Slater Creek Stormwater Assessment and Action Plan

Prepared by:

Monroe County Department of Environmental Services

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Slater Creek Stormwater Assessment and Action Plan is a pilot plan of the Monroe County Stormwater Master Plan

Special acknowledgement needs to be given to the Center for Watershed Protection. Staff conducting this Report relied heavily on the concepts and strategies provided by the Center in its Urban Subwatershed Restoration Manual Series (CWP, 2004) and other reports and studies conducted by the Center. Also, this work would not have been possible without the support and cooperation of the Town of Greece, NY who provided important local knowledge and collaboration throughout the assessment process.

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List of Abbreviations

cfs	cubic feet per second (rate of water flowing)
CWP	Center for Watershed Protection
DES	Department of Environmental Services
EMC	Event Mean Concentration
EPA	US Environmental Protection Agency
GIS	Geographic Information System
GPS	Global Positioning System
H.S.	High School
ICM	Impervious Cover Model
LiDAR	Light Detecting And Ranging
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
POC	Pollutant of Concern
SWAAP	Stormwater Assessment and Action Plan
TMDL	Total Maximum Daily Load
USGS	US Geological Survey
WS	Watershed
WTM	Watershed Treatment Model

Section 1:   Introduction

1.1 Setting

Slater Creek is a 3,000 acre watershed in northern Monroe County located entirely in the Town if Greece. The stream is bifurcated with two distinct tributaries (Figure 1). To the east the stream first surfaces from storm sewers at Dewey Avenue near St. Joseph's Villa Campus and is called Veness Creek. The creek flows northward ultimately merging with Fleming Creek. To the west the stream originates in the vicinity of Mt. Read and Vintage Lane. The two branches converge just south of the Lake Ontario Parkway. The creek then flows into Little Pond, a six (6) acre waterbody that then discharges to Lake Ontario.

Slater and Little Pond both have a variety of use impairments linked to various pollutant sources, in particular, urban stormwater runoff. Land use in the watershed is primarily high density residential development with some commercial and public land use throughout. The stream is highly channelized with flows that respond quickly to rainfall.

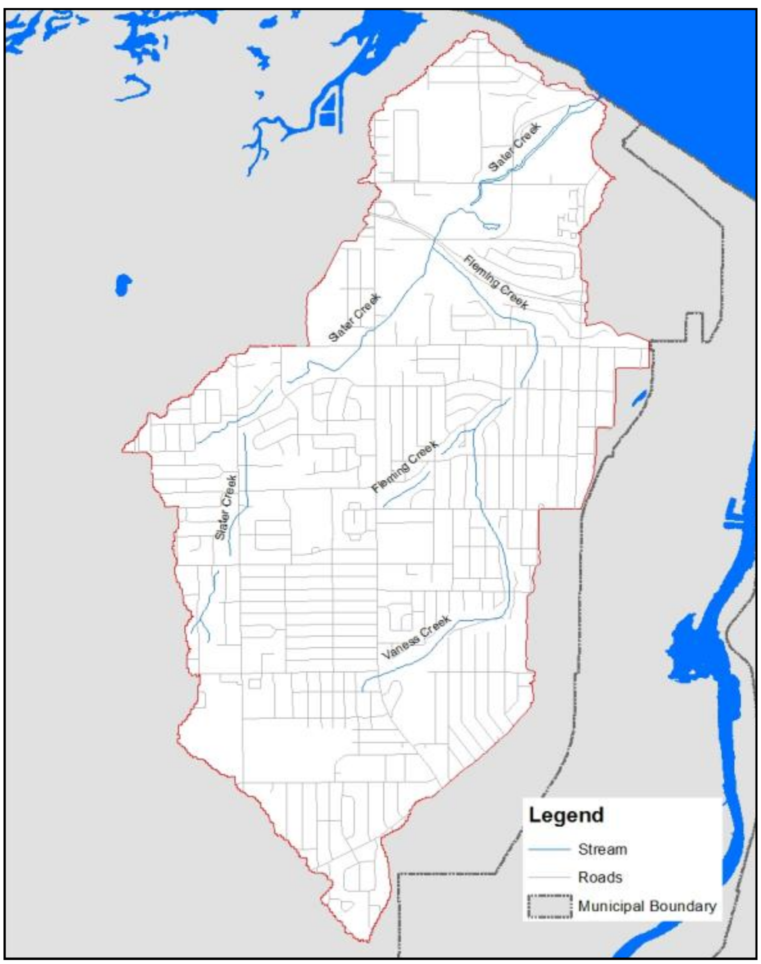


Figure 1 Slater Creek Watershed and Tributaries

1.2 Purpose

The Slater Creek Stormwater Assessment and Action Plan (SWAAP) summarizes the results of a detailed assessment of Slater Creek and presents recommendations for its protection, restoration and removal from the New York State Impaired Waterbodies List. This project was conducted with support from the Stormwater Coalition of Monroe County and the Monroe County Department of Environmental Services. This SWAAP will become a portion of a comprehensive, county-wide Stormwater Master Plan that assesses priority waterbodies in Monroe County in order to meet water quality and regulatory goals.

1.2.1 Regulatory Background

The New York State General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems, referred to as the "MS4 Permit", regulates 25 municipalities in Monroe County including the Town of Greece in the Slater Creek watershed. Impaired waters are listed in the New York State Water Quality Section 305b Report (NYS DEC, 2004). Slater Creek is listed as impaired due to urban stormwater runoff and other pollutants . Slater Creek is also listed on the New York State Section 303(d) List of Impaired/ TMDL Waters. The list identifies those waters that do not support appropriate uses and that require development of a Total Maximum Daily Load (TMDL) or other restoration strategy.

Below is a summary of impacted uses, Pollutant Types and Sources taken from the 2004 Waterbody Inventory Sheet:

Water Quality Problem/Issue Information (CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
FISH CONSUMPTION	Impaired	Known
AQUATIC LIFE	Impaired	Known
Habitat/Hydrolgy	Stressed	Known
Aesthetics	Stressed	Known

Type of Pollutant(s)

Known:	D.O./OXYGEN DEMAND, Aesthetics (floatables, odors), Priority Organics (PCBs, mirex, dioxin)
Suspected:	Water Level/Flow, Nutrients, Oil and Grease, Pathogens, Silt/Sediment
Possible:	Metals, Salts

Source(s) of Pollutant(s)

Known:	URBAN/STORM RUNOFF
Suspected:	TOX/CONTAM. SEDIMENT, Hydro Modification, Landfill/Land Disp.
Possible:	Atmosph. Deposition, Deicing (stor/appl)

1.3 Goals and Objectives

Goals are general statements of purpose or intent that express what watershed planning will accomplish. Establishing goals can be an iterative process whereby goals are updated, revised and expanded as the planning and stakeholder involvement process matures. Proposed goals are listed here to be used as a starting point for future efforts in the watershed.

- Reduce nutrient and bacteria pollution to Slater Creek by addressing priority nonpoint pollution sources.
- Increase understanding and awareness of watershed issues and promote action and stewardship responsibilities among commercial and residential stakeholders.
- Mitigate stormwater impacts on water quality from new and existing development.

1.3.1 Stakeholder Involvement

Watershed planning is driven by the goals of those that care for the watershed. Aligning the efforts and resources of stakeholders towards common goals is critical to the adoption and implementation of any watershed plan. Stakeholders can generally be grouped into four broad categories that include the public, agencies, watershed partners and potential funders. For the purposes of this document the primary stakeholders have been state, local and county municipal and agency officials. As efforts increase towards achievement of the watershed goals it will be imperative that the public be included in the effort.

1.4 Project Scope

The scope of this project was similar to that of other watershed assessments conducted in Monroe County. The primary emphasis was on gathering and interpreting watershed data thru a few simple defined methods that would allow for a concise watershed characterization:

Desktop Assessment - Extensive use of GIS and aerial imagery

Pollutant Modeling - Phosphorus, sediment, nitrogen and pathogens were modeled using the Watershed Treatment Model (WTM)

Field Study - Monroe County Department of Environmental Services (DES) and Soil & Water Conservation District staff conducted stream surveys to determine areas of heavy erosion and restoration potential

Water Quality Sampling – Six months of weekly sampling was done for a variety of nutrients, solids and bacteria. Stream segment sampling was done to isolate potential bacteria hot spots.

Retrofit Project Inventory and Ranking - An outcome of the desktop assessment was an inventory of potential restoration practices in the watershed. These practices were ranked using a matrix developed and used in other assessments.

Recommendations - To restore Slater Creek and remove it from the State 303(d) list, a number of key actions are recommended for the watershed. These recommendations provide a framework for implementing the numerous management and restoration practices identified by the assessment process.

Section 2: Watershed Characterization

2.1 Watershed Data

One of the initial tasks in developing this SWAAP was to gain an understanding of the baseline, or current condition of the Slater Creek watershed. Various Watershed metrics were assembled and are shown in Table 1.

Table 1. Watershed Data for Slater Creek

Metric	Value
Area	3,267 acres
Mapped Stream Length	8.0 miles
Primary/secondary land use	Residential
Land Use (percent of watershed)	
Agricultural	1%
Residential	62%
Vacant Land	5%
Commercial	9%
Recreation & Entertainment	5%
Community Service	8%
Industrial	1%
Public Services	6%
Wild, Forested, Conservation Lands & Public Parks	0%
# of Stormwater Outfalls	53
Current Impervious Cover (%)	29%
Estimated Future Impervious Cover (%)*	30%
Wetland acres	≈ 25 acres
Municipal Jurisdiction	Greece (100%)

*estimated 2021

2.1.1 Land Use

Like most of Western New York, the Slater Creek watershed was originally heavily forested and transitioned to agricultural in the mid to late 1800's when streams were typically rerouted around crop fields and orchards. In the 1930's through the next 60 years, agricultural land was largely replaced with residential and commercial land uses. Much of the development in the watershed occurred prior to the Town of Greece implementing its first stormwater controls in 1975. Using the New York State office of Real Property's Land Use Classification, Slater Creek watershed's current predominant land uses were determined and are shown in Figure 2. Approximately 62 percent of the Slater Creek watershed is residential, followed by 9 percent commercial/non-residential.

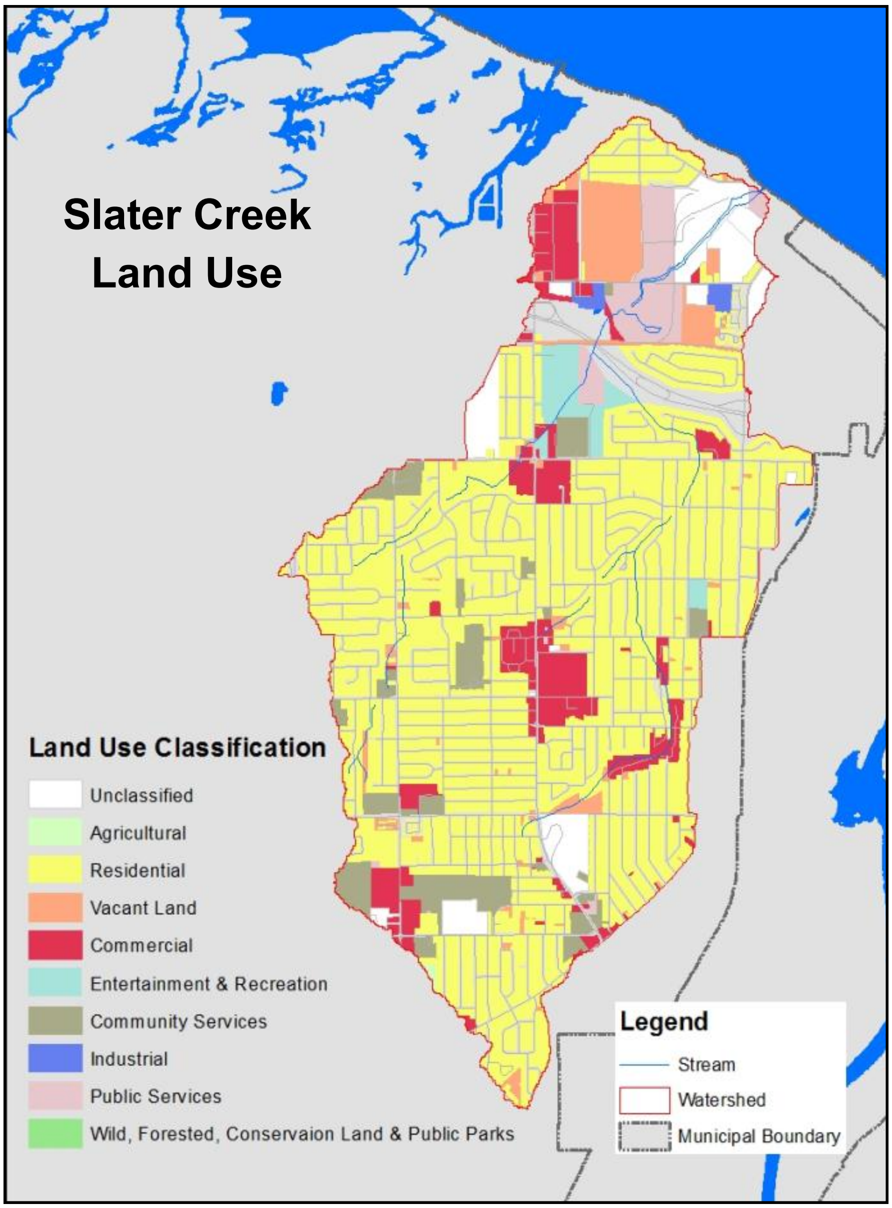


Figure 2 Slater Creek Land Use from Property Class Description

2.1.2 Water Quality

Impervious Cover Analysis

Research has shown a direct connection between the amount of impervious cover in a watershed and the receiving stream's health. Using this research, the Center for Watershed Protection created the "Impervious Cover Model" (ICM) to predict a typical stream's health. The decline of a stream generally becomes evident when the watershed impervious cover exceeds ten percent. The basic predictions of the ICM have been confirmed by a recent review of nearly 60 peer-reviewed stream research studies (Schueler, Fraley-McNeal, et al, 2008). Basically, two thirds of all the stream monitoring studies confirmed or reinforced the basic ICM relationship. As mentioned, the new studies did identify caveats on the impervious cover/ stream quality relationship spurring a reformulated ICM model to reflect this new research (Figure 3)

Both existing and future impervious cover percentages were estimated for the Slater Creek watershed. As shown in Table 1, current watershed impervious cover is 29 percent. According to the ICM, a typical stream's overall health is predicted to be non-supporting of aquatic life at this level of imperviousness. Pool and riffle structures needed to sustain fish are diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Streams in this category essentially become conduits for conveying stormwater flows.

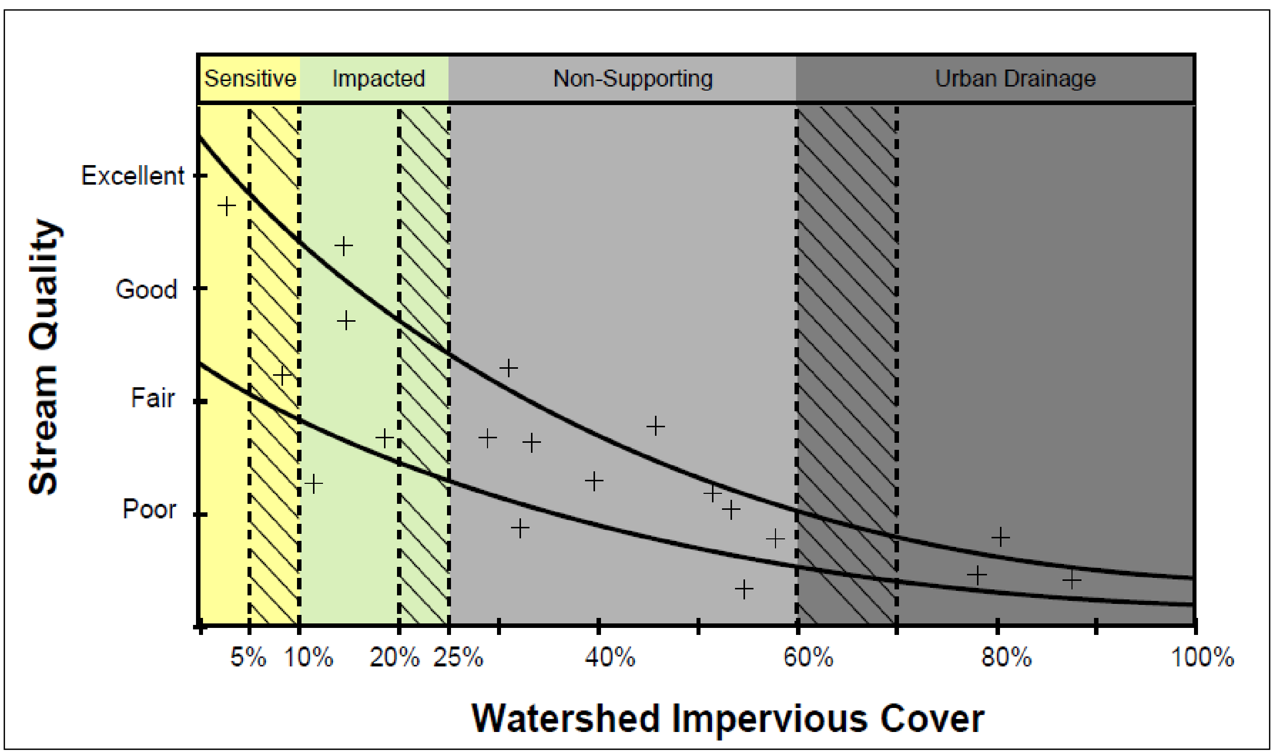


Figure 3 Relationship of Impervious Cover and Stream Health

Typical impairment indicators are increased summer stream temperature, low or no summer flows, highly unstable stream channels evidenced by severe widening, downcutting, and streambank erosion, increased bacteria levels, and low or no aquatic diversity.

Past monitoring data, summarized later in this document, tends to support the poor health of Slater Creek and verifies the ICM as the creek does not support much aquatic life and exhibits other indicators of impairment as well.

Previous Water Quality Assessments

The NYSDEC has conducted three biological assessments on Slater Creek. In 1999 and 2004 assessments were done at the stream intersection with Mt. Read Boulevard. In 2000 sites were monitored on the Fleming Creek tributary at both Britton Road and Latta Road. The Mt. Read site was listed as severely impacted on both occasions. Britton Road was moderately impacted and Latta was slightly impacted. At all locations the invertebrate fauna was dominated by sewage tolerant worms, midges, snails and sowbugs. Table 2 provides a basic summary of this data.

Table 2 Summary of NY State Biomonitoring

Site	**Date**	**Status**	**Comments**
Mt Read	1999	Severely Impacted	Sewage Strongly Indicated
	2002	Severely Impacted	Sewage Strongly Indicated
Britton	2000	Moderately Impacted	Consistent with Organic Waste Inputs
Latta	2000	Slightly Impacted	Consistent with Organic Waste Inputs

In 2004, NYSDEC published its report to the EPA entitled 30 Year Trends In Water Quality Of Rivers And Streams In New York State Based On Macroinvertebrate Data 1972-2002. Slater Creek is listed in a table titled "Ten remaining problems: severely impacted sites." This table summarizes ten streams that have substantial remaining water quality problems in New York State, as determined by the resident invertebrate fauna where all exhibit severe biological impact. Slater Creek is first on this top ten list where it states: *"severely impacted water quality was assessed for this small stream in Greece, apparently caused by sewage wastes. The invertebrate fauna was dominated by sewage-tolerant worms, midges, snails, and sowbugs. The stream is proposed for inclusion in the draft Section 303(d) list of impaired waters.*

These assessments, and the consistent evidence of sewage, provided the foundation for the inclusion of Slater Creek on the NY States 303(d) list for impaired waters.

2014 Stream Sampling Results

As part of the SWAAP, Monroe County DES conducted strategic water sampling in an effort to provide meaningful data on stream health and water quality for comparison with NYSDEC sampling . Water quality sampling involved the collection of weekly grab samples at Station 1, just south of Ling Road. and periodic segment sampling during dry (stream baseflow) and wet weather. The weekly samples were analyzed for eight water quality parameters: Total Suspended Solids (TSS); Total Phosphorus (TP); Total Kjeldhal Nitrogen (TKN); Soluble Reactive Phosphorus (SRP); Ammonia; Nitrate/Nitrite (NO_x); Chloride (CHL); and Ecoli. Sampling conducted in relation to this project follows United State Geological Survey Quality Assurance Quality Control protocols for collection and analysis of surface water. Analysis of samples includes analysis of external standards for assurance of accuracy; analysis of both laboratory and field duplicates for assurance of precision and analysis of spikes for determination of possible matrix interferences. Laboratory analysis was conducted by the Monroe County Environmental Laboratory located at the DES Frank E VanLare Wasterwater treatment Plant, a certified environmental lab (Environmental Laboratory Approval Program number 10383).

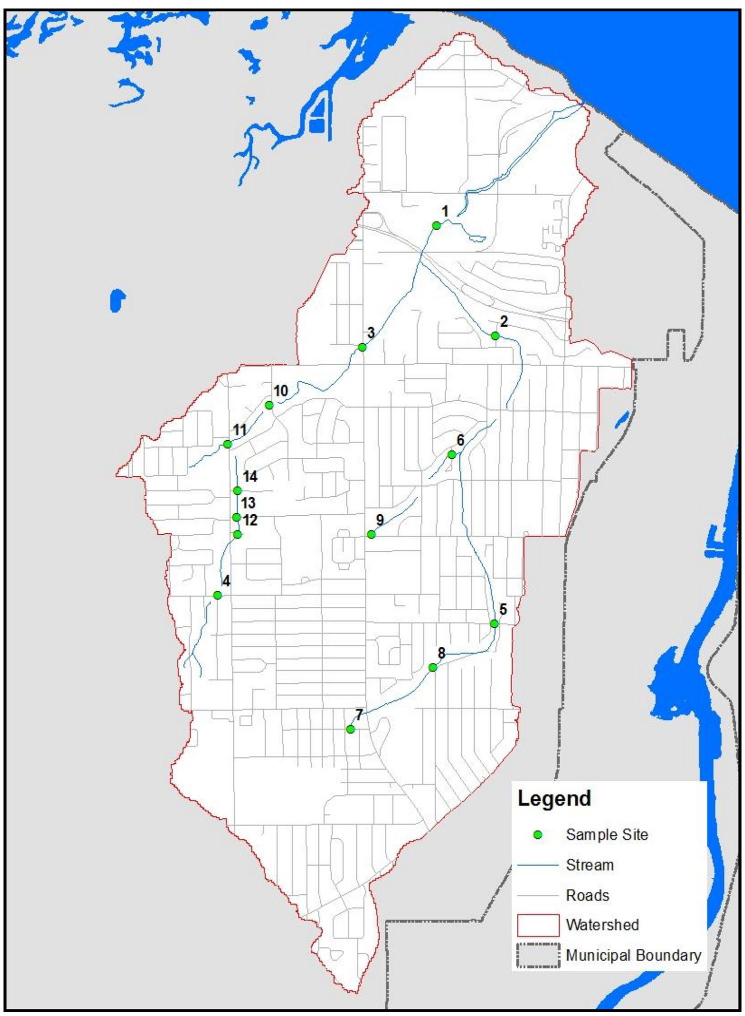


Figure 3 Sampling Locations on Slater Creek

Segment analysis samples were collected at road crossings to allow easy access to the stream and provide samples from smaller areas. Figure 3 Shows all sample locations .

Weekly grab samples were collected from June to December 2014. Figure 4 shows the weekly concentrations of Ecoli during the sampling period. Concentrations of pollutants in the baseflow of the stream are useful to identify areas with potential base flow contamination. This can then be used as a comparison to wet weather flow and pollutant concentrations. There was great variability in the weekly concentrations of Ecoli. Often this was due to runoff generated by recent rains but not always. For example, on December 9,2014, the Ecoli concentration was 20,140 MPN (Most Probable Number) but there was no rainfall recorded in the watershed. This high concentration is likely a result of an upstream cross connection or illicit discharge.

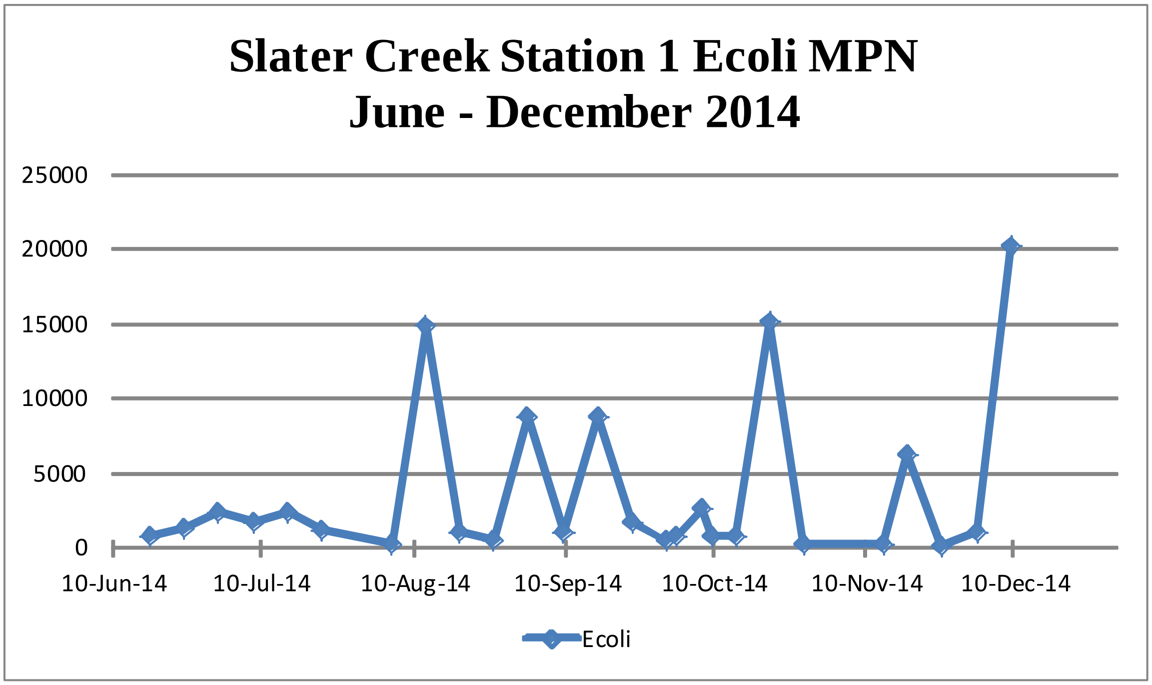


Figure 4 Weekly Concentrations of Ecoli at Ling Rd Station 1

Extended monitoring over a period of months also allows us to look at fluctuating concentration of analytes over periods of wet and dry weather. Table 3 shows two such sample dates, September 30, 2014 baseflow and July 15, 2014 wet weather event where approximately 0.85 inches of rain was recorded at a nearby rain gage. The table shows large increases in concentrations of certain pollutants such as Ecoli, total phosphorus and total suspended solids. Other pollutants show a decrease in concentration as the rain water tends to provide a dilution effect. These are typically dissolved constituents such as ortho phosphorus and ammonia. This pattern of polluted runoff is typical in highly urban watersheds where impervious surfaces provide a large source of pollutants.

Table 3 Comparison of Base Flow and Wet Weather at Station 1			
Analyte	**Sept 30, 2014 Base Flow**	**July 15, 2014 Wet Weather**	**Units**
Ecoli	520	2420	MPN/100mL
Ammonia	0.026	0.0861	mg/L
Nitrate	1.99	0.404	mg/L
Dissolved Phosphorus	0.0533	0.0423	mg/L
Total Kjeldahl Nitrogen	0.907	0.706	mg/L
Total Phosphorus	0.046	0.111	mg/L
Total Suspended Solids	4.86	52.8	mg/L

Calcium chloride, or road salts, are often thought to be contributors to poor water quality in areas of the Northeastern United States that rely heavily on road salts during winter months. The Priority Waterbody Sheet for Slater Creek lists " deicing salts" as a possible pollutant in the Creek. Figure 5 shows weekly concentrations of chloride during the six month sampling period. On several occasions levels exceeded the 250 mg/L level established by New York State for surface waters. Had this sampling been conducted between December and April, the typical salt application period, levels would have likely been consistently above that level.

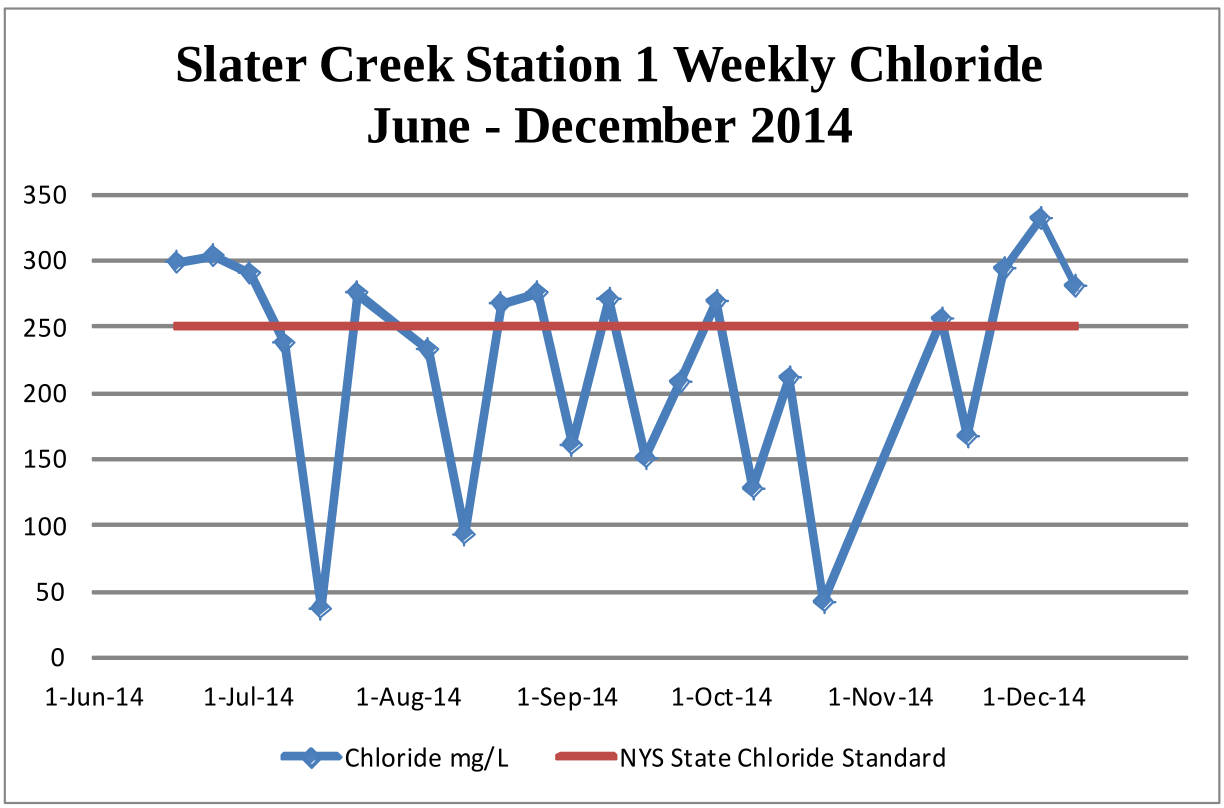


Figure 5 Weekly Chloride Concentrations in Slater Creek

While sampling at a fixed point near the mouth of the stream yielded useful data, segmented sampling was also conducted on a variety of occasions in an effort to identify bacteria "hot spots" upstream. One such sampling date on October 9, 2014, is illustrated in Figure 6. Two hotspots are clearly identified by the significantly higher Ecoli results. Site 10 on Paddy Hill Drive yielded an Ecoli value of 68,670 MPN and at site 9 on Dewey Avenue, the Ecoli concentration was 7890 MPN. Ecoli concentrations this high are indicative of wastewater in the stream. As a result, County staff will work with the Town of Greece to determine the sources of the bacteria. This work will involve going into the storm sewer collection system upstream of the sample points and backtracking the bacteria signature to its source.

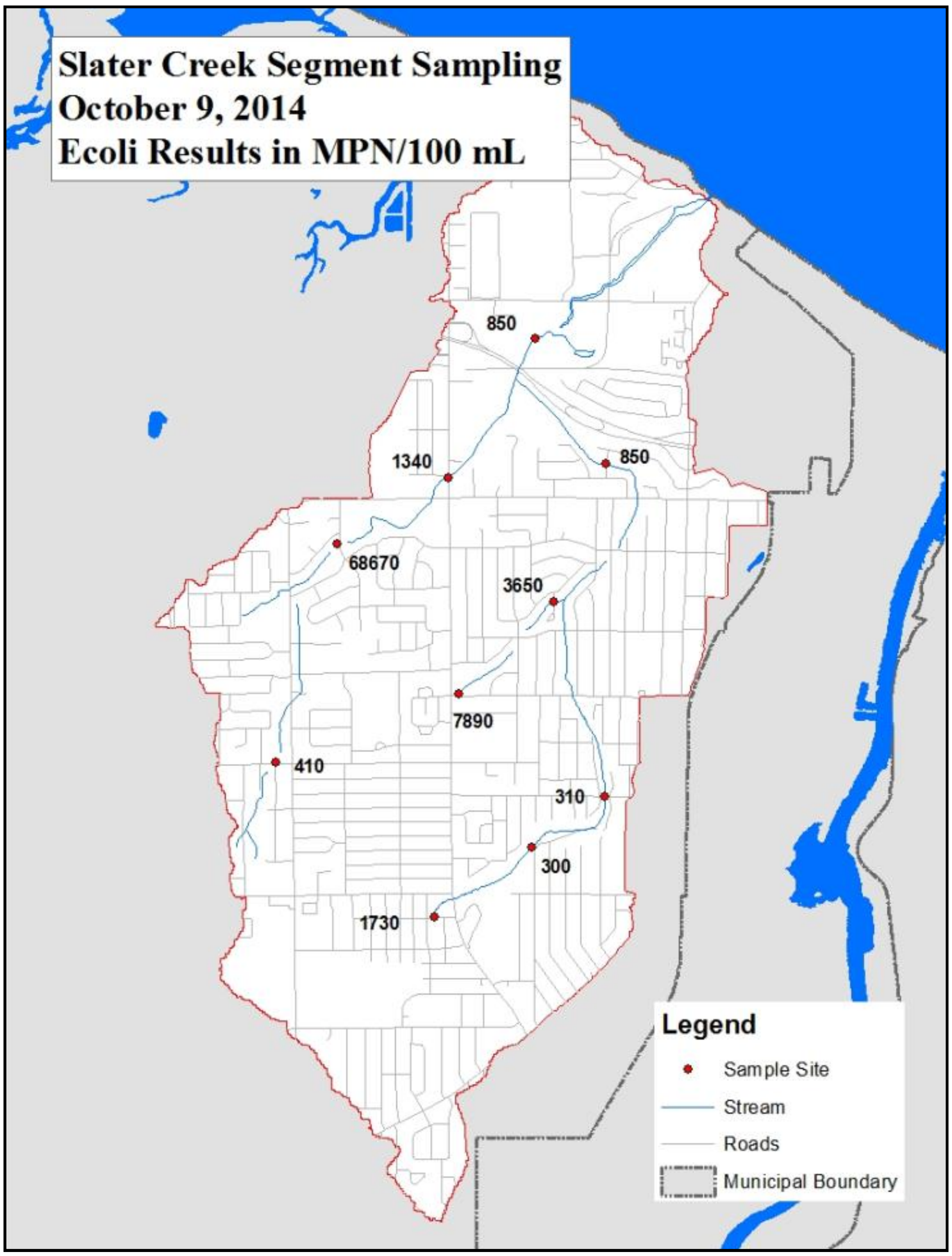


Figure 6 Segment Analysis Sample Results

Cross Connections

A cross connection occurs when the sanitary waste of a parcel is connected to the storm sewer. This can have very adverse impacts on surface waters. The United States Environmental Protection Agency (US EPA) estimates that a family of four uses approximately 400 gallons of water a day with 27% of that use coming from the toilet. When a home is cross connected, all the water used by toilets, showers, washers, etc is being discharged to the storm sewer. In recent years a number of cross connections have been identified and repaired in the Slater Creek watershed.

In 2005 workers replacing a bridge over Slater Creek at Dewey Avenue north of Latta Road identified a suspicious discharge coming from the storm sewer. Upon further investigation by County and Town of Greece staff, it was determined that a nearby single family home on Dewey Avenue was cross connected. The connection was removed.

In 2007 staff from Monroe County Department of Transportation (MCDOT) performing routine maintenance work identified a suspicious discharge in the storm sewer in the vicinity of Mt Read Boulevard and English Road. County DES staff followed up and discovered a manhole at Mt. Read and English Rd to be cross connected. It was an unusual situation where the manhole had both a sanitary main and a storm main flowing into it. Town of Greece staff quickly eliminated the illicit discharge.

It is likely that the biological assessment conducted by NYS DEC of Slater Creek at Mt. Read Boulevard in 2004 and 1999 was impacted by the wastewater from this manhole as the discharge to the creek occurred upstream of the assessment point. (See PWL sheet Appendix B)

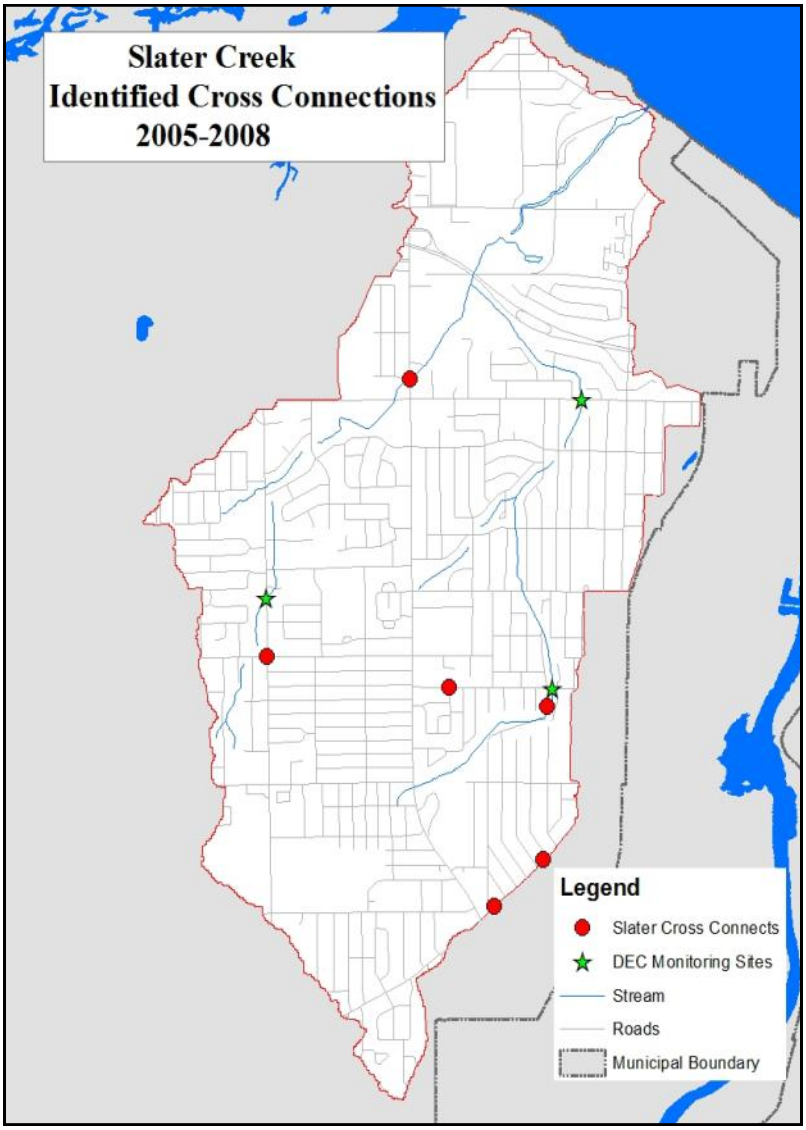


Figure 7 Slater Creek Cross Connections

In 2008 County staff conducted storm sewer outfall inspections through out the County as part of its Illicit Discharge Detection and Elimination inspection program. This work included inspections of over 50 outfalls in the Slater Creek watershed. Four additional cross connections were identified during these inspections. Two were on Britton Road and two were on Stone Road in the upper watershed of Vaness Creek. Figure 7 shows all cross connections known and repaired to date along with the NYS DEC designated biomonitoring sites.

Bacterial monitoring conducted in 2014 indicates that there are more cross connections in the watershed. The segment analysis sampling shown in Figure 6 points to two locations that warrant follow-up.

2.1.3 Biology

In 2013, County staff conducted an assessment of Slater Creek's habitat quality and biological diversity by looking at stream riparian area, substrate and benthic macroinvertebrates (aquatic insects living in the stream bed). Benthic macroinvertebrates are a common indicator of water quality in streams, rivers and lakes. The ratio and number of these macroinvertebrates change with the stream food resources and human impacts and therefore can be used as a tool for assessing the ecological status of the biotic community and water quality. Stream habitat is typically measured by examining a composite of individual habitat metrics thought to contribute to habitat quality.

The advantages of benthic macroinvertebrate sampling are numerous, but the key advantage is the invertebrates are living in the stream all the time and are subjected to all changes in water quality and habitat over the course of seasonality, storm events, and changes in the land use. This technique is widely accepted and is used by NYS DEC as an indicator of water quality across the state. Using benthic macroinvertebrate population data can give a better summary of water quality throughout the watershed, and used in conjunction with targeted water quality sampling is a good rapid approach to assess the watershed.

At each sample location, macroinvertebrates were sampled with a kick net and each species was identified and counted. The stream bed and shoreline habitat were also assessed at each location. An indicator of stream health is a *population's pollution tolerance* which groups species present into their tolerance to polluted waters. Examples of pollution intolerant species are mayflies and stoneflies. Pollutant tolerant specie examples are leeches and maggots. A second measure is the location's *water quality score* which measures species diversity and population within a species. The third measure is *habitat quality* which measures the amount of silt in the steam bed, bank stability and the width of the riparian zone (all thought to contribute to habitat quality). The quality of the habitat can be a result of many factors. Results can be found in Table 4

Table 4. Slater Creek 2011 Macroinvertebrate Sample Results

Site (upstream to down-stream)/subwatershed	Population's Pollution Tolerance	Water Quality Score	Habitat Quality
1 –Ling Road	Tolerant	Poor	Poor
2 –Velma Lane	No Macroinvertebrates	Poor	Moderate
3–Latta Roadd.(at Dewey Avenue.)	Tolerant	Poor	Poor
4- English Rd. (at Mt Read Boulevard behind Messiah Church)	Tolerant	Poor	Moderate
5- Britton Road	Tolerant	Poor	Moderate

Further verifying the ICM, the macroinvertebrate population as a whole in Slater Creek is typical of a stream in an urbanized watershed. Results indicate that the water quality was generally poor to very poor. The fauna and quality of habitat are degraded in all sections with mainly pollution tolerant and intermediate tolerant species present. Habitat scores indicated some variability between sample locations. Most locations were dominated by pollutant tolerant species and habitat scores were heavily impacted by channelization, silting in of the stream bed and a lack of vegetation along the stream bank.

2.1.4 Geology and Soils

The form of a stream, its channel, banks and floodplain are the result of an evolving series of processes influenced by geology, climate, natural events and humans. The makeup of watershed soils is important from a restoration perspective, as it relates to the potential for infiltration of stormwater. Infiltrating stormwater reduces stormwater runoff volumes and peak flows therefore reducing flooding. Infiltration also recharges groundwater that seeps down a gradient into stream channels providing a normal base flow and aquatic habitat. Once runoff is infiltrated into soils, plants and microbes can naturally filter and break down many common pollutants found in stormwater runoff, thereby improving a stream's water quality.

Underlying bedrock for the majority of the watershed is in excess of six feet below the ground surface. Where the Fleming Creek branch first daylights at Dewey Avenue, it flows through a deep ravine through soils that are deep, excessively well drained to somewhat poorly drained having coarse to medium texture subsoil that overlay sand deposits. The majority of the watershed lies within former proglacial lakes with soils termed lacustrine which are made up of fine-grained, laminated silts and clays and are generally calcareous with low permeability of variable thickness up to 50 meters (NYS Museum Surficial Geology GIS Datasets).

Soil scientists further define soils by their ability to absorb stormwater, placing each soil type into one of four categories, A through D. A and B soils are well drained. C and D soils are poorly drained. However, the predominant soil class in Slater Creek is termed "Urban Land" that denotes areas that have been so altered by land development that grouping into a specific soil type is not feasible. The amount of each soil type in Slater Creek is: A soils 0%, B soils 5%, C soils 39%, D soils 6%, and Urban Land is 50%, (Figure 8). A conservative input value for the Watershed Treatment Model completed for the watershed was to say these soils were impervious or hydrologic soil group D. Restoration project planning in all areas will need soil testing to properly design the practices.

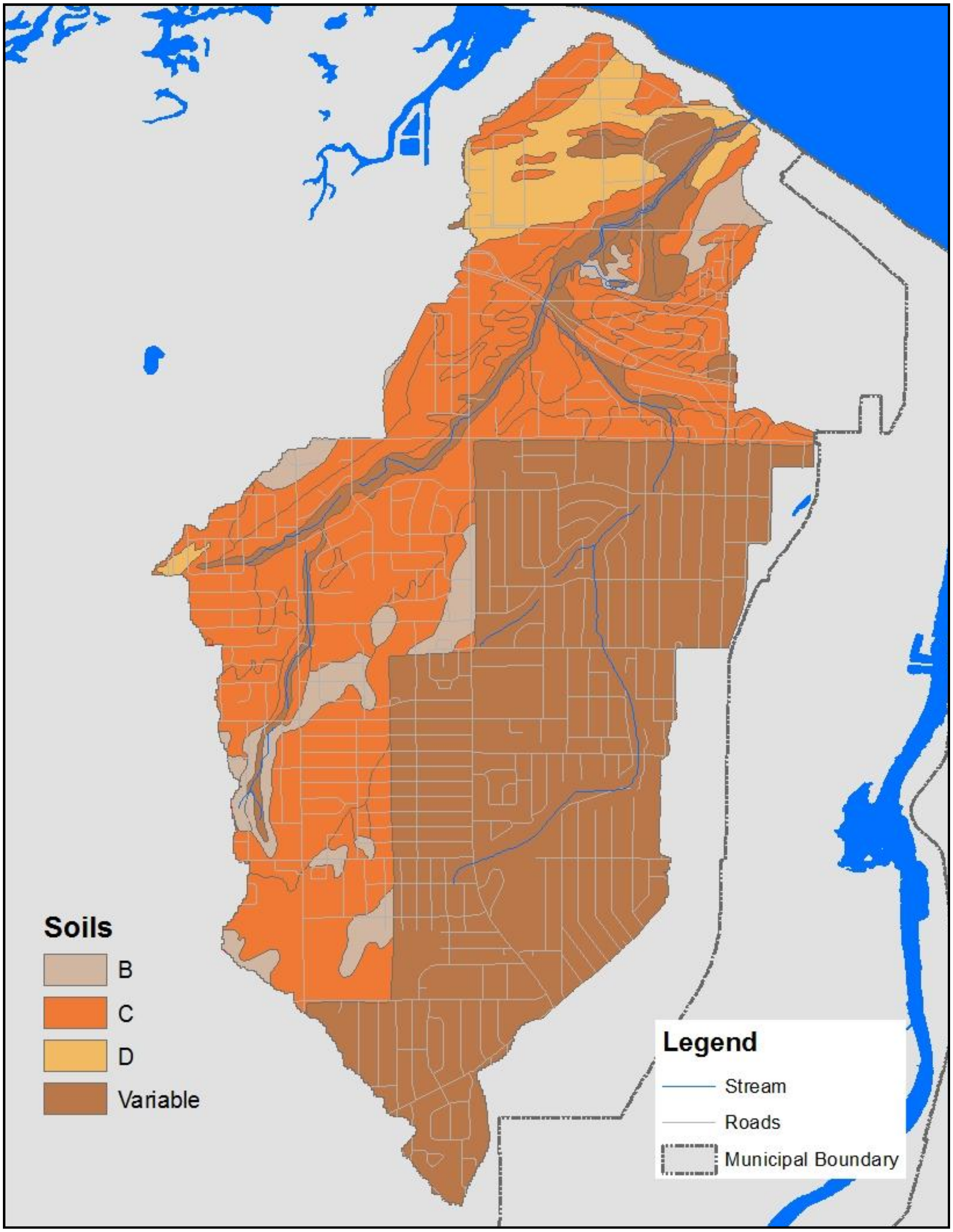


Figure 8. Slater Creek Hydrologic Soil Types

2.1.5 Drainage and Hydrology

The Town of Greece prepared a town-wide drainage study (Larsen 1974) which describes separately the two branches of the Slater Creek watershed. The main branch is the western branch originating west of Mt Read Boulevard north of Maiden Lane. It is not well defined until it flows under English Road. After it flows north east under Mt Read Boulevard, drainage problems were reported near McGuire Road. The stretch is now piped from Mt Read Boulevard to north of McGuire Road possibly to correct the drainage problem. The report states that the creek's floodplain had been developed in this area resulting in numerous drainage issues during times of heavy rainfall. The report goes on to state that there are no undeveloped areas to create stormwater storage areas.

In 2011 the Town of Greece studied the drainage issues at the confluence of Veness Creek and Fleming Creek (Erdman Anthony 2011). The area was prone to frequent flash flooding, resulting in nuisance and frequent yard repair to residents living along the stream corridor as shown in Figure 9. The goal of the study was to identify problems in the stream corridor and to decrease the frequency of flooding. Preliminary recommendations were to perform maintenance, remove obstructions, minimize debris potential, improve access, increase channel capacity, and improve performance of culverts. Although there are no specific water quality improvement measures proposed in the study, there will be some benefit to water quality from stream bank repair and flow attenuation measures.

Figure 9 Fleming Creek Near Ripplewood Drive, 2008 flooding

Dewey Avenue Corridor Improvements

In 2007 the Town of Greece conducted a study of the what is called the "Dewey Avenue Corridor". Dewey Avenue is a primary roadway that runs through the heart of Slater Creek watershed as shown in Figure 10. In general, the Dewey Avenue area consists of businesses and residential neighborhoods that are within about one half mile of the street, and contains some of the oldest commercial and residential development in the Town. (Figure 11 A and B) Study goals were the following:

1. Fill vacant and underutilized commercial spaces;
2. Improve and preserve the surrounding neighborhood's aging housing stock;
3. Revitalize the corridor's commercial districts;
4. Enhance the characteristics of the residential neighborhood; and
5. Replace outmoded public infrastructure systems and facilities.

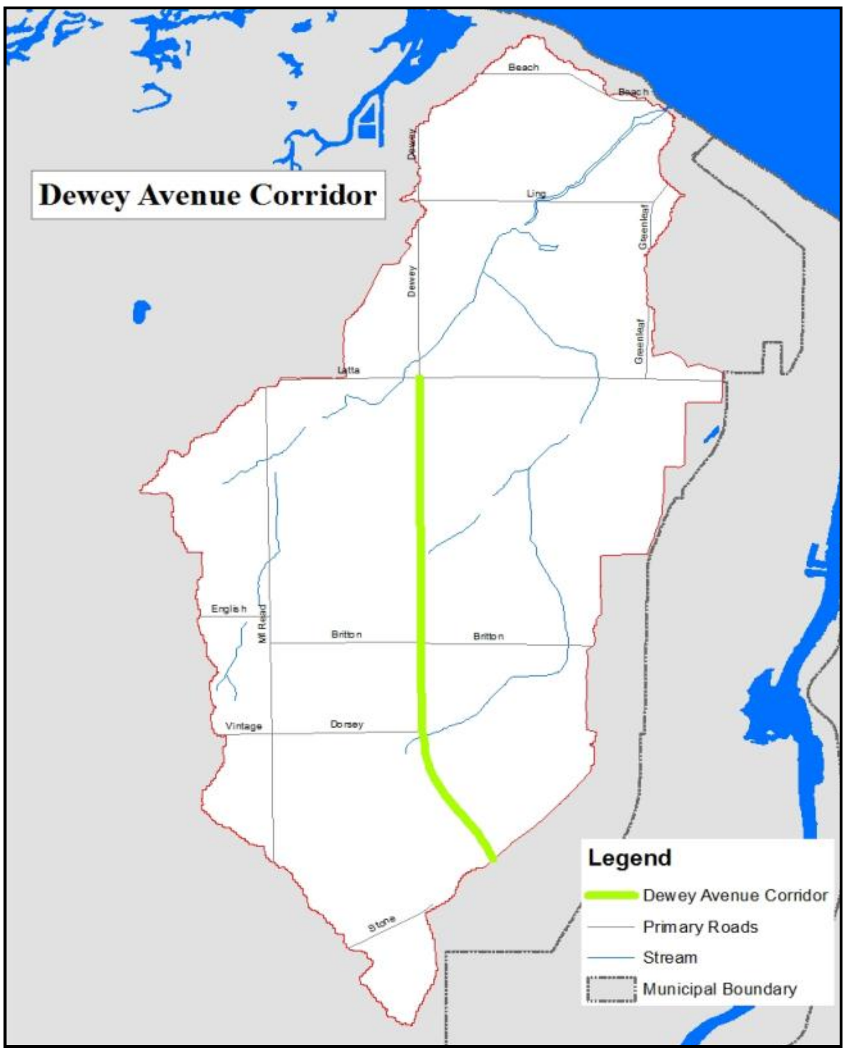


Figure 10 Dewey Avenue Corridor in Slater Creek Watershed

Figures 11 A and B Examples of Older Development in the Dewey Avenue Corridor

While the study and recommendations were not directed at stormwater, there will certainly be a net benefit to stormwater as the plan gets implemented. The proposed impervious cover reduction and open space enhancement will serve to reduce stormwater runoff and improve water quality. Figure 12 shows an example of proposed streetscape enhancements near Britton Road. Figure 13 demonstrates how redevelopment within a watershed can include improvements to water quality. The figure shows Northgate Plaza, a large multi acre parcel built well before current stormwater standards. The second photo shows the redevelopment of the plaza in 2012 that includes green infrastructure such as bioretention and swales as well as impervious cover reduction. As redevelopment occurs along Dewey Avenue we will see more of these kinds of features and the resultant benefit to water quality in Slater Creek.

Figure 12 Dewey Ave Corridor Proposed Streetscape Enhancements

Figure 13 Northgate Plaza in 2009 (above) and 2012 (below) Showing impervious area reduction and increased green space

Section 3. Water Quality Modeling Results

The Watershed Treatment Model (WTM) was used to estimate existing and future nutrient and total suspended solid loads within the Slater Creek watershed. The WTM, (Caraco, 2002), is a spreadsheet model used to:

- Estimate pollutant loading under current watershed conditions
- Determine the effects of current management practices
- Estimate potential load reductions associated with implementation of structural and non-structural management practices
- Evaluate the effects of future development

The model has two basic components: Pollutant Sources and Treatment Options. The Pollutant Sources component of the WTM estimates the load from primary land uses (residential, commercial, forest land) and secondary sources (i.e. active construction, managed turf, channel erosion, illicit connections) in a watershed without treatment measures in place. The Treatment Options component of the model estimates the potential reduction in this uncontrolled load if various treatment measures (both structural and nonstructural) are used.

The following caveats should be considered while reviewing the use of the WTM:

- The WTM is a planning level model primarily for urban/suburban applications. There are many simplifying assumptions made by the WTM, and the model results are not calibrated. Therefore, the results of the model simulations should be compared on a relative basis rather than used as absolute values. The application of existing treatment practices in the Slater Creek watershed is based on GIS data, best professional judgment, and default values associated with the WTM.

- The WTM land use primary source estimates are based on area calculations from Monroe County's GIS parcel layer. Each parcel has an attribute showing the property class description as well as lot size. The WTM impervious cover estimates were determined by the Monroe County GIS Division using the 2005 Monroe County Land Cover Model and aerial imagery. The WTM estimates were adjusted where reasonable, using best professional judgment, to align more closely with the directly measured values generated from the county impervious cover layers.

Inputs for primary and secondary pollutant sources in the watershed provided the foundation of the model. Primary sources included metrics on land use, soils and depth to groundwater. Areas of residential housing (divided by density), commercial, and industrial lands are inputs to primary pollutant sources. Vacant and park land in the watershed (5 percent) was lumped into the "Rural Land" category.

An example of a secondary source input is the fraction of illicit connections of sanitary waste to storm sewers in the watershed. Actual numbers were available since Monroe County and the Town of Greece surveyed outfalls for illicit discharges as required under their MS4 permit. Another WTM input estimates pollutant loads from sanitary sewers themselves. Monroe County GIS data was available for sanitary sewer systems in the watershed and once the length of sanitary sewer miles was tallied, WTM uses values for expected sanitary sewer overflows based on national studies of increased wet weather flow volumes. Loads are further refined with the WTM by assuming there are no combined sewers in the watershed.

The model then inputs existing management practices that are being applied in the watershed. For structural stormwater management practices, staff reviewed aerial photos with storm sewer overlays to determine where developed areas were discharging to stormwater management practices, the type of the practice, area draining to the practice, and percent of impervious cover within the drainage area.

Based on primary and secondary sources of pollutants loads and existing management practices, modeling results are listed in Table 5 for: TN, TP, TSS, fecal coliform; and, runoff volume for existing conditions.

Table 5: Existing Loads in Slater Creek Watershed

Pollutant Source	Total Nitrogen (lbs/yr)	Total Phosphorus (lbs/yr)	Total Suspended Solids (lbs/yr)	Fecal Coliform (billion/yr)	Runoff Volume (acre-feet/year)
Urban Land	18,938	4,077	464,431	678,088	3,136
Active Construction	-	-	-	-	-
Sanitary Sewer Overflow	386	64	2572	291,960	-
Combined Sewer Overflow	-	-	-	-	-
Channel Erosion	2,087	1,983	521,774	-	-
Road Sanding	-	-	-	-	-
Forest	-	-	-	-	-
Rural Land	2,680	408	58,260	22,721	-
Livestock					-
Illicit Connections	2,586	472	17,508	1,895,197	-
Marinas	-	-	-	-	-
Point Sources	-	-	-	-	-
Septic Systems	-	-	-	-	-
Open Water	-	-	-	-	-
Total Storm Load	22,558	6,378	1,039,926	846,789	3,136
Total Non-Storm Load	4,119	626	24,620	2,041,176	-
Total Load to Surface Waters	**26,677**	**7,004**	**1,064,546**	**2,887,966**	**3,136**

Section 4. Retrofit Analysis

An inventory of potential retrofit sites was generated using GIS mapping tools to locate public properties, stormwater practices like ponds, old urban areas (built before stormwater management requirements) and, pervious soil areas. Next, the appropriate stormwater management practice was determined for the properties identified and were ranked based on their feasibility, how much they would improve water quality and, cost effectiveness. While the stormwater management practice types focused on green infrastructure (stormwater volume-reducing practices such as infiltration), project types include retrofitting stormwater ponds as a highly cost-effective practice. Stormwater pond projects rank well and are a recommended component of watershed restoration. Complete details of methods used to complete the rapid assessment and retrofit ranking is explained in a reference document titled “Assessment Methodology, Project Descriptions, and Retrofit Ranking Criteria For Monroe County Green Infrastructure Rapid Assessment Plans”.

Two broad categories of retrofit project types were considered:

1. New stormwater ponds, upgrades to existing stormwater ponds and adding stormwater storage to existing drainage channels.

2. Green Infrastructure (GI). This category was divided and ranked by where a GI project might be installed and includes:
   - Public Right of Ways,
   - Older Residential Neighborhoods, and
   - Other Locations (such as areas with large impervious surfaces ie shopping malls)

Green infrastructure projects can be installed on private property as well as in the right of way on neighborhood streets, major roadways, and highways. These types of projects involve the modification of concrete channels and stormwater conveyance systems. Green infrastructure projects on private property involve the installation of rain gardens to capture and retain roof runoff. Table 6 lists project types and locations as well as how they scored. Figure 14 shows project locations within the watershed.

Due to the built out nature of the Slater Creek watershed there were limited retrofit opportunities as compared to other County water quality assessments and retrofit plans.

Table 6: Slater Creek Retrofit Ranking List					
Project Type	**Project Location**	**Feasibility**	**Environmental Benefits***	**Cost Effectiveness**	**Total Score**
Dry Pond	1801 Latta Road	4	I, FS, WQ, E	3	12
Bioretention	545 Ling road	4	I, FS, WQ, SC	3	12
Dry Pond	McKendree Drive	4	I, FS, WQ	3	11
IC	1200 Latta Road	4	I, WQ, E, SC	2	11
IC	588 Stone Road	4	I, WQ, E, SC	2	11
Dry Pond	500 Maiden Lane	4	I, FS, WQ	3	11
IC	190 Longridge Avenue	4	I, WQ, E, SC	2	11
IC	800 Tait Avenue	4	I, WQ, E, SC	2	11
Wet Pond	3737 Mt Read Boulevard	2	I, FS, WQ	3	9
Dry Pond	720 Latta Road	2	I, FS, WQ	3	9
Bioretention	3732 Mt Read Boulevard	3	I, FS, WQ	2	9
Dry Pond	Carlee Court	2	I, FS, WQ	3	9

*

I = Infiltration
FS = Flood Storage
WQ = Water Quality
SC = Source Control

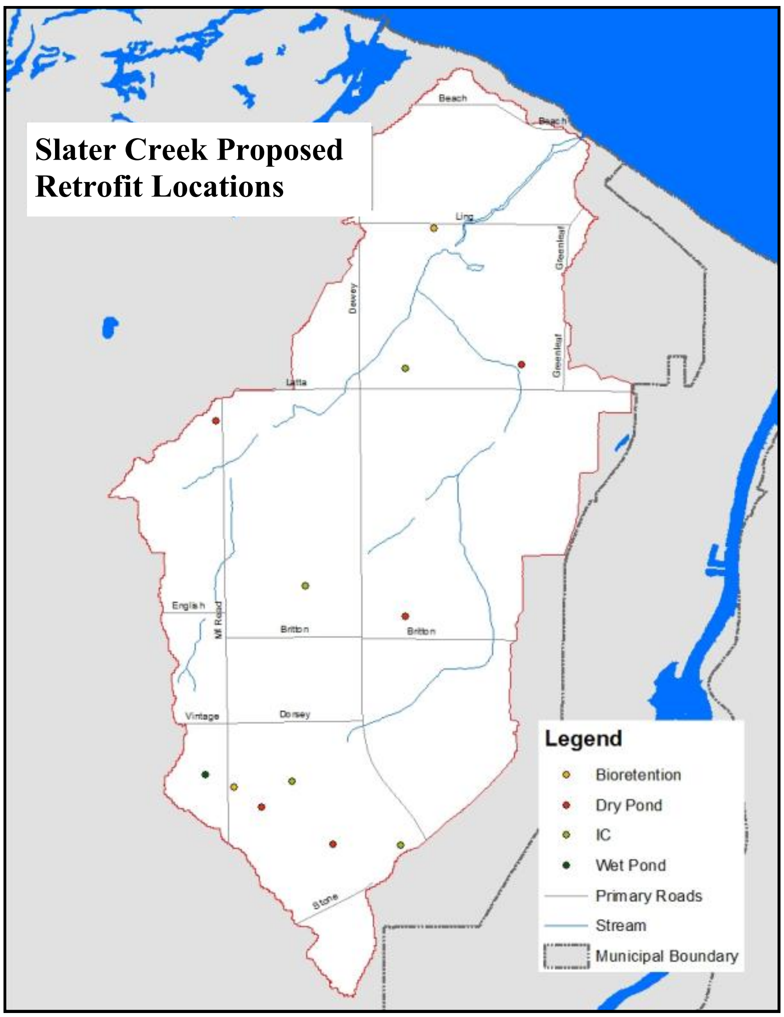


Figure 14 Proposed Retrofit Locations

Section 5. Summary

This report has provided a characterization of Slater Creek, a summary of documented impairments, evidence for the causes if these impairments and a framework for restoration and removal from the NYS 303(d) list.   A significant source of the impairment and poor water quality has been shown to be sanitary cross connections to the Creek. Many of the existing cross connections have been identified and repaired. Any remaining, cross connections, will be identified and removed following a process of illicit discharge detection and elimination.

Future management of the watershed will follow a series of short, medium and long term recommendations that if implemented, will make huge strides in improving water quality. A major focus by the Town of Greece will be implementation of the Dewey Avenue Corridor Project. Street and neighborhood enhancements will serve the dual purpose of mitigating stormwater flows and improving water quality.

Considering the current and future measures identified in this report, a case can be made for removal of Slater Creek from the NYS 303(d) list of impaired waters.

Section 6. Recommendations

5.1 Recommendations

Watershed plan recommendations are the most important element of a watershed plan, and generally consist of three parts which are described below: 1) protection and restoration projects, 2) regulatory and programmatic changes, and 3) land use changes and management approaches.

Specific recommendations were developed for Slater Creek based upon observations and findings made during the stream and watershed assessment. These recommendations are divided into short, mid and long-term recommendations. Short-term recommendations should occur with the next year and include those deemed most important or imminent to protecting the health of the watershed. Mid-term recommendations should occur within one to three years and long-term recommendations may take longer than three years to implement.

Short-Term Recommendations

Follow up on identified bacteria hot spots - An extensive sanitary survey should be conducted in the vicinity of Paddy Hill Road and the Dewey Avenue/Denise Road area.

Establish a watershed stakeholders group. A stakeholders group should be established to consider the Assessment and Action Plan and to guide future activities to ensure they reflect local interests.

Develop an enhanced pet waste program – Consistently high bacteria levels in the stream indicate high bacteria loads from non-point source runoff. Pet waste has often been indicated as a bacteria source to urban streams.

Implement small-scale priority restoration projects in Slater Creek. Of the small-scale priority restoration projects identified in Slater Creek, the short-term goal should be to seek the funding to implement one project. Small-scale projects can be performed with a low-tech engineering approach and utilize volunteer labor for installation of portions of the projects such as plantings.

Mid-Term Recommendations

Directly contact landowners of potential restoration sites to discuss possible project implementation. County and Town officials should work with other local partners to contact landowners of priority restoration projects identified in Slater Creek to solicit their interest in implementation. This will likely involve several phone calls or meetings and may necessitate obtaining additional information about the site (e.g., site plans, utility locations), working with local consulting firms to estimate costs, presenting ideas to local homeowners associations, and educating the landowners about watershed issues and the benefits of restoration.

Establish a program to conduct regular stream biomonitoring. Utilize the already established monitoring stations to continue to monitor the long-term health of the macroinvertebrate community on an annual or biennial basis. The monitoring should closely follow techniques and methodology utilized by NYSDEC

Conduct an annual State of the State of Slater Creek Watershed meeting for local partners. Invitees would include local governments, developers, businesses and watershed residents. The purpose of the meeting is to interact and talk about the latest work being done in the Slater Creek watershed and to generate interest in implementing priority projects.

Implement large-scale priority restoration projects in Slater Creek. Of the proposed large-scale priority restoration projects identified in Slater Creek, a mid-term goal should be to seek funding to implement one project. Large-scale projects require a greater degree of design and engineering, are typically more expensive and may include multiple components such as stormwater retrofits, stream restoration and riparian plantings.

Establish a program to monitor watershed restoration and protection efforts. It is important to measure and track both the short and long-term health of Slater Creek, and the success of restoration efforts. As restoration projects are implemented in Slater Creek, a monitoring plan should be considered for each project. Specifically, opportunities to measure the effectiveness of innovative restoration projects, such as bioretention or downspout disconnection, should be explored.

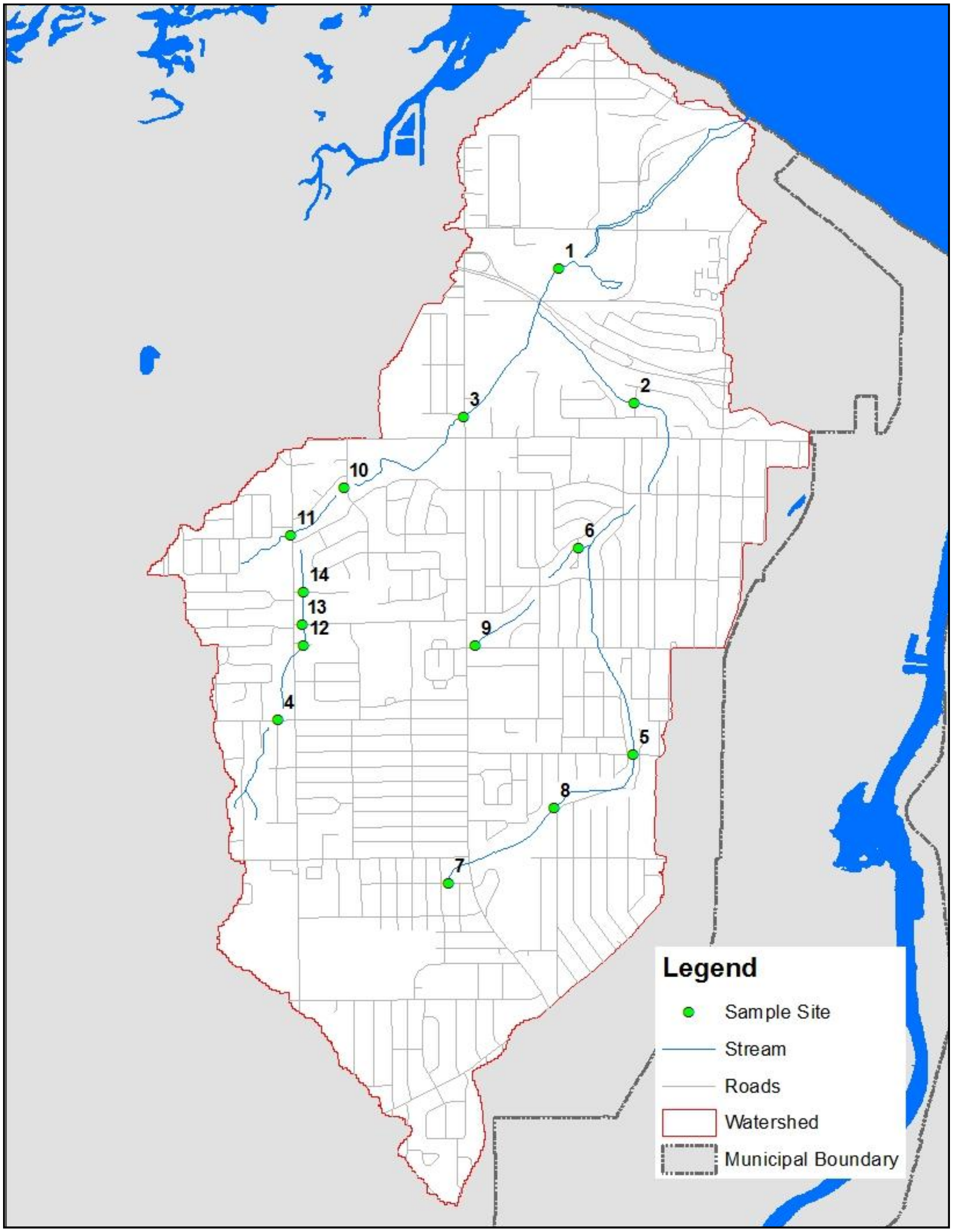
Establish a restoration committee to seek funding for implementation of stormwater restorations and stream restoration projects. This committee should have a goal of coordinating an effort to obtaining funding for large-scale and small-scale restoration projects in Slater Creek. Specific tasks include identifying potential funding mechanisms, submitting proposals for funding and/or soliciting potential funders.

Long-Term Recommendations

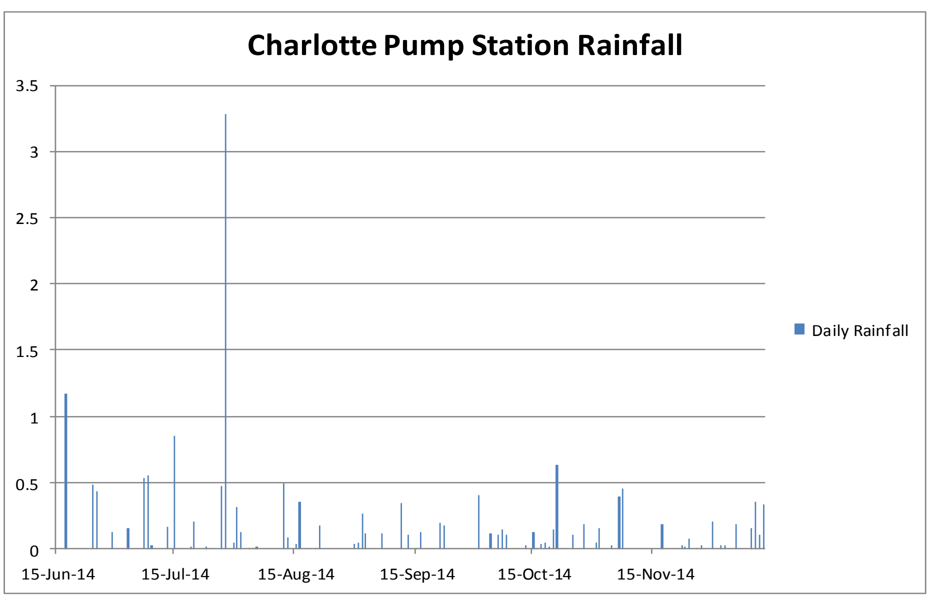
Adopt a stormwater ordinance that requires development to incorporate better site design principles including infiltration and recharge of stormwater runoff. Revisions have been adoption to the NYSDEC Stormwater Management Design Manual. The manual emphasizes innovative stormwater treatment practices termed "Green Infrastructure". There is a five-step process for stormwater site planning and practice selection in the SWPPP; site planning to preserve natural features and reduce impervious cover, calculation of the sites water quality volume, incorporation of runoff reduction techniques by applying green infrastructure, the use of standard treatment practices where applicable, and finally design of volume and peak discharge control practices. The goal is to encourage on-site stormwater management and increased groundwater infiltration as a means to minimize stormwater discharge and limit the amount of surface pollutants entering New York streams. It is recommended that the Town of Greece adopt the NYSDEC regulations in a stormwater ordinance to encourage the use of practices that provide infiltration and recharge of stormwater.

Appendix A

Slater Creek Watershed Sample Locations



Slater Creek Station 1 Weekly Sampling Data June - December 2014 mg/L								
Sampdate	Chloride	Ammonia	Nitrate + Nitrite	Ortho-phosphate	Total Kjeldahl Nitrogen	Total Phos-phorus	Total Sus-pended Solids	Ecoli (MPN/100 mL)
17-Jun-14	298	0.066	2.08	0.0321	0.492	0.0281	5.67	866
24-Jun-14	303	0.06	2.4	0.0363	0.459	0.0474	3.08	1300
1-Jul-14	291	0.0591	2.17	0.0401	0.402	0.0423	4	2420
8-Jul-14	237	0.0409	1.12	0.044	0.473	0.0535	4.6	1733
15-Jul-14	37.4	0.0861	1.59	0.0423	0.706	0.111	52.8	2420
22-Jul-14	276	0.035	0.404	0.0402	0.48	0.0382	6.91	1203
5-Aug-14	233	0.0279	2.13	0.0321	0.276	0.0252	3.78	200
12-Aug-14	94	0.0397	3.05	0.0541	0.84	0.103	17	14830
19-Aug-14	268	0.0124	1.14	0.0267	0.261	0.0238	2.4	1100
26-Aug-14	276	0.0116	2.87	0.0166	0.172	0.0275	1.54	520
2-Sep-14	162	0.0276	1.06	0.0406	0.757	0.0491	6.6	8820
9-Sep-14	271	0.0518	2.2	0.0529	0.456	0.0597	5.8	1090
16-Sep-14	151	0.0728	1.49	0.0519	0.727	0.0606	5.4	8820
23-Sep-14	208	0.0224	1.47	0.0465	0.433	0.047	4.38	1690
30-Sep-14	269	0.026	1.99	0.0533	0.907	0.046	4.86	520
7-Oct-14	129	0.0174	1.03	0.0593	0.585	0.061	6.4	2690
14-Oct-14	212	0.0265	1.44	0.0521	0.479	0.0563	2.67	860
21-Oct-14	42.2	0.044	0.542	0.0936	1.15	0.307	113	15150
13-Nov-14	256	0.0183	1.48	0.0473	0.347	0.0479	2.4	300
18-Nov-14	168	0.0384	0.814	0.0475	0.343	0.0454	1.78	6270
25-Nov-14	293	0.017	0.626	0.0439	0.576	0.0684	4	100
2-Dec-14	331	0.0184	1.22	0.028	0.577	0.086	2.2	1100
9-Dec-14	280	0.0203	1.75	0.0243	0.538	0.0436	2.6	20140



Slater Creek Ecoli Samples		
Sample Site	Sample Date	Ecoli
Slater 10	9-Oct-14	68670
Slater 10	28-Oct-14	26130
Slater 10	18-Nov-14	860
Slater 10	25-Nov-14	100
Slater 11	28-Oct-14	310
Slater 11	18-Nov-14	100
Slater 12	28-Oct-14	3320
Slater 12	18-Nov-14	1460
Slater 13	18-Nov-14	1070
Slater 14	18-Nov-14	620
Slater 15	25-Nov-14	21430
Slater 2	2-Oct-14	970
Slater 2	9-Oct-14	860
Slater 3	2-Oct-14	300
Slater 3	9-Oct-14	1340
Slater 4	2-Oct-14	200
Slater 4	9-Oct-14	410
Slater 4	18-Nov-14	980
Slater 5	2-Oct-14	1970
Slater 5	9-Oct-14	310
Slater 6	2-Oct-14	1340
Slater 6	9-Oct-14	3640
Slater 7	9-Oct-14	1730
Slater 8	9-Oct-14	300
Slater 9	9-Oct-14	7890

Slater Creek Station 1 Ecoli	
Sample Date	Ecoli MPN/100mL
17-Jun-14	866
24-Jun-14	1300
1-Jul-14	2420
8-Jul-14	1733
15-Jul-14	2420
22-Jul-14	1203
5-Aug-14	200
12-Aug-14	14830
19-Aug-14	1100
26-Aug-14	520
2-Sep-14	8820
9-Sep-14	1090
16-Sep-14	8820
23-Sep-14	1690
30-Sep-14	520
2-Oct-14	850
7-Oct-14	2690
9-Oct-14	850
14-Oct-14	860
21-Oct-14	15150
28-Oct-14	200
13-Nov-14	300
18-Nov-14	6270
25-Nov-14	100
2-Dec-14	1100
9-Dec-14	20,140

Appendix B

Slater Creek and tribs (0301-0020) — Impaired Seg

Waterbody Location Information

Revised: 04/06/2004

Water Index No:	Ont 120			**Drain Basin:**	Lake Ontario
Hydro Unit Code:	04130001/100	**Str Class:**	C		Oak Orchard/12 Mile
Waterbody Type:	River			**Reg/County:**	8/Monroe Co. (28)
Waterbody Size:	7.6 Miles			**Quad Map:**	BRADDOCK HEIGHTS (H-10-4)
Seg Description:	entire stream and tribs				

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
FISH CONSUMPTION	Impaired	Known
AQUATIC LIFE	Impaired	Known
Habitat/Hydrolgy	Stressed	Known
Aesthetics	Stressed	Known

Type of Pollutant(s)

Known: D.O./OXYGEN DEMAND, Aesthetics (floatables, odors), Priority Organics (PCBs, mirex, dioxin)
Suspected: Water Level/Flow, Nutrients, Oil and Grease, Pathogens, Silt/Sediment
Possible: Metals, Salts

Source(s) of Pollutant(s)

Known: URBAN/STORM RUNOFF
Suspected: TOX/CONTAM. SEDIMENT, Hydro Modification, Landfill/Land Disp.
Possible: Atmosph. Deposition, Deicing (stor/appl)

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 4 (Source Identified, Strategy Needed)
Lead Agency/Office: DEC/Reg8 — **Resolution Potential:** Medium
TMDL/303d Status: 3b (Waterbody Requiring Verification of Cause/Pollutant)

Further Details

Aquatic Life Support and recreational uses in Slater Creek are impaired by various water quality impacts attributed to urban runoff and suspected illegal discharges of wastewater. The habitat and hydrology of the stream are adversely impacted by channelizing/piping portions the stream and its use for stormwater conveyance. Trash, floatables, odors reduce the aesthetics of the stream. Fish consumption is also restricted as a result of a health advisory for Lake Ontario that extends to tribs up to the first impassable barrier.

A biological (macroinvertebrate) assessment of Slater Creek at Mount Read was conducted in 2004 and 1999. Sampling results indicated severely impacted water quality conditions. Sewage was strongly indicated as the primary cause of the impact, and sewage odors were noted during sampling. The invertebrate fauna was dominated by sewage-tolerant worms, midges, snails and sowbugs. No mayflies, stoneflies or caddisflies were found at the site. (DEC/DOW, BWAM/SBU, January 2006)

Biological assessments were also conducted on Fleming Creek, a trib of Slater Creek, in Greece in 2000. Sampling results indicated moderately impacted water quality conditions at a site at Britton Road, and slightly impacted conditions upstream at Latta Road. The invertebrate fauna was dominated by tolerant midges, worms, sowbugs and black flies. The community composition is consistent with organic waste inputs. (DEC/DOW, BWAM/SBU, January 2006)

Fish consumption advisories for Lake Ontario (and all tribs to the first barrier) also applies to this tributary water. A NYSDOH health advisory recommends eating no American eel, channel catfish, carp, chinook salmon, lake trout (over 25") or brown trout (over 20"). The advisory also recommends that consumption of white perch, white sucker, rainbow trout, smaller lake and brown trout, and coho salmon (over 25") be limited to no more than one meal per month. The fish consumption advisories are a result of PCB, mirex and dioxin contamination of lake sediments. The advisory for Lake Ontario was first issued prior to 1998-99. (2006-07 NYS DOH Health Advisories and DEC/DFWMR, Habitat, December 2006).

Nutrient, metals, salts, silts/sediments, oil and grease and pathogens inputs are typical of urban/stormwater runoff from the type of urban residential and commercial development in the watershed. Possible impacts from the adjacent Rochester Gas and Electric Russell Power Plant site (existing, lined coalpile and former landfill operation) are also a concern. Results of site investigations completed to date have indicated severe impacts, but the impacts have not been attributed to site leachate/runoff. An RG&E study has demonstrated that benthic macroinvertebrate impacts in the ash deposit area are similar to (if not less than) those in an upstream control area. The impacts/impairments appear to be the result of poor water quality originating upstream or factors unrelated to sediment quality in the vicinity of Russell Station. A pump and treat system to intercept, collect and pump leachate to the existing Russell Station wastewater treatment facility has been proposed to control the visible plume in the creek from the site. (Monroe County DOH/WQCC, May 2001)

This segment includes the entire stream and all tribs. The waters of the stream and tribs, including Fleming Creek (-1) are Class C. (May 2001)

Little Pond (0301-0021) — MinorImpacts

Waterbody Location Information

Revised: 06/25/2007

Water Index No:	Ont 120-P151d			**Drain Basin:**	Lake Ontario
Hydro Unit Code:	04130001/100	**Str Class:**	C		Oak Orchard/12 Mile
Waterbody Type:	Lake			**Reg/County:**	8/Monroe Co. (28)
Waterbody Size:	6.4 Acres			**Quad Map:**	BRADDOCK HEIGHTS (H-10-4)
Seg Description:	entire lake				

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	**Severity**	**Problem Documentation**
Fish Consumption	Stressed	Known
Aquatic Life	Stressed	Suspected

Type of Pollutant(s)

Known: PRIORITY ORGANICS (PCBs, mirex, dioxin), Thermal Changes
Suspected: - - -
Possible: - - -

Source(s) of Pollutant(s)

Known: - - -
Suspected: POWER GENERATION, Other Source (migratory fish species)
Possible: - - -

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 4 (Source Identified, Strategy Needed)
Lead Agency/Office: DEC/FWMR
Resolution Potential: Medium
TMDL/303d Status: n/a

Further Details

Aquatic life support in Little Pond are thought to experience impacts from a power plant cooling water discharge. Fish consumption is also restricted as a result of a health advisory for Lake Ontario that extends to tribs up to the first impassable barrier.

Fish consumption advisories for Lake Ontario (and all tribs to the first barrier) also applies to this tributary water. A NYSDOH health advisory recommends eating no American eel, channel catfish, carp, chinook salmon, larger lake trout (over 25") or larger brown trout (over 20"). The advisory also recommends that consumption of white sucker, rainbow trout, smaller lake and brown trout, and larger coho salmon (over 25") be limited to no more than one meal per month. White perch is limited to one meal per month East of Point Breeze, and eat none west of the point. The fish consumption advisories are a result of PCB, mirex and dioxin contamination of lake sediments. The advisory for this lake was first issued prior to 1998-99. (2006-07 NYS DOH Health Advisories and DEC/DFWMR, Habitat, December 2006).

A permitted cooling water discharge from the Rochester Gas and Electric Russell Station generating facility provides up to 95% of the pond flow through to the lake. The thermal impacts attributed to the discharge have a potential to impact the aquatic community in the pond. However the facility is in compliance with SPDES permit limits and adequate water quality in the stream is being maintained. RGE recently added an oil/water separator to the treatment of the discharge to the pond. (Monroe County WQCC, May 2001)

The pond also receives inputs from Slater Creek which is significantly impacted by pollutants typical of urban/stormwater runoff. The outlet of the pond in monitored by Monroe County Environmental Health Laboratory for bacteriological water quality on a weekly basis during the summer recreational season. (Monroe County WQCC, May 2001)