Rockland County Green Infrastructure

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Mission Statement

In order for Rockland County's sources of potable water to remain sustainable to support population growth and economic recovery, the aquifers must be replenished. Potential solutions in the form of green infrastructure will be compared based on criteria as defined by an appointed task force. Implementing green infrastructure will increase infiltration and aims to increase the available potable water for Rockland County as it continues to grow and flourish.

Background

- 199 sq mi, southernmost county west of the Hudson
- Population growth
- Potential water supply shortage if unsustainable withdrawals
- Green Infrastructure
  - Balances supply and demand
- Large availability of impervious areas

Images: http://www.epodunk.com/cgi-bin/genInfo.php?locIndex=22499
http://www.upstatenyroads.com/counties/rockland.shtml

Project Schedule and Milestones

Fall 2015	
Date	**Objective**
September 29th, 2015	Quantify relative infiltration potential of various GI technologies
October 6th, 2015	Identify various Rockland County site and soil conditions
October 6th, 2015	Use EPA Stormwater Calculator
October 20th, 2015	Proposal Presentation*
October 22nd, 2015	Initial task force meeting
October 27th, 2015	Mission Statement and submit written proposal*
November 3rd, 2015	Design alternatives quantifying infiltration potential
November 17th, 2015	75% Proposal Presentation
November 19th, 2015	Task force meeting
December 8th, 2015	Final Proposal Presentation

Project Schedule and Milestones

Spring 2016	
Date	**Objective**
February 1st, 2016	Public Presentation to Rockland County
February 8th, 2016	Literature Review
February 8th, 2016	Specific site selection with task force
February 23rd, 2016	GIS Data Analysis
February 23rd, 2016	Maintenance Manual
February 29th, 2016	Overview of permitting requirements
March 15th, 2016	Conceptual level site design
March 29th, 2016	Economic analysis performed
April 18th, 2016	Posters Due
April 27th, 2016	Senior Design Day
May 3rd, 2016	Final written report

Applicable Codes/Regulations

- Municipal Separate Storm Sewer System (MS4)
  - Permit for stormwater discharge in urban areas
- State Pollutant Discharge Elimination System (SPDES)
  - General permit for stormwater discharge from construction activity
    - Required to develop and implement a Stormwater Pollution Prevention Plan
- NY State Stormwater Management Design Manual
  - Contains guidelines on the construction of GI technologies

https://gedeongrc.com/dec-environment-awards/

Design Alternatives

- Rain Garden
  - Depressed area filled with vegetation to allow stormwater to infiltrate slowly
- Infiltration basin
  - Area of highly permeable soils that temporary store water until it can infiltrate
- Permeable pavement
  - Materials that allow water to flow through it rather than turning into runoff

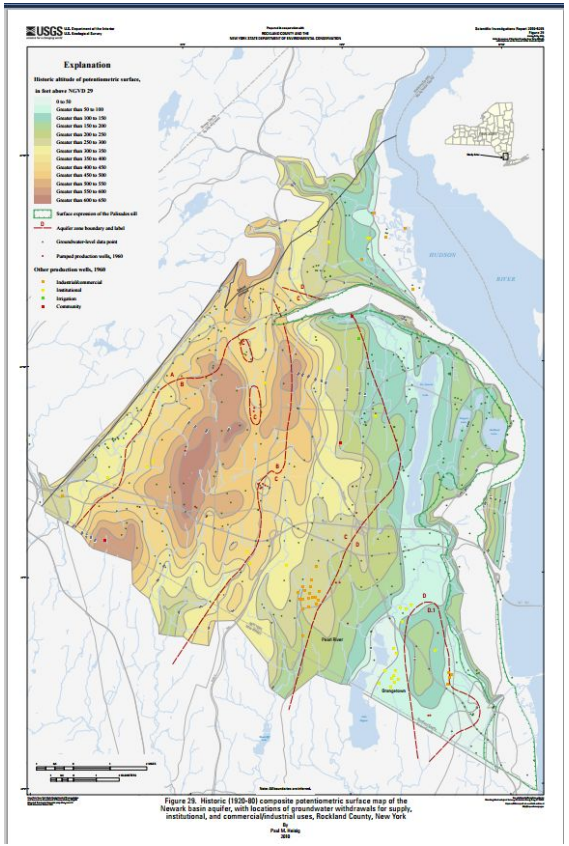
Images: http://www.ecolandscaping.org/03/rain-gardens/native-plant-selection-for-biofilters-and-rain-gardens/
http://www.southwesturbanhydrology.com/solutions/bio-retention-basins/
http://www.stormwaterpartners.com/facilities/basin.html

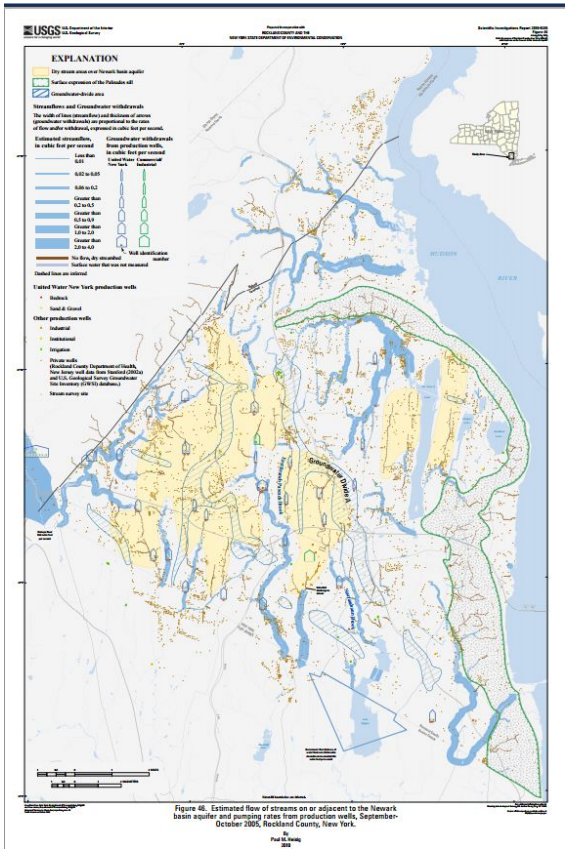
Stormwater Management Design Guidelines

- Rain Garden & Infiltration Basin
  - Grass height between 4-6 inches
  - Peak flow less than 3 cfs
  - side slopes no greater than 3:1
  - subgrade width between 2-6 feet
- Permeable Pavement
  - Lowest point of storage reservoir minimum 3 ft above groundwater table
  - 100 ft from drinking wells
  - 25 ft from structures and septic systems

Concept Development and Selection

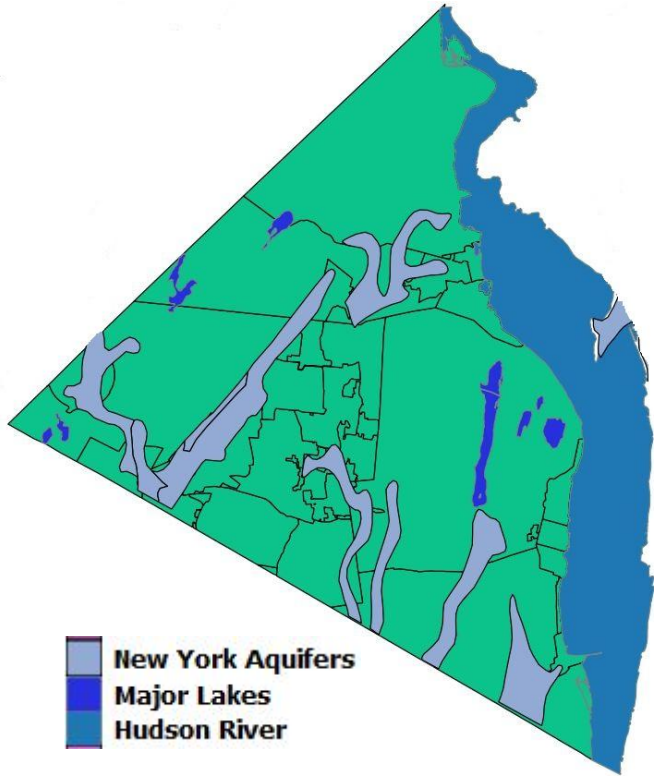
- US EPA National Stormwater Calculator/SWMM
- Land and Soil Metrics
- GI Control Ratios
  - Design Parameters
  - Primarily Public Systems
- General site strategies to be implemented where applicable



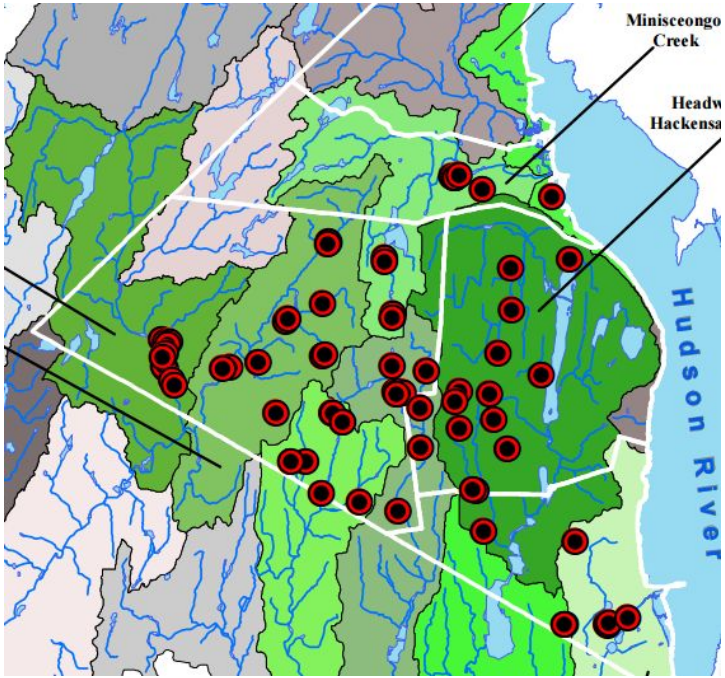


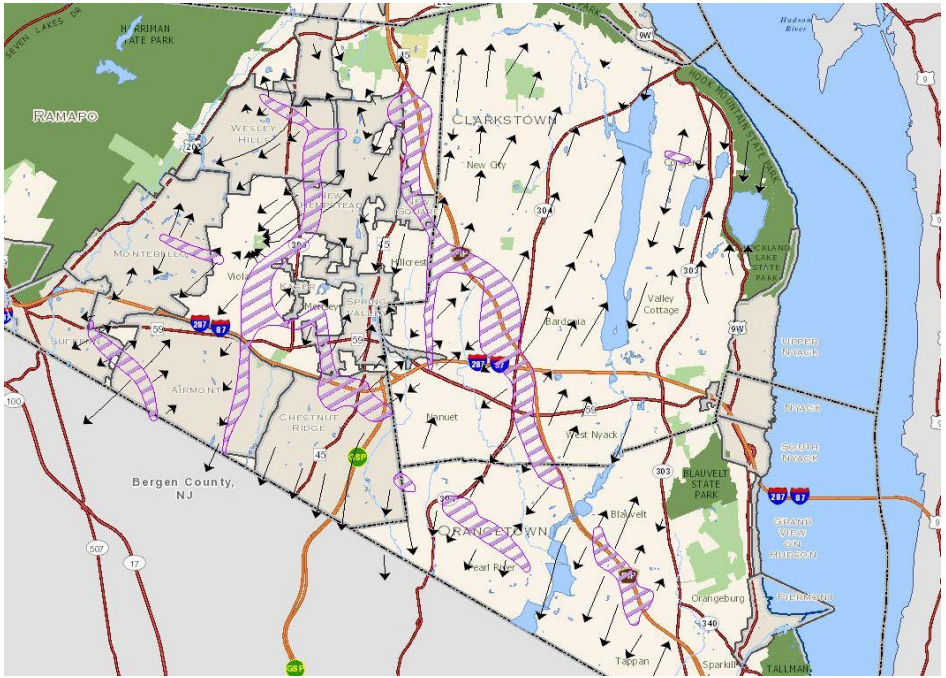
GIS Data

- QGIS
- Site Selection based on maximizing potential infiltration
- Other Factors
  - Soil and land characteristics
  - Location where recharge is needed
  - Public or private property
  - Aesthetics
  - Functional use of space
  - Potential demonstration site

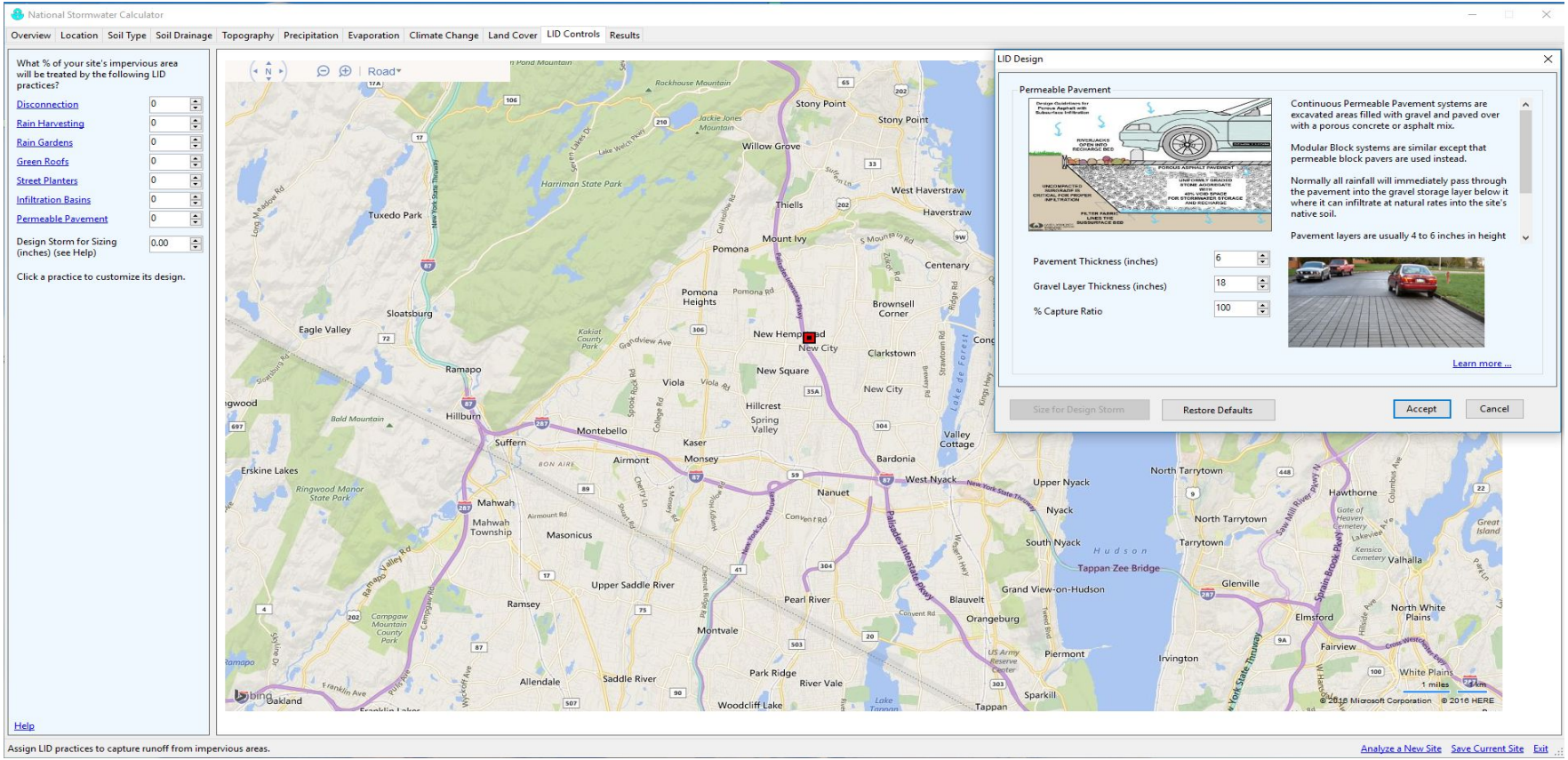


United Water New York Wells and Groundwater Flow

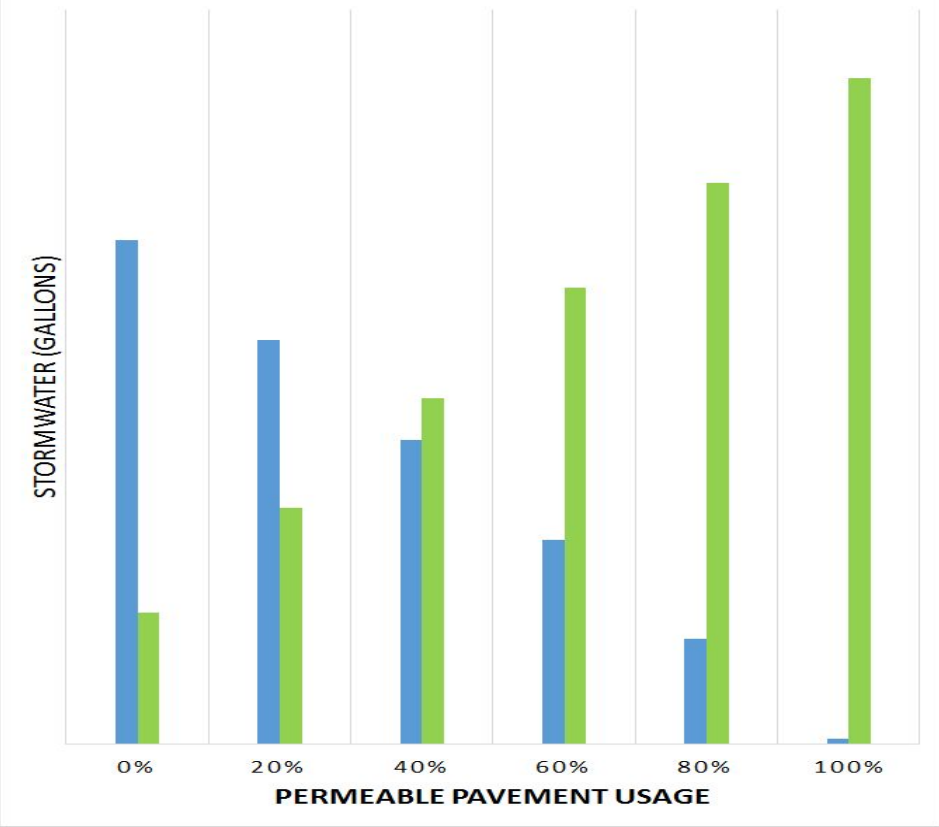




Stormwater Calculator

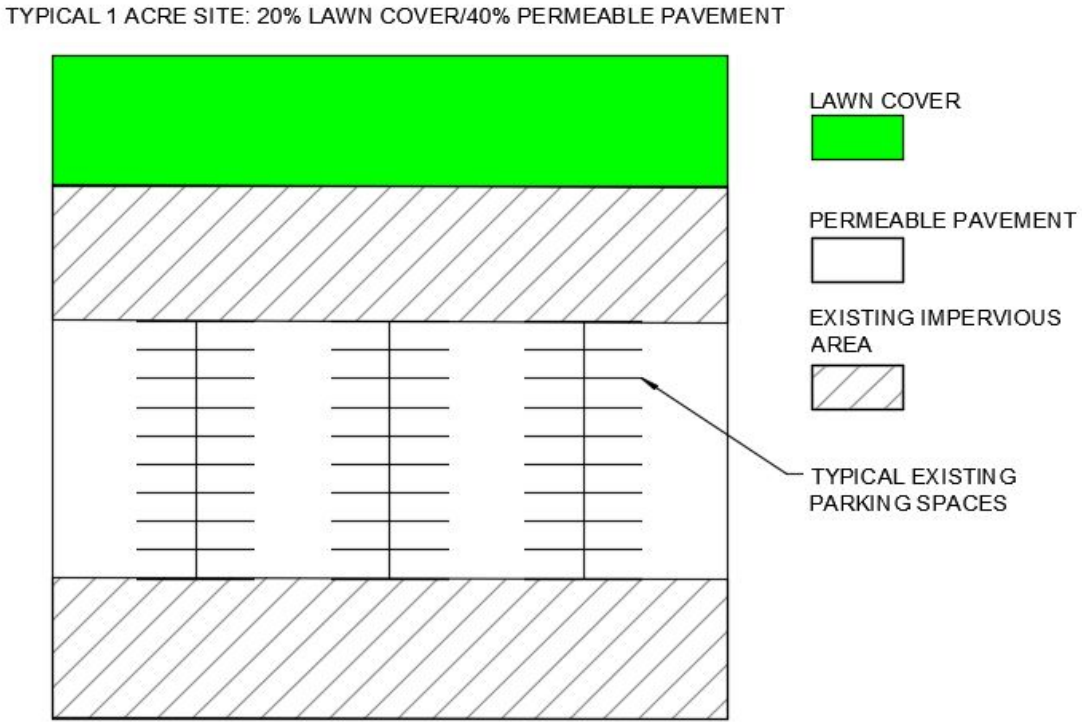


Infiltration Results for Permeable Pavement



Percentage of Permeable Pavement	Runoff (Gallons)	Infiltration (Gallons)
0%	960,000	250,000
20	770,000	450,000
40%	580,000	660,000
60%	390,000	870,000
80%	200,000	1,070,000
100%	10,000	1,270,000

Conceptual Site



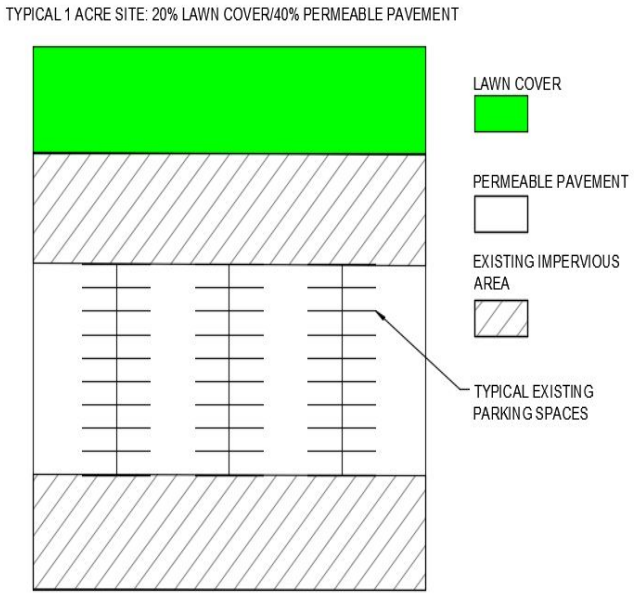
Effectiveness per 10% Increase in Technology

Green Technology	Rise in Percentage of Infiltration	Approximate Water Quantity (Gallons)
Permeable Pavement	+7.2%	110,000
Infiltration Basin	+3.0%	33,000
Rain Garden	+2.4%	41,000

Impact Visualization

- Typical 1 Acre: 20% Lawn Cover/40% Permeable Pavement generates approximately 660,000 Gallons of Infiltration

Function	Water Usage (Gallons)	Equivalent Uses Per Year (Gallons)
Average Shower	17.2	38,370
Standard Washing Machine Load	27	24,445
Standard Dishwasher Load	11	60,000
Toilet Flush	1.6	412,500
10 Minute Garden Hose Car Wash	100	6,600



Evaluating Solutions

- Point system evaluating technologies and locations
- Created to adapt to client priorities

Point Distribution	Description
40 Infiltration	US EPA Stormwater Calculator Data and GIS Data, gallons of water infiltrating per year
30 Cost	
15 Cost of materials	Initial construction of technology
15 Cost to maintain	Cost per gallon of water infiltrated
15 Maintenance	
10 Time	Required hours per year of maintenance
5 Ability to maintain	Willingness/ease of maintenance implementation of location
5 Loss of purpose	Evaluation of land losing intended purpose
5 Permitting requirements	Additional permitting will lower score
5 Combined sewer area	Points awarded to sites infiltrating in areas where runoff flows to combined sewer
Total= 100 possible points	

Decision Matrix

	Rain Garden		Infiltration Basin		Permeable Pavement	
	Value	**Points Awarded**	**Value**	**Points Awarded**	**Value**	**Points Awarded**
40 Infiltration						
30 Cost						
15 Cost of materials						
15 Cost to maintain						
15 Maintenance						
10 Time						
5 Ability to maintain						
5 Loss of purpose						
5 Permitting requirements						
5 Combined sewer area						
Total (out of 100)		0.00		0.00		0.00

Cost of Materials

Technology	Cost per square foot
Infiltration Basin	$2.50
Rain Garden	$4.00
Permeable Pavement	$4.00

http://www.statecollegepa.us/index.aspx?NID=2480
http://sustainablestormwater.org/2007/05/05/permeable-pavers/
http://water.epa.gov/polwaste/npdes/swbmp/Infiltration-Basin.cfm
http://www.lowimpactdevelopment.org/school/articles/rain_garden.pdf
http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Infiltration%20Practice/Porous%20Pavement.htm

Example

- 1 acre, 20% lawn 80% impervious
- 40% permeable pavement
- 13,939 sq ft x $4 per sq ft = $55,756
- 660,000 gallons of water collected in the first year

- **Cost = $0.08 per gallon infiltrated within 1 year**

Questions?