas of Opportunity
- The implementation of a buffer system could promote green infrastructure planning in the Town of Webster. A buffer is a vegetated setback that protects areas adjacent to a shoreline, wetland, or stream. The Town of Webster has shoreline along Irondequoit Bay and Lake Ontario and several steam corridors, including Shipbuilders, Four Mile, Mill, and their tributaries. Naturally vegetated buffers protect aquatic ecosystems, provide a safe conduit for flood waters, treat stormwater, prevent drainage problems, act as valuable park and recreational systems, and have a positive impact on the value of property adjacent to the buffer system. The Town of Webster

currently has a Cluster Development Ordinance that promotes open space preservation. Buffers could compliment the open space requirements of the Cluster Development Ordinance.

- *Town of Webster Comprehensive Plan Update* (December 2008) recommends additional buffer guidelines as Goal E in "Environmental Resources, Open Space, & Recreation." A good model is the three-zone stream buffer system found in Chapter 5 of the *New York State Stormwater Management Design Manual*.

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: 188-3: Minimum widths (Article 1 - Highway 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: □ 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: Chapter 188: Streets and Sidewalks □ 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: 192-21: General requirements for subdivisions (B) □ 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: 0 out of 4 points
	Can utilities be placed below the paved section of the ROW? □ Supportive language in code/ordinance Section: 192-21: General requirements for subdivisions (E) □ 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.?** 60 *ft.* □ Yes ☑ No Section: 192-21: General requirements for subdivisions (E) □ 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: Recommend inclusion with code/ordinance.	
	Are alternatives to cul-de-sacs such as "hammerheads" allowed for permanent turnarounds? □ 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: *Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts*, U.S. Environmental Protection Agency. Available at: http://www.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.pdf.	
5. Vegetated Open Channels	**Are curbs and gutters required for most residential streets?** ☑ Supportive language in code/ordinance Section: 188-3: Minimum widths □ 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 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: 190-6 and 190-21 □ 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:	

Project Findings

Code and Ordinances Worksheet Findings

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: 225-72: Off-street parking (E) 3 □ No Standard *Action:* □ Leave as is ☑ To be revised 4.5 spaces per sq. ft. for shopping centers? □ Yes ☑ No Section: 225-72: Off-street parking (E) 2 □ No Standard *Action*: □ Leave as is ☑ To be revised 2 spaces per single family home? □ Yes ☑ No Section: 225-72: Off-street parking (B) 1 □ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	Score: 0 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: *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: 225-72: Off-street parking (I) 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 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: ☑ 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.	
9. Parking Lots	**Are minimum stall dimensions for standard parking spaces 9 ft. x 18 ft. or less?** 9 *ft. x* 20 *ft.* □ Yes ☑ No Section: 225-72: Off-street parking (H) 1 □ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	Score: 3 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: *Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts,* U.S. Environmental Protection Agency. Available at: http://www.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.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: Recommend inclusion with code/ordinance.	
10. Parking Lot Runoff	**Does a minimum percentage of parking lots need to be landscaped?** ☑ Supportive language in code/ordinance Section: 225-15 (B) 6 and (C); 225-16 (B) 6 and (C); 225-18 (B) 7 and (C); 225-17 (B) 6 and (C); 225-19 (B) 6 and (C); 225-19.1 (E) 7 and (F) □ 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.	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: 190-21: General design and performance criteria □ 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: 192-27: Cluster developments □ 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: 7 out of 8 points
	Is water quality or land conservation a major goal? ☑ Yes □ No Section: 192-27: Cluster developments (B) Legislative 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: 192-27: Cluster developments (E) Applicability □ 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: 192-27: Cluster developments (E) Applicability □ 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: 192-21: General requirements of subdivisions □ 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: 1 out of 6 points
	Are reductions in frontage distances allowed where appropriate to minimize street length? □ Supportive language in code/ordinance Section: 225-11: R-3 Single-Family Residential District (B) □ 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: *Skinny Streets and One-sided Sidewalks: A Strategy for Not Paving Paradise*, Rutgers Cooperative Extension, Water Resources Program. Available at: http://www.water.rutgers.edu/Educational_Programs/Senior%20Design2008/ELC_PWP50.pdf.	

	Are reductions in setback distances allowed where appropriate to minimize driveway lengths? □ Supportive language in code/ordinance Section: 225-11: R-3 Single-Family Residential District (B) □ 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: 225-63: Sidewalks □ No Standard *Action:* ☑ Leave as is □ To be revised Notes: 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: Recommend inclusion with code/ordinance.	
	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 s □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend inclusion with code/ordinance.	
	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:	
14. Driveways	**Is the minimum driveway width 9 ft. or less (single lane) or 18 ft. (two lanes)?** _____ *ft.* _____ *ft.* □ Yes □ No Section: ☑ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	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: 192-27: Cluster developments (K) Reservation of open space lands □ 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 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: □ 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.	
	Does a minimum percentage of open space need to remain in its natural condition? ☑ Supportive language in code/ordinance Section: 192-27: Cluster developments (I) Open space ☑ 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: 192-27: Cluster developments (H) Permitted uses ☑ 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.	

16. Rooftop Runoff	**Can rooftop runoff be discharged to yard areas?** ☑ Supportive language in code/ordinance Section: 190-21: Design and performance criteria (B) 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:	Score: 2 out of 4 points
	Is temporary ponding of stormwater allowed in front yards or on rooftops? ☑ Supportive language in code/ordinance Section: 104-10: Standards and criteria (19) □ 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?_____** *ft.(minimum)* □ 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 a local buffer ordinance with 75 feet or more as minimum buffer width.	Score: 0 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: □ 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 a local buffer ordinance and/or program.	
18. Buffer Maintenance	**Does the ordinance require that the river or stream buffer remain in its natural condition?** □ 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 a local buffer ordinance and/or program.	Score: 0 out of 4 points
	Are uses in the buffer area defined by the ordinance? □ 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 a local buffer ordinance and/or program.	
	Does the ordinance specify enforcement or education mechanisms? □ 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 a local buffer ordinance and/or program.	

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: 225-8: 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: 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: ☑ 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: 225-8: (E) EPOD (3) Woodland 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: 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: 225-8: (E) EPOD (3) Woodland 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:	
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: 192-27: Cluster developments ☑ 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: 192-27: Cluster developments ☑ 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: □ 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: □ No Standard *Action*: □ Leave as is ☑ To be revised Notes:	
	Are there effective design criteria for stormwater best management practices? ☑ Yes □ No Section: Chapter 190: 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 127: 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): 54

Residential Streets and Parking Lots Score (out of 40): 17
Lot Development Score (out of 36): 21
Conservation of Natural Areas Score (out of 24): 16

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.