

NEWEA & NYWEA Joint Spring Meeting Technical Conference and Exhibition



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Green Infrastructure Design and Flood Mitigation in Westchester County: Rain Gardens, Constructed Wetlands and Pervious Pavements

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AGENDA

- 1. Background
- 2. Guiding Principles
- 3. Objectives
- 4. Test and Review
- 5. Q/A

Project Metrics Ease of Maintenance Village Philosophy Location

Water Quality Protection Run Off Reduction Comprehensive Storm water Plan

Background

- The Village completed a Comprehensive Storm Water Management Plan.
- The American Recovery and Reinvestment Act (ARRA) authorized that not less than 20% of economic stimulus funding provided for the State Revolving Funds (SRFs) be used for green infrastructure.
- Critical Bronx River sub drainage basin areas identified inclusive of Fox Meadow Brook (BR-4, BR-7, BR-8).
- 26 Capital Improvement Projects were identified, three presented here:
 - Rain Gardens at Village Library
 - George Field Park Dry Detention Pond
 - Cooper Green Rain Gardens and Dry Detention Pond



Guiding Principles

Provide flood mitigation within the Fox Meadow Brook Drainage Basin.

Reduce peak run off rates in the Bronx River Watershed through dry detention storage and infiltration (rain gardens).

Rehabilitate and preserve natural landscapes and wetlands through invasive species management and re-construction.

Improve water quality.

Petition for and obtain County grant funding and other grant funding to subsidize the project.

Village Philosophy

Flood Mitigation is a primary goal to be achieved through green practices that also provide water quality treatment while preserving or enhancing the environment

Flood mitigation in sub-urban, urban densely populated regions shall be achieved through run off reduction

<u>Quantify</u> the results using flow metering and water quality sampling

Village of Scarsdale Public Library

Olmsted Rd, Scarsdale

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Village of Scarsdale Public Library

Olmsted Rd, Scarsdale



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Olmsted Rd, Scarsdale



Rain Garden Sizing – NYSDEC Design Manual

Area d	escription		L-1	
$WOV \leq VSM + VDL + (DP \times ARG)$				
$VSM = APG \times DSM \times nSM$				
$VDI = APC \times DDI \times pDI$				
	rain garden surface area	of	1 275	
ARG		SI	1,373	
DSIM	depth of soil media	π	1.5	usually 1 to 1.5
DDL	depth of drainage layer	ft	1	usually 0.05 to 1.0
DP	depth of ponding above surface	ft	0.5	maximum of 0.5
nSM	porosity of soil media	%	0.4	>20%
nDL	porosity of drainage layer	%	0.4	>40%
P	90% rainfall number	inches	1.3	
I	percent imperviousness		100	
A	area draining to practice	sf	18,831	
WQv	water quality volume	cf	1938	
Rv	0.05 +0.009(1)	-	0.95	
VSM	volume of soil media	cf	825	
VDL	volume of drainage layer	cf	550	
VSM + VDL + (DP x ARG)		cf	2062.5	
WQv <= VSM + VDL +(DP x ARG)			OK	

Library Rain Garden Metrics

- 18,000 square foot roof area
- 1,800 square foot rain garden
- 2,000 cubic foot water quality volume
- Achieve 500,000 gallons per year of run off reduction
- Achieve 500,000 gallons per year of water quality treatment
- Achieve 10,000 gallons per of water re-use (nonpotable sources)
- Over 500 plantings
- Construction Cost: \$200,000
- Cost per Gallon removed: \$0.40/gallon



Design Elements *Olmsted Rd, Scarsdale*



Design Elements

- Leaf Eater
- 75 Gallon rain cistern
- 500 gallon u/g rain cistern
- Solar Powered Irrigation Pump
- Solar / battery power
- 30 psi @ 3 gpm
- Rain Bird drip irrigation system
- Digital Flow Meter to measure irrigation re-use



Run Off Reduction Flow Monitoring

How do you know how good your doing?

- Visual ?
 - Unreliable
 - Un-quantifiable

ADS Flow Shark

- Cellular and web based
- Battery life with GSM/GPRS wireless connection providing up to 15 months at standard 15 minute sample rate.
- Completely accessible for any internet connection
- Data software for trending

Design Elements Olmsted Rd, Scarsdale

Run Off Reduction Rain Fall Intensity Response Curves



Rainfall Intensity (Inches)





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D&B ENGINEERS

Watershed Initiative a program of the New York State Office of

D&B ENGINEERS AND ARCHITECTS, P.C.

Village of Scarsdale Westchester County, New York

WELCOME TO OUR RAIN GARDEN

The four rain gardens constructed on the grounds of the Scarsdale Public Library serve a dual function to reduce polluted stormwater runoff while beautifying the site. They feature well-drained soil and maintenancefriendly native plants that slow the velocity of stormwater runoff from the buliding's roof, while filtering pollutants prior to the water entering the South Fox Meadow Open Watercourse, a tributary to the Bronx River.

A shallow depression in the rain gardens collects a few inches of water and absorbs it into the ground or by the plants, instead of flowing directly into the watercourse. Plants and soil trap, absorb and filter pollutants : found in stormwater runoff including fertilizers, pesticides, petroleum ; and metals.

The rain gardens are planted with wildflowers and other native vegetation, such as Summersweet, Winterberry and Fireworks Goldenrod. Native plants have roots that grow twice as deep as the plants are tall, making them very efficient in absorbing water. Each year about one third of the roots die, leaving deep tunnels for water and oxygen to filter into the ground and nurture new plant growth. These plants are the basis for restoring natural ecosystems to open space, residential and urban areas. Rain gardens are diverse beautiful habitats to many animals that we do not normally see, such as turtles and frogs.

ENVIRONMENTAL BENEFITS OF THE RAIN GARDENS

Rain gardens improve water quality by protecting local streams from pollutants carried by urban stormwater. They increase the amount of water filtering into the ground, which recharges the aquifer and helps to prevent flooding, erosion and drainage problems. The gardens enhance the beauty of the Library and community and provide a valuable habitat for birds, frogs, butterflies and many beneficial insects.

RAIN BARREL BENEFITS

The rain barrels located alongside the Library building capture and store stormwater from the building roof, helping to reduce the amount of water entering the storm sewer system and open watercourse. In addition, they reduce ponding on the Library grounds as well as runoff to the parking lot, which reduces flooding and the amount of harmful pollutants entering the South Fox Meadow Open Watercourse. The stormwater stored in the barrels provides a free and sustainable water source for the solar-powered irrigation systems to water the rain gardens.









Solar Panel: provides an energy source for irrigation pump.

Leaf Eater: eliminates leaves and debris from entering the rain barrels.

> Rain Barrels: collects stormwater roof runoff for irrigation.

> > Overflow: rain barrel overflow is diverted to the rain gardens for irrigation.

Irrigation Pump: for the drip irrigation system.

> Downspouts: all downspouts are provided with a wve connection for seasonal use. During summer conditions, water is directed to the rain gardens, while during winter conditions, water is directed to the existing stormwater system.

Irrigation Pump: for the drip irrigation system.

Flow Meter: quantifies the amount of stormwater used for irrigation along with measuring irrigation flow.

Drip Irrigation: each rain garden has a rain barrel water source to provide irrigation.

RAIN GARDEN DESIGN PARAMETERS



Typical rain gardens Choose native are 4 to 8 inches plants based on deep. This depth, proportionate to and moisture. the surface area that generates longer and are more tolerant of local stormwater runoff, helps ensure that weather and soil water soaks back conditions. into the ground

instead of ponding

on the surface.

Depth

Plants

Soil A good organic soil their need for light Native plants live top soil.

Location

YOU

ARE

HERE

often located at the end of roof gutters or downspouts, as a buffer between the lawn and street.

mix for rain gardens is 60% sand, 20% compost and 20%

Rain gardens are



Catch Basin Inserts – Library

Olmsted Rd, Scarsdale

Storm-Sack catch basin insert with hydrocarbon boom Features:

CB-1B

CB-2A

CB-2B

CB-3A

12

12

12

Intersection of Brite Road and Odden Road

Intersection of Brite Road and Ogden Road

Intersection of Olmstead Road and Brewster Road

Intersection of Olmstead Road and Brewster Road

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Intersection of Brewster Road and Hickory Lane

- 1. Heavy duty, adjustable, aluminum mounting frame
- 2. Emergency By-pass to eliminate flooding potential
- 3. High flow, woven Geotextile filter bag
- 4. Corner braces/lifting tabs

Metric is 1 ton removal 2.0 to 3.0 cf of debris/insert 15 inserts using approx. 45 lbs/cf density









- Rehabilitated, re-constructed wetland, 30,000 square feet – on e of the largest in Westchester
- Enhances water quality
- Improves bio-habitat
- Eliminate invasive species (Japanese Knot Weed, Norway Maples)
- Dry detention 7 acre feet of storage (2,300,000 gals)
- 1 to 3 feet overall depth



Cooper Green

- Designated "park land"
- Largely unused
- Future home of dry detention basin and one of the largest rain gardens in Westchester County



- 3,000 square feet of Rain Garden along pervious walkway – Flexi-pave
- One of largest Rain Gardens constructed in the region
- 2.5 acre-feet of run-off storage (815,000 gals)

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If each of the fifteen Westchester County sub-watersheds that flow to the Bronx River could reduce peak flows for a 3 to 5 inch rain event by 30%, it would result in a significant reduction in flooding impacts. **Peak Flow Reductions***

George Field Park Sub-basin 70% reduction in peak flows

Cooper Green 58% reduction in peak flows

*For 3.5 inches of rain storm event , (flash events and 24 –hr sustained events)



Storm Intensity (inches)

George Field Park Metrics

- 2.3M Gallon dry storage
- 30,000 SF constructed wetland
- 300 LF of road side water quality swale
- Reduction in flow to Bronx River in 3.5 inches of rain: 30% to 70%
- Construction Cost: \$950,000
- Cost per gallon stored: \$0.40/gallon



Cooper Green Metrics

- 0.815M Gallons dry storage
- 3,000 SF rain garden
- Construction Cost: \$580,000
- Cost Per Gallon Stored: \$0.70/gallon



Voila: George Field and Cooper Green Back to Normal

(Updated May 2) On Monday May 1 we reported that the seven acre retention pond at George Field Park was put to the test on April 30th when Scarsdale was deluged. Weather forecasters report that five inches of rain fell in Central Park on Wednesday. The retention pond in Green acres, which is the largest in Westchester County, was built to retain water during storms and release it downstream in a timed fashion. The pond can hold 2,300,000 gallons of water. Stephen Sherman took this video of George Field and shared it with us. Check out the new lake at Green acres!

The pond was built as part of a large storm water retention program that sends water south to Cooper Green, downstream along the Post Road, into Harcourt Woods and eventually drains into the Bronx River. The intention was to eliminate flooding in homes in the Grange, along Greendale, Oxford and Cambridge roads as well as Rugby Lane, Windmill, and Windmill Circle. The good news is that the retention pond did what it was supposed to do. Twelve hours later, by 7:30 pm on May 1, it was drained of the excess water and pretty much back to its usual state. That is what is supposed to occur. At Cooper Green, opposite the Public Safety Building, the rain garden was dry after the storm as well. Below find pictures of George Field and Cooper Green on May 2, completely drained of water. It appears to be doing what it is designed to do -- retain heavy rain falls for a slower release downstream.

LOCAL FINDS

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Test and Review

In the NYSDEC Design Guidelines, what is the Maximum Allowable Depth of Ponding above the surface of a rain garden?

6 inches

The porosity of the drainage layer (Ndl) must be greater than _____ %

40%

Questions?







