

Stormwater Conveyance System & Green Infrastructure Planning Project CITY OF PLATTSBURGH



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*Lake Champlain – Lake George
Regional Planning Board*

**LAKE CHAMPLAIN BASIN
PROGRAM
TECHNICAL ADVISORY
COMMITTEE**

December 3, 2014



City of Plattsburgh

The City of Plattsburgh is the largest urbanized population center on the New York shore of Lake Champlain

Population: 19,989
Area: 6.6 Sq. mi



City of Plattsburgh Background Information

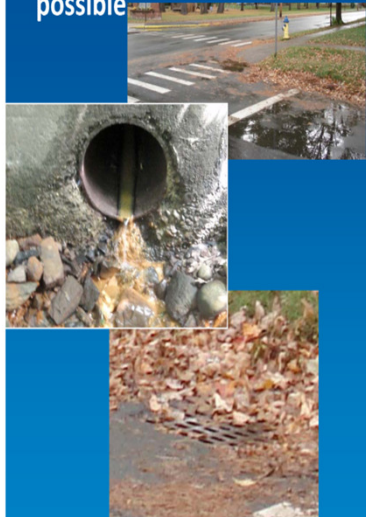
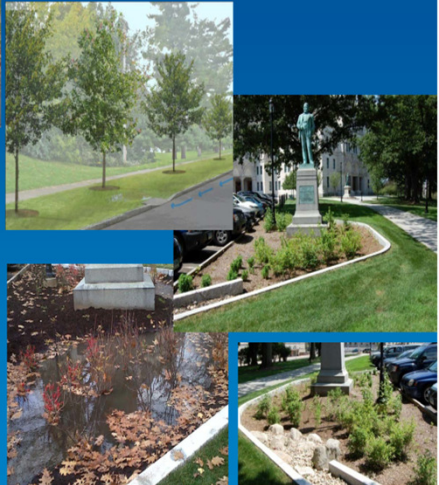
- Shoreline: 5.5 Miles
- Miles of Street: 61 miles
- Storm Sewer: 108,022 feet (20 miles)
- Sanitary/Combined Sewer: 267,000 feet (50 miles)



Project Objectives

- GIS based mapping of City Stormwater System
- Calculation of flow, storage within system and discharge
- Assess vulnerabilities
- Green Infrastructure opportunities/implementation
- Public education

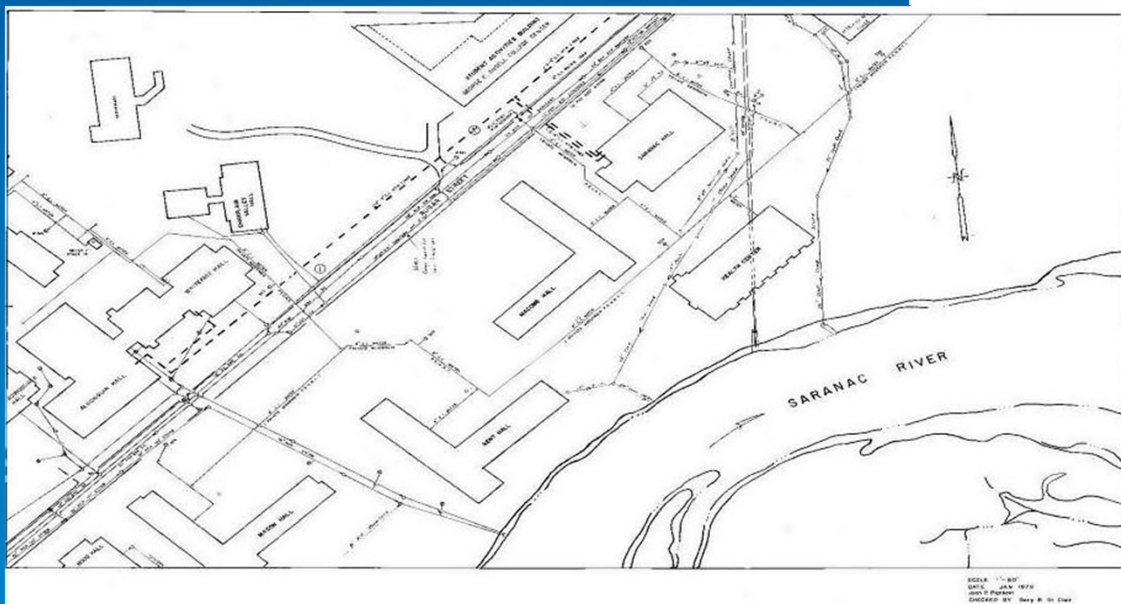
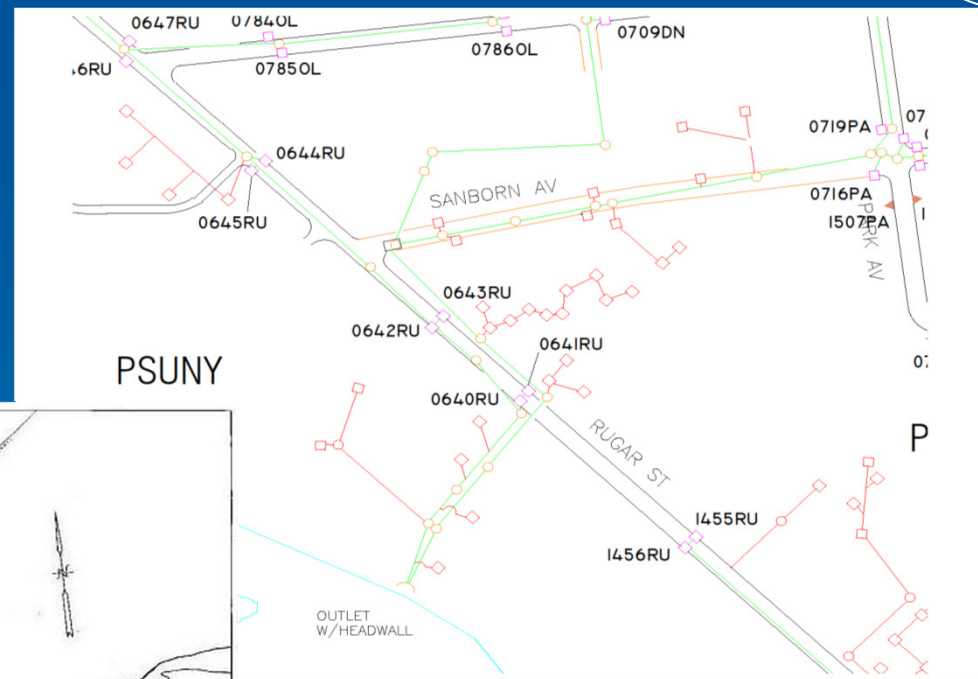
Stormwater Management

<u>Traditional (Gray Infrastructure)</u>	<u>Green Infrastructure</u>
move rain away as fast as possible	keep rain near where it falls
	

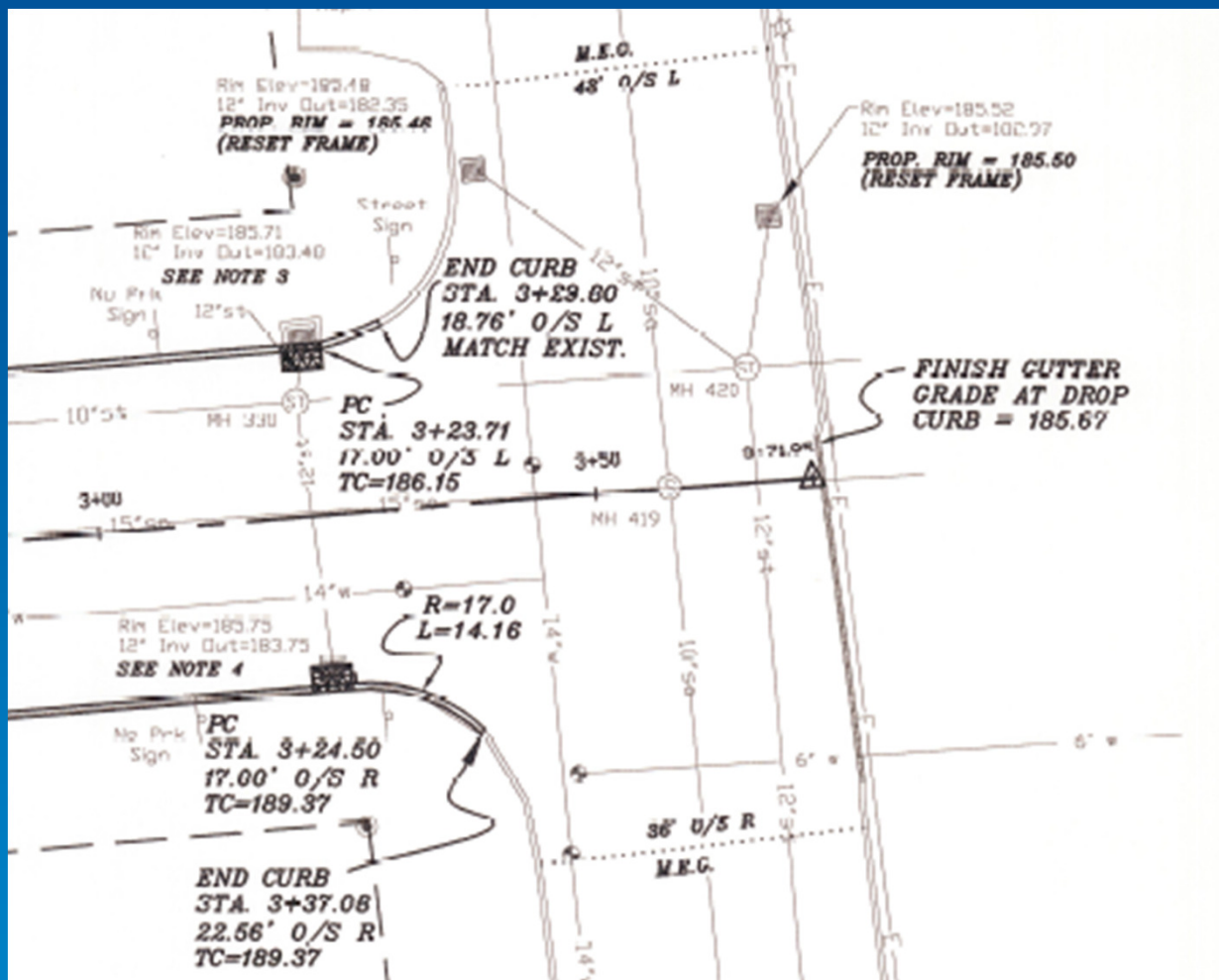
City of Glens Falls Green Infrastructure Presentation

CDM

Compile & Digitize Existing Stormwater Infrastructure Maps



Compile & Digitize Existing Stormwater Infrastructure Maps



Geometrically correct (Ortho-rectify) data

- Storm sewer manholes and catch basins data:
 - rim/invert elevation
 - Material
 - frame & grate type
- Storm sewer mains:
 - Diameter
 - Length
 - Material
 - Year installed



Complete Stormwater Infrastructure Mapping

- Geometrically correct positional discrepancies
- Field GPS Survey
 - 2,400 catch basins
 - 660 manholes



Complete Stormwater Infrastructure Mapping

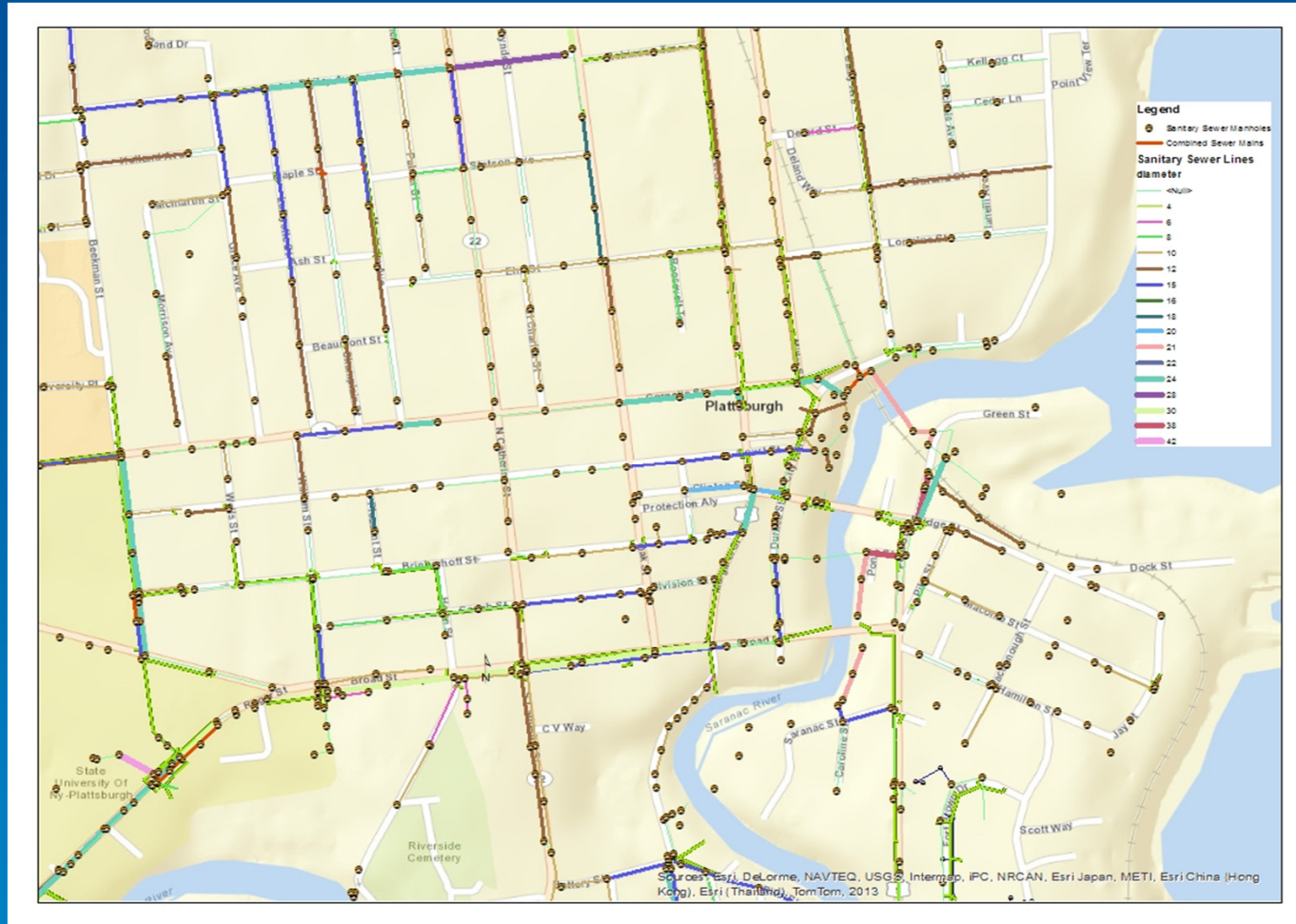
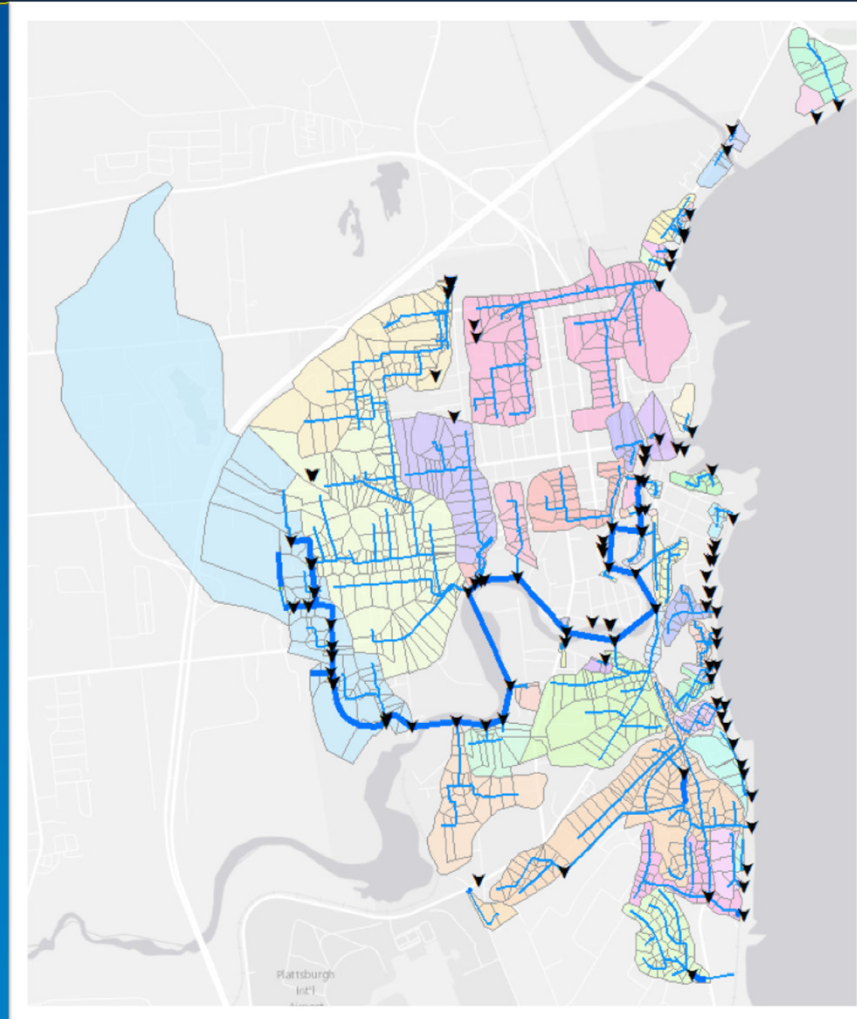
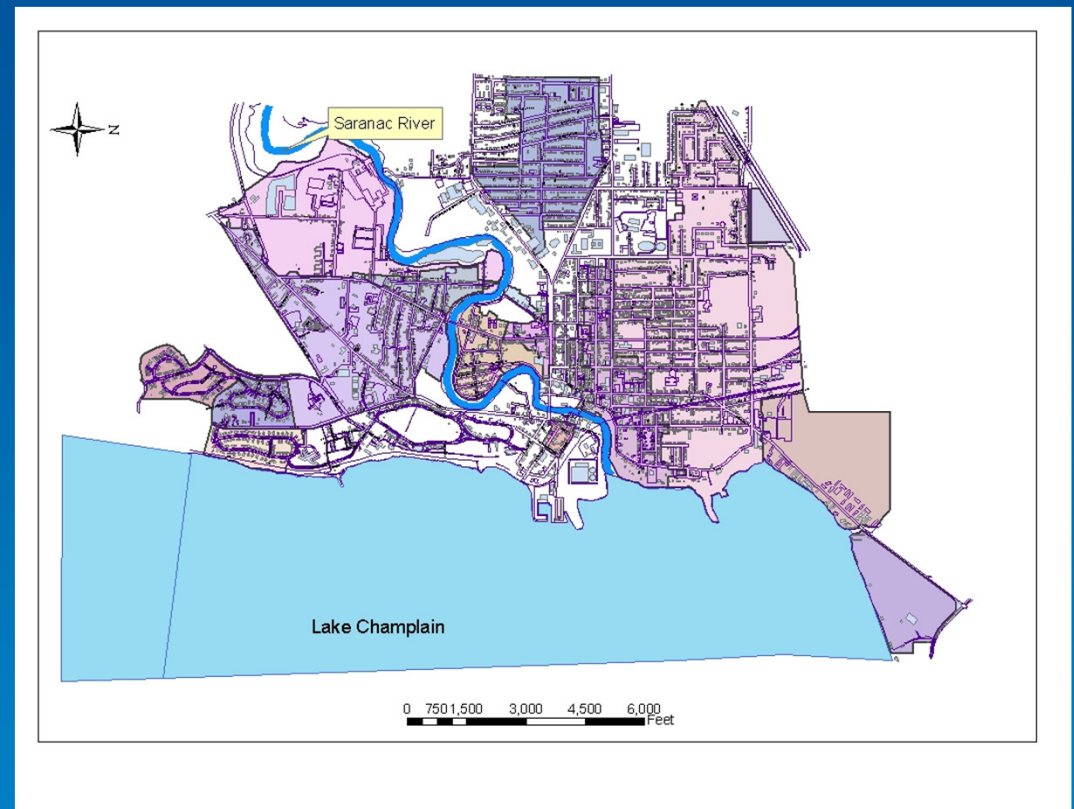


Fig. 3-2 – Modeled sub sewersheds



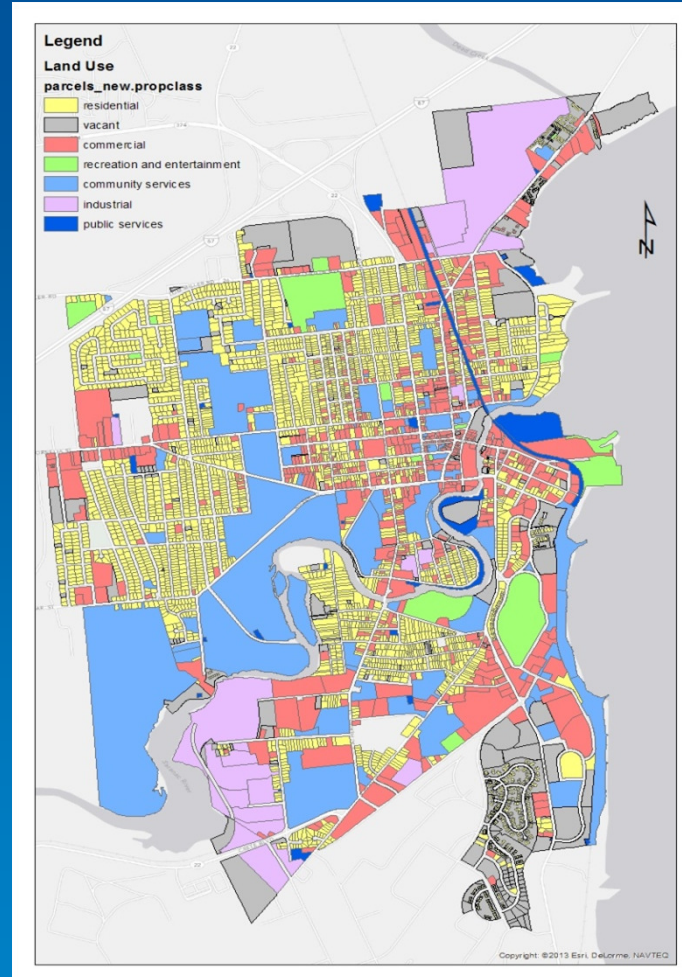
Delineation of Sub-Sewersheds

- Digital Elevation Model overlaid with completed stormwater infrastructure map
- Field verification as necessary



Calculate runoff, discharge and storage volume

- Identify land use

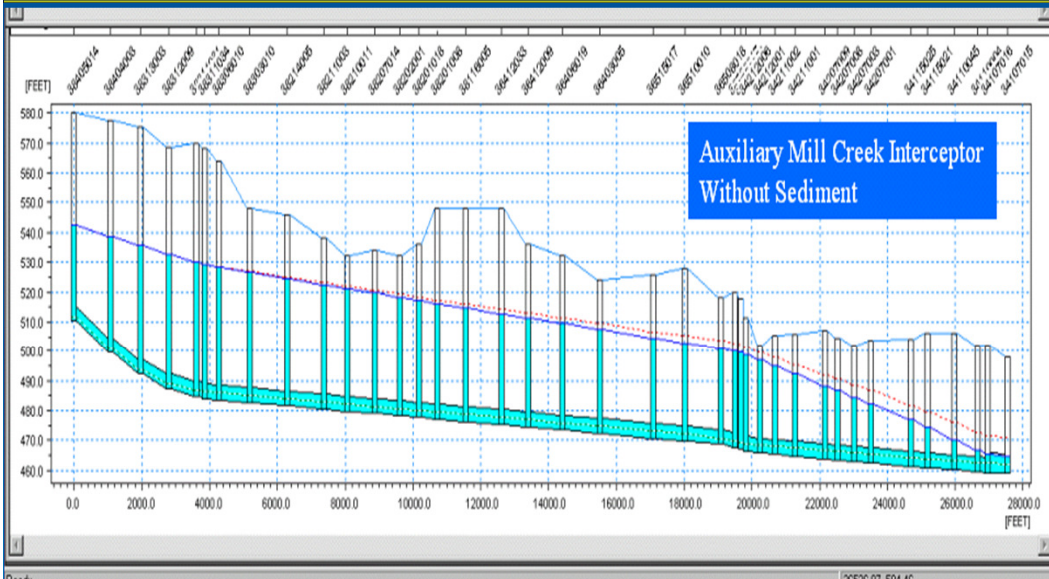


Calculate Runoff, Discharge and Storage Volume

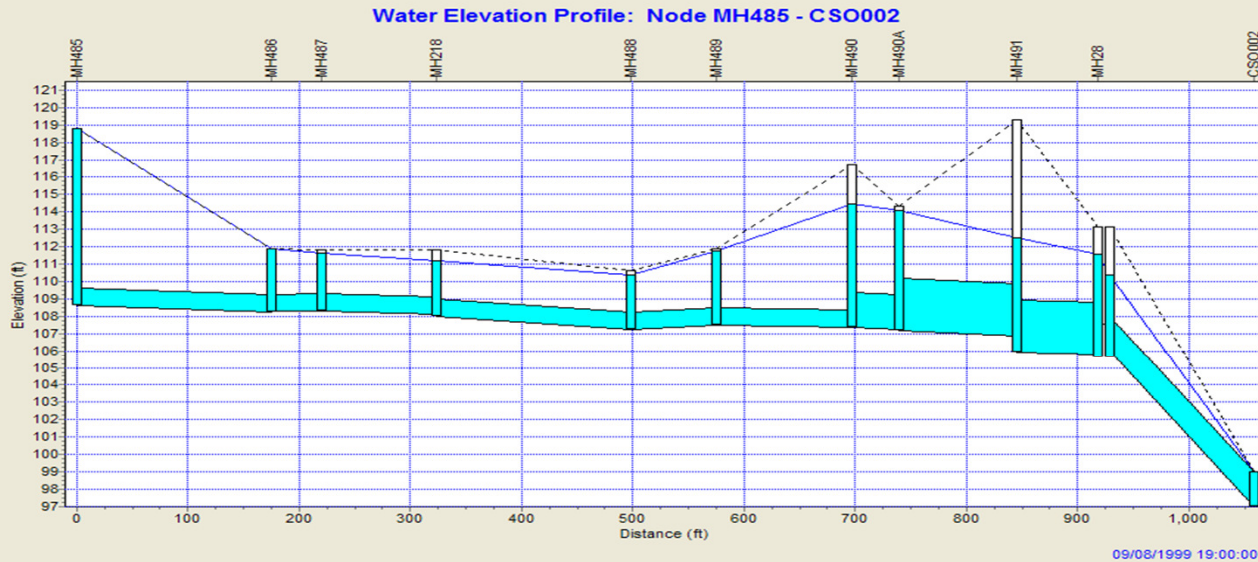
- Use EPA Stormwater Management Model (SWMM) along with historical rainfall and snowmelt data to characterize the frequency and volume of discharges to receiving waters from the storm sewer system
- Dynamic rainfall-runoff simulation model used for single event and long term (continuous) simulation



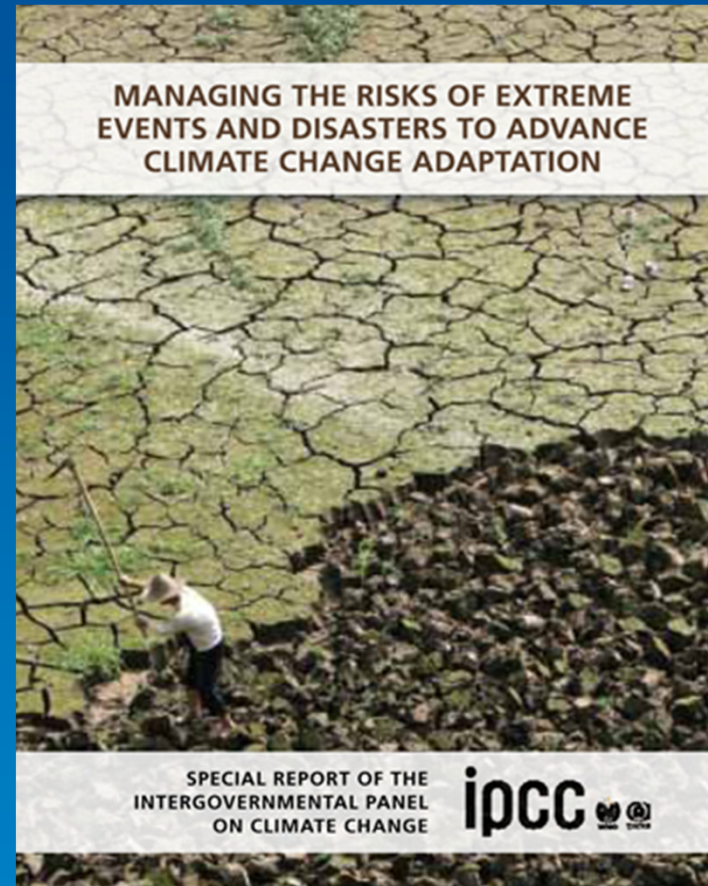
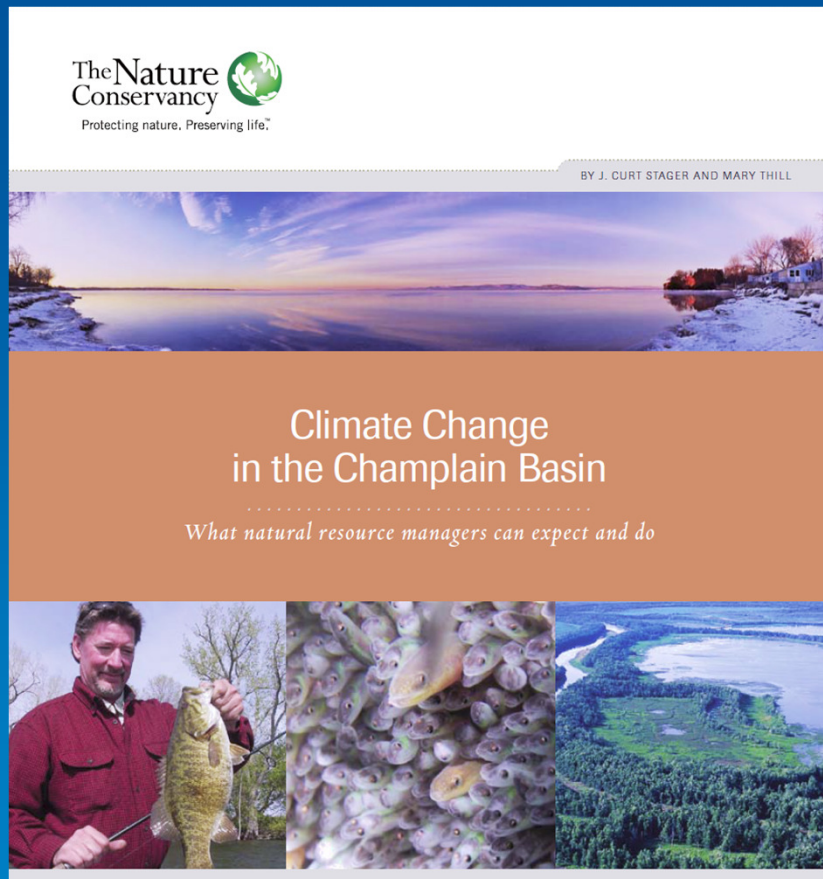
Identify System Vulnerabilities using SWMM5



Assessing System Vulnerabilities



Climate Change & Vulnerability



24-Hour Precipitation Projections

Table 3-3. 24-hour Precipitation Frequency Current Estimates and Projections

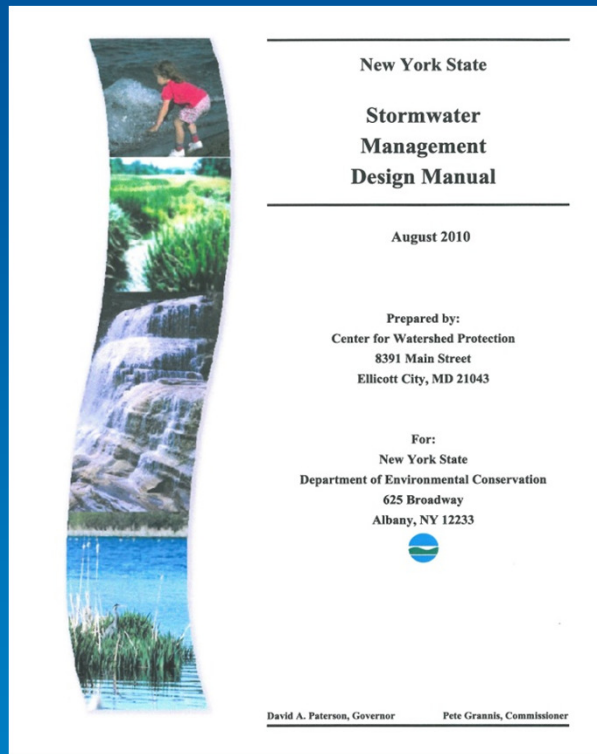
ARI (y)	NRCC / Plattsburgh	EPA CREAT / Peru NY			
		2010	2035	2060	2100
5	2.62	2.4	2.5	2.6	2.8
10	3.04	2.9	3.1	3.2	3.4
25	3.71	3.7	3.9	4.1	4.4
50	4.32	4.5	4.7	4.9	5.2
100	5.02	5.4	5.7	5.9	6.3

ARI: Average recurrence interval

Gray shading indicates values directly from CREAT; others interpolated or extrapolated

GI Retrofit Project Design and Construction

GI Project design and implementation using NYSDEC Stormwater Design Manual



Municipal Parking Lot at Durkee Street

NYSDEC Stormwater Design Manual

Chapter 5 – Green Infrastructure Practices

Section 5.3 – Runoff Reduction

This section presents a series of green infrastructure principles and practices that can be incorporated in the site design to allow for:

- micro management of runoff
- promote groundwater recharge
- increase losses through evapotranspiration
- emulate the preconstruction hydrology, resulting in reduced water-quality-treatment volume.

Green Infrastructure (GI) Technologies Evaluation

- GI practices evaluated to reduce stormwater runoff and improve stormwater quality
 - Disconnection of rooftop runoff
 - Rainwater harvesting—rain barrels/cisterns
 - Infiltration planters
 - Rain gardens
 - Tree pits
 - Porous pavements
 - Green roofs
 - Stream daylighting
 - Stormwater planters



Details, Details

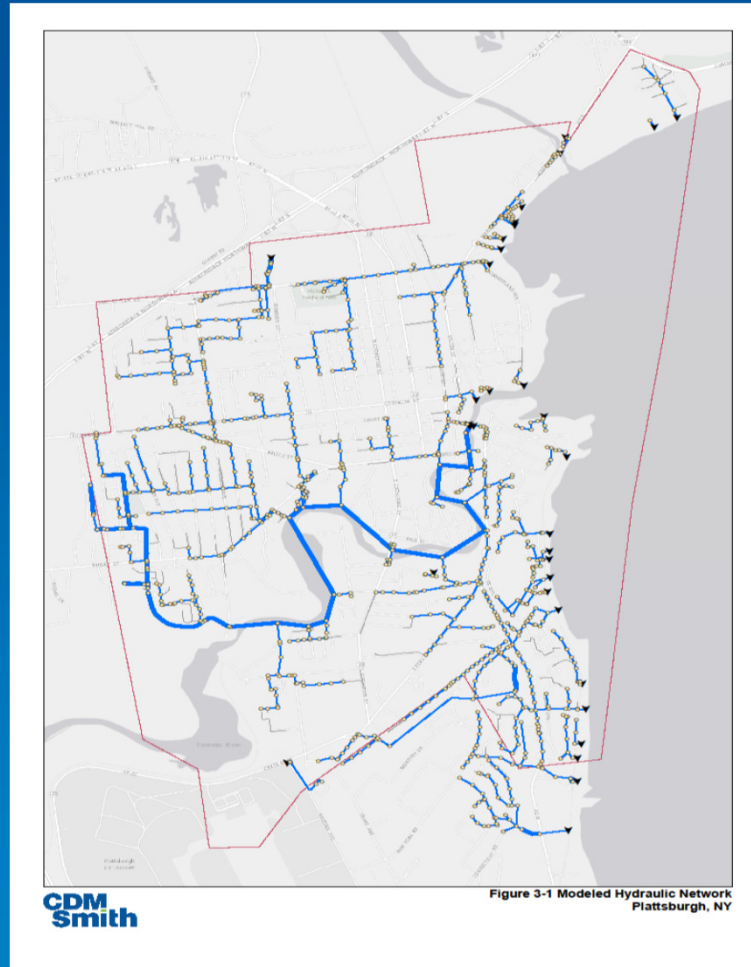
- Validity of soils data
 - Soil infiltration rates
- Groundwater impacts
 - Depth (2-ft separation)
 - Flow paths
- Institutional issues
 - Who owns/maintains the treatment units ?
 - Who pays ?
 - What happens in more densely developed communities?



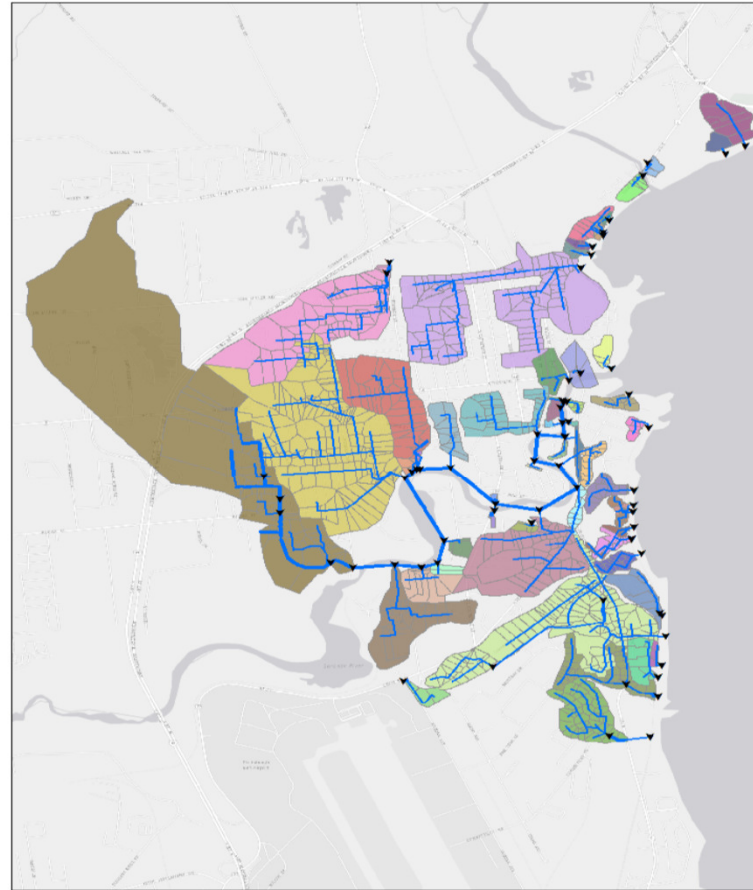
Site Evaluation Ranking Matrix Parameters and Ranking Criteria

SITE EVALUATION	POINT SCORING				
	5	4	3	2	1
Level of coordination necessary to implement GI project	Low		Moderate		High
Is the property City owned?	Yes		Easement/ROW		No
SUBWATERSHED ASSESSMENT					
Site Slope	0 to 4%	5 to 8%	9 to 12%	13 to 15%	16+%
Hydrologic Soil Group	A	B	C	C/D	D
Acreage available for siting GI projects	>5 acres	3 to 4 acres	2 to 3 acres	1 to 2 acres	< 1 acre
FLOOD REDUCTION					
Is the site within a flood prone area?	Directly		Bordering		No
For the 5 year design storm, are storm manholes surcharged above the ground surface?	Yes				No
For the 10-year design storm, what level of flooding occurs in in the site or manholes directly upstream of the site?	0.5 to 1.0 MG	0.1 to 0.5 MG	0.01 to 0.1 MG	<0.01 MG	
Does the site or the area immediately around the site contribute to flood problems downstream in the sub-sewershed?	Yes		Possibly		No
Number of Combined Sewer Overflow (CSO) events in the subwatershed over the past 5 years	10+	7 to 9	4 to 6	1 to 3	0
POLLUTANT REDUCTION					
Proximity to storm sewer system inlet	0 to 50 ft	51 to 100 ft	101 to 150 ft	151 to 200 ft	201 + ft
Existing stormwater treatment system?	No				Yes
Major land use within sub-watershed	Industrial or densely populated	Industrial/Commercial	Commercial	Commercial/Residential	Residential/Schools
Imperviousness of sub-watershed	High	High - Moderate	Moderate	Low-Moderate	Low
Does this project address a direct discharge into:	Lake Champlain		Saranac River		Other
Will the project reduce stormwater flow into a CSO?	Yes		Possibly		No
NATURAL SYSTEM ENHANCEMENT					
Will a GI project enhance or preserve existing natural vegetation?	Yes		Possibly		No
PROJECT BENEFITS					
Will the project cultivate educational opportunities (base on location, accessibility, to public, amt. of foot traffic)?	Yes, highly visible	Yes, moderately visible	Moderate	Low to Moderate	No

Modeled Hydraulic Network



Sub-Sewersheds



**CDM
Smith**

Figure 3-2 Modeled Sub-Sewersheds
Plattsburgh, NY

Simulated Flooding and Minimum Depth Below Rim 5-Year Design Storm

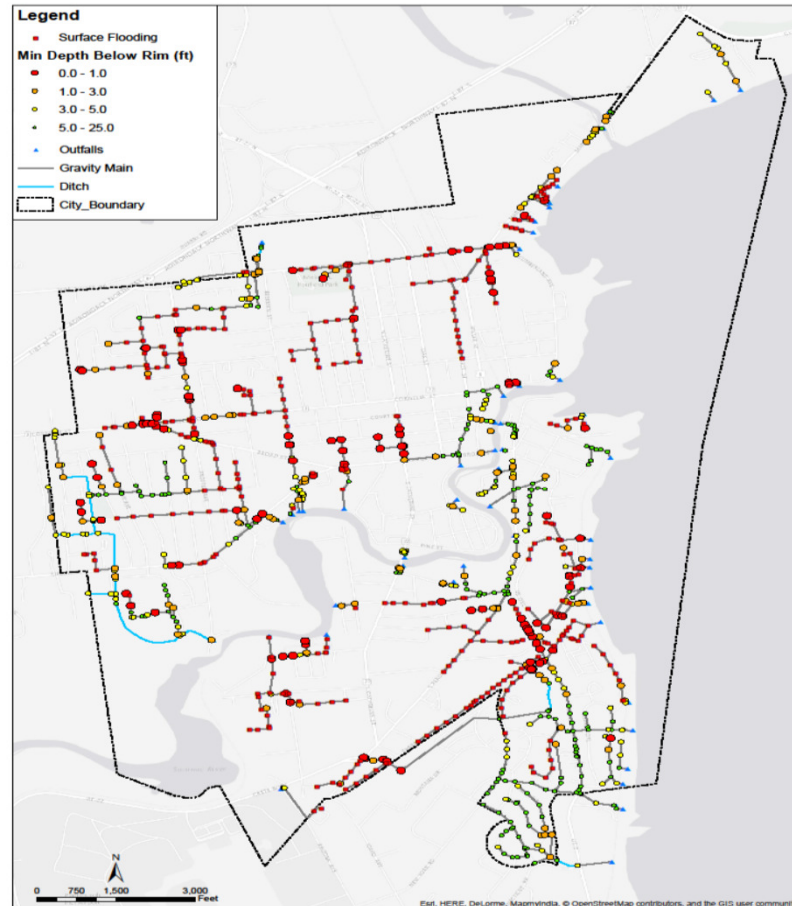
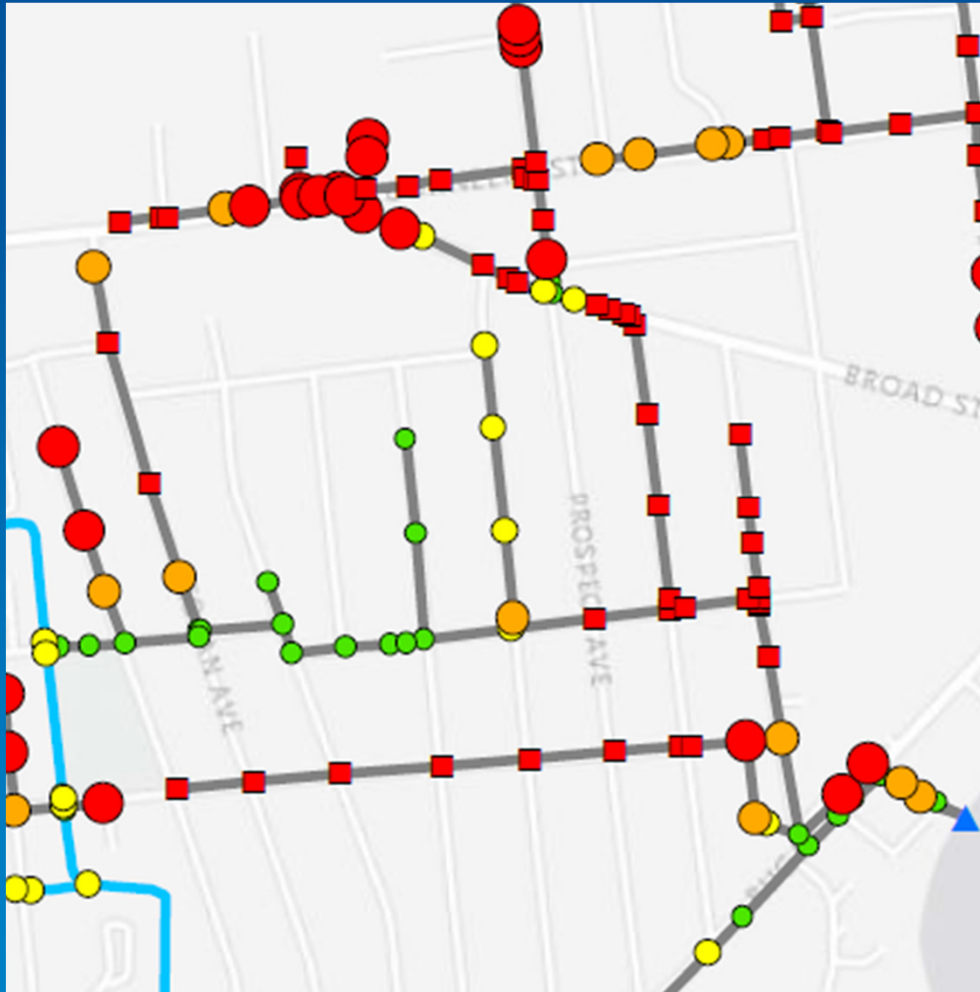


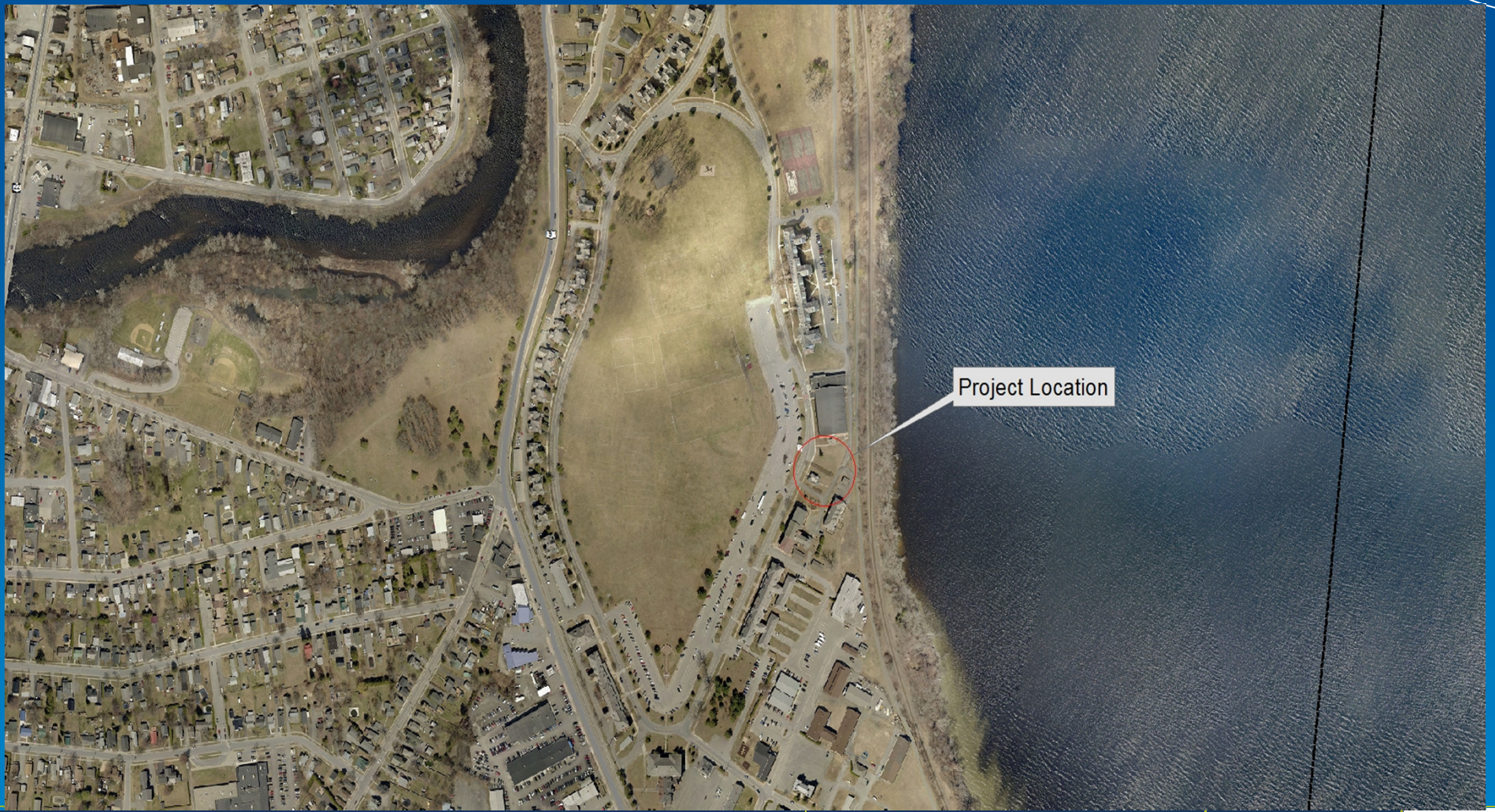
Figure 5-3 Simulated Flooding and Minimum Depth Below Rim
5-yr Design Storm
Plattsburgh, NY

CDM
Smith

Simulated Flooding and Minimum Depth Below Rim 5-Year Design Storm



U.S. Oval Parking Lot



Bioretention Basin Project Location

U.S. Oval Parking Lot



Bioretention Basin Project Location



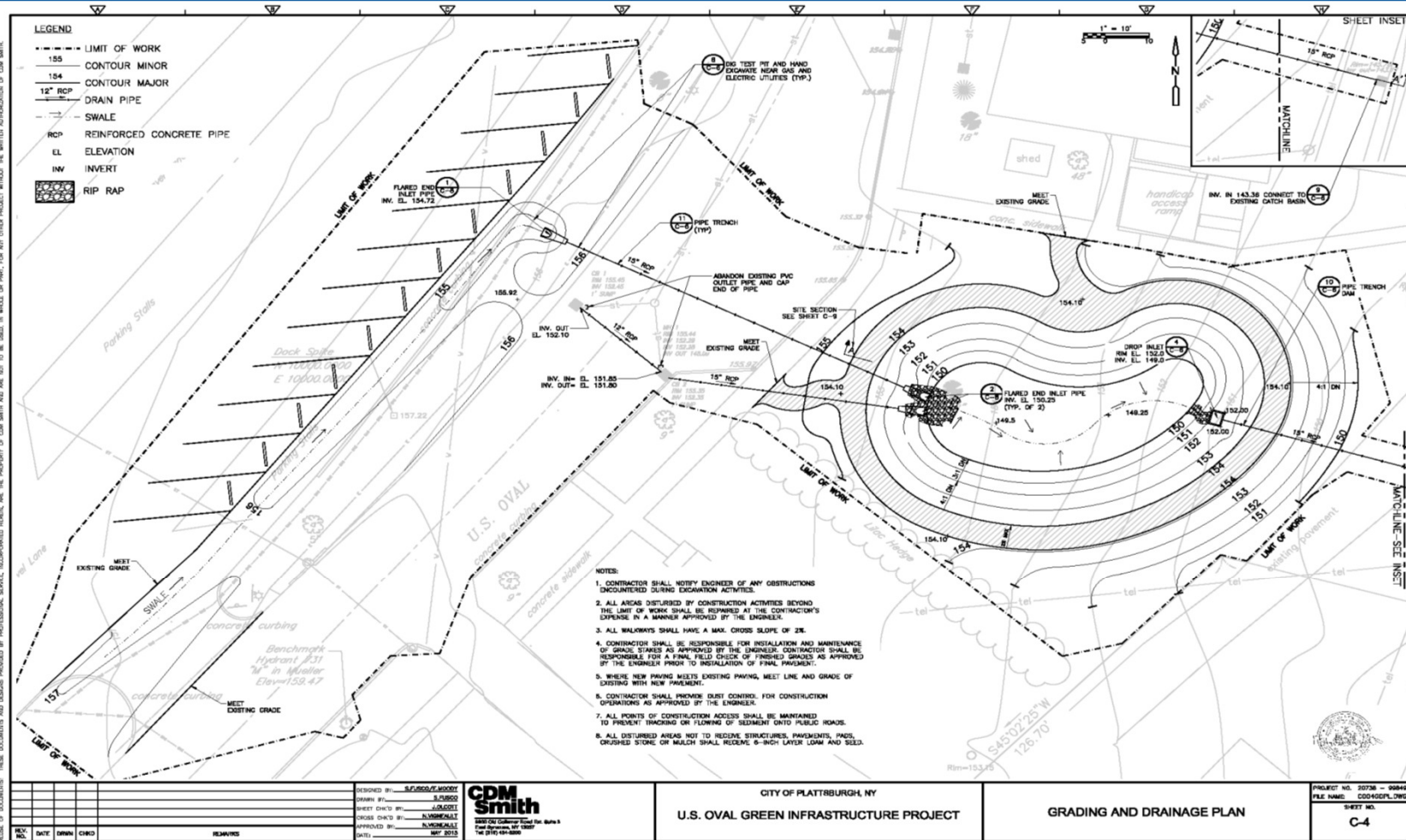
Flooding at U.S. Oval



Bioretention Basin construction progress photo



Bioretention Basin Grading Plan



Bioretention Basin



Bioretention Basin Public Outreach Workshop



Public Outreach Workshops

Broaden the objectives to encourage use by public

Reasons to incorporate GI into projects is not limited to only flood avoidance and pollutant reduction


- Also Consider:
 - Creation of habitat
 - Increased land value
 - Improved neighborhood/aesthetics
 - Groundwater recharge
 - Water quality improvement
 - Erosion control – attenuate peak flow rate
 - Educational value – promote watershed education and stewardship



Embracing Stormwater Management in Site Design



U.S. Oval Green Infrastructure Project Poster



City of Plattsburgh US Oval Green Infrastructure Project

STORMWATER RUNOFF

The Nation's #1 Pollutant Source

Stormwater runoff is water from storm events or snow melt that does not soak into the ground and instead runs over impervious surfaces such as roads, roofs, and driveways. As this happens, the stormwater picks up pollutants like oil and gas from leaking cars, nutrients from yard fertilizer, dirt and sediment from construction sites and unvegetated landscapes, bacteria from pet waste and litter that is left on streets and sidewalks. The stormwater then runs into the storm drains, which outlet in the Saranac River and Lake Champlain, taking the pollutants with it. Once this pollution is in the water, it can harm fish and wildlife that live there and make the water too dirty to swim and fish in.

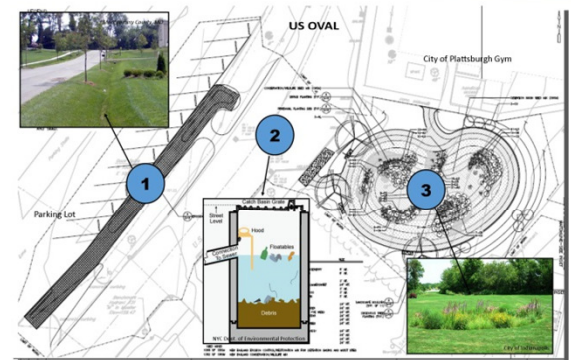
The high-powered storms that the region has been experiencing lately have caused an additional issue with stormwater by creating flooding. When a large volume of stormwater is created quickly, the City's stormwater conveyance system backs up, causing streets, buildings and basements to flood. However, the City is working diligently to manage this stormwater, and the US Oval Green Infrastructure Project is an example of that effort.

"Green infrastructure is an approach to water management that protects, restores, or mimics the natural water cycle. Green infrastructure is effective, economical, and enhances community safety and quality of life. It incorporates both the natural environment and engineered systems to provide clean water, conserve ecosystem values and functions, and provide a wide array of benefits to people and wildlife."

- American Rivers

THE PROJECT

Retaining and Infiltrating Stormwater through Bioretention





Engineered drawing created by CDM Smith

GREEN INFRASTRUCTURE

Mimicking Nature to Manage Runoff

Green infrastructure projects utilize the concepts of nature to help manage stormwater runoff within urbanized areas. Instead of piping the stormwater directly into the closest waterbody, these practices help retain and infiltrate the stormwater back into the ground. This helps reduce flooding by creating an area for the stormwater to be channeled to and absorbed, instead of allowing it to pool on the street and near buildings. Green infrastructure practices also help reduce pollutants by utilizing plants to absorb nutrients from lawn fertilizers and pet waste, as well as using bacteria in the soil to perform bioremediation, which is a natural process by which bacteria break down harmful chemicals such as gas and oil into water and other non-harmful substances.

In 2010, the NYS Department of Environmental Conservation began encouraging public and private entities to utilize green infrastructure practices in managing stormwater runoff. This project is the City of Plattsburgh's first step in joining in this statewide effort. Funding for the project has been provided through a grant from the Lake Champlain Basin Program.

Poster design and layout created by the Lake Champlain- Lake George Regional Planning Board

BIORETENTION

bio [bahy - oh] A combining form meaning "life" or "pertaining to life." The act of holding in place.

- 1 **Bioswale.** A bioswale is a depressed, vegetated drainage channel that is used to transport water off of roadways and parking lots. The benefit of a bioswale, versus an open paved channel or an underground conveyance pipe, is that the grass and plants within the channel will uptake and clean pollutants out of the stormwater, while also catching garbage and debris.
- 2 **Stormwater Conveyance Pipes.** The stormwater that exits the bioswale will be routed underneath the street in a series of stormwater conveyance pipes. These pipes will dump the water into two catch basins, where the water will sit and allow dirt and debris to fall out of suspension in the water. At the top of a catch basin is an outlet pipe, which will move any overflowing water into an additional stormwater conveyance pipe that will then discharge the water to the bioretention area.
- 3 **Bioretention Basin:** Bioretention basins are landscaped basins where stormwater is retained. The stormwater slowly infiltrates into the ground, or is uptaken by plants, where it is treated by a number of physical, chemical, and biological processes that remove pollutants in the water. Bioretention basins are not only attractive landscape features, but they also improve water quality, reduce flooding, and provide habitat for local birds and butterflies.

Educational Signage

BIORETENTION

bio [byoh] a combining form meaning "life" re•ten•tion [ri-ten-shuhn] The act of holding in place



RAIN GARDEN



What is a Rain Garden?

Anatomy of a Rain Garden



Rain Gardens

Rain gardens are the smaller versions of bioretention basins. They are bowl shaped, landscaped depressions that are designed to capture and filter stormwater from roofs, driveways and lawns. By collecting water and allowing it to slowly soak into the ground, rain gardens reduce the potential for flooding and minimize the amount of pollutants flowing from your lawn into a storm drain, and eventually into our local lakes, rivers and streams. Planting your rain garden with native plants not only enhances the beauty of your yard, but also provides valuable habitat for bird and butterflies.

Native Plants

Using New York and Adirondack native plants is the best choice for your rain garden because they are already adapted to the local climate and rainfall patterns, and their deep roots will help soak up excess water from rain events. They require less maintenance than non-native plants and don't need fertilizers and pesticides to survive. They also provide valuable habitat for local birds and butterflies, and can attract hummingbirds to your garden as well.

Below are some native plants that you can see in this bioretention basin and can use in your own rain garden.



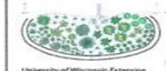
Images provided by Emily DeBolt, Fiddlehead Creek Native Plant Nursery.

Rain Gardens in an Urban Landscape.

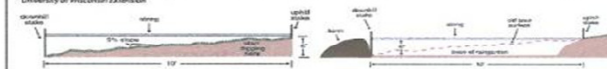


Where to plant.

Plant rain gardens near downspouts, areas of roof runoff or in naturally depressed locations. They should be placed at least 10 feet away from an existing foundation. The size of your rain garden depends on how much water volume will run into it. Rain gardens are typically between 100 and 300 square feet, with the length twice as long as the width. Picking a unique shape will help create a more aesthetically pleasing view. If you have limited space consider multiple small rain gardens throughout your property.



A typical rain garden is between 4 and 8 inches deep. If placing a rain garden on a slope, choose one in your yard that water runs down, either during a rain storm or from a down spout. Use the dug out soil to build a berm at the downhill edge of the garden to help retain the water that enters the garden.



Compost should be added to any rain garden that you are building. If you have sandy soils, add compost directly into the garden. If you have clay soils, rototill the soil first to improve drainage and then add compost. In general, 6 inches of compost is ideal, while still leaving a 6 inch depression to plant in.

Place the plants, still in their pots, around the rain garden until the desired look is achieved. Dig each plant hole twice as wide as the plant and deep enough so



the crown of the plant is level with the ground you are planting in. Fill in around the hole with compost and firmly tamp around the roots to remove any air pockets. Water the plants immediately to avoid shock. Place double shredded mulch, 2 inches thick evenly throughout the

garden. The plants should receive one inch of water per week until the plants are established. PVC pipe attached to a downspout and buried underground can help direct water into a rain garden.



Introducing Homeowners to Green Infrastructure

Lake Champlain is listed on the NY Department of Environmental Conservation's Impaired Waterbodies List due to an increased amount of pollution within its water. The major contributor of this pollution is stormwater runoff. Stormwater runoff is water from rain or melting snow that does not soak into the ground. Instead, it runs over impervious surfaces, for example roofs, driveways, patios and sidewalks.

The City of Plattsburgh is committed to helping reduce stormwater pollution from entering into the Saranac River and Lake Champlain, as well as reducing the amount of flooding on its streets. The City has taken many steps to improve stormwater conveyance and retention, and is now asking the homeowners within the City to join them. Together, we can create a sustainable City that is a great place to live, work and visit.

City of Plattsburgh

**INTRODUCING
HOMEOWNERS
TO GREEN
INFRASTRUCTURE**

"Informing the public about the condition of the Lake is critical in restoring and protecting water quality and the diverse natural and cultural resources of the Basin. By enhancing the public's understanding and appreciation of water quality, fisheries, wetlands, wildlife, recreation, and cultural heritage, it will foster a sense of personal responsibility that leads to improved stewardship of the Basin's resources."

*Lake Champlain Basin Program
State of the Lake Report*

As the stormwater moves across impervious surfaces it picks up pollutants such as gas, oil, litter, fertilizers and pet waste. The stormwater then runs into the storm drains, which discharge to Lake Champlain and the Saranac River. These pollutants can have a negative effect on the Lake by causing excess algae and plant growth, which harms fish populations and the quality of the Lake's water for swimming and drinking.

But you can help! By installing a small green infrastructure practice on your property!



For more information, please contact

City of Plattsburgh
Engineering and Planning Department
41 City Hall Place
Plattsburgh, NY 12901
Monday through Friday
8:00 am to 4:00 pm
Phone (518) 563-7730



You can do this too....

City of Plattsburgh **BIORETENTION**

Bioretention
 bio
 (bahy-oh)
 a combining form
 meaning "life"
 re-ten-tion
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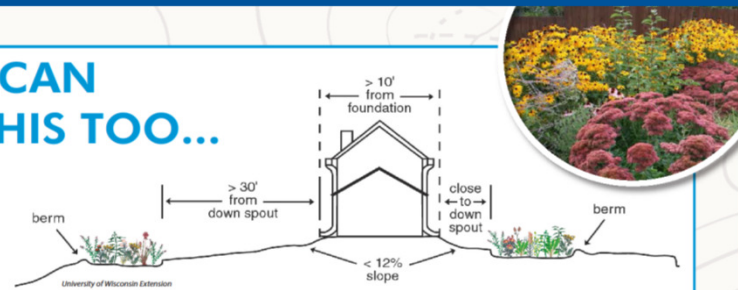
What is a bioretention basin?
 Bioretention basins are landscaped depressions or shallow basins used to slow and treat stormwater runoff. Stormwater is directed to the basin where it slowly infiltrates into the ground and is treated by a number of physical, chemical, and biological processes that remove pollutants in the water. Bioretention basins are not only attractive landscape features, but they also improve water quality, reduce flooding, recharge groundwater and provide habitat for local birds and butterflies.

What makes a bioretention basin work?

There are several parts to a bioretention area that make it work.

- 1. Inlet:** The area where stormwater enters into the bioretention basin. It is usually lined with rock to slow down the speed of the stormwater and trap any large pieces of litter.
- 2. Shallow Ponding Area:** The middle of the basin where the water settles and begins to infiltrate into the soil. Also, the standing water allows sediment to fall out of suspension.
- 3. Vegetation:** The vegetation helps remove nutrients that the stormwater has picked up from fertilizers and pet waste through nutrient cycling, which means the plants uptake the nutrients and use them to grow. Native plants work best in a bioretention basin because they have deep roots to help absorb the stormwater, and can withstand periods of drought and standing water.
- 4. Engineered Soil:** Most bioretention basins are filled with engineered soil, which is soil that has been specially mixed to improve the soil's absorption, water storage and infiltration capacity. This allows the basin to more quickly and readily store water instead of letting it overflow the basin.
- 5. Sand and Gravel Bed:** The sand and gravel bed is located underneath the engineered soil to help filter the water as it infiltrates into the ground and percolates through to the groundwater.
- 6. Underdrain System:** The underdrain system is below the sand and gravel bed, and is in place to make sure the bioretention basin doesn't flood beyond capacity. Should too much water accumulate on top or infiltrate through the system, the underdrain system releases the excess water into pipes connected to the City's stormwater conveyance system.

YOU CAN DO THIS TOO...



Bioretention basins designed for homeowners are called rain gardens. Rain gardens are bowl shaped depressions that are landscaped with native plants to help capture and infiltrate stormwater runoff from roofs, driveways, and lawns. By collecting water and allowing it to soak into the ground, rain gardens can reduce the potential for flooding and minimize the amount of pollutants coming from yards and into the storm drains. This will keep these pollutants out of the Saranac River and Lake Champlain.



The best place to plant a rain garden is near a downspout, area of roof runoff or in a naturally depressed location. They should be placed at least 10 feet away from an existing foundation. The size of the rain garden depends on how much runoff will be directed to it, but most are between 100 and 300 square feet and 4 to 8 inches deep. Picking a unique shape will help create a more aesthetically pleasing view, just be sure that the garden is twice as long as it is wide.



Images provided by University of Wisconsin Extension

Don't forget the native plants!

Here are some native plants that you can find in this bioretention basin, as well as some others, that you can use in your own rain garden.

- 1 Swamp Azalea
- 2 Shrubby Sundrop
- 3 Woodland Phlox
- 4 Nannyberry



Images provided by Emily DeBolt, Fiddlehead Creek Native Plant Nursery



Results

- Completed mapping system to identify areas for improvement within the City's sub-surface infrastructure
- City is better prepared to address stormwater volume reductions and stormwater quality improvements
- Aid to elected officials within the City in making important choices for the betterment of Lake Champlain as a whole.
- Able to plan for vulnerable areas within the City should be weather patterns continue as they have in recent years.
- Public education regarding green infrastructure technologies not only for the improvement of water quantity and quality, but also for the quality of life of the residents within the City.

Questions?

