



New York State Water
Resources Institute

Managing Stormwater with Green Infrastructure: Overview and Benefits

Emily Vail

Hudson River Estuary Program
NYS Department of Environmental Conservation
Cornell University NYS Water Resources Institute



Presentation Outline

- Hudson River Estuary Program
- Impact of stormwater
- Green infrastructure
 - Planning
 - Examples of practices
- Benefits
- What you can do

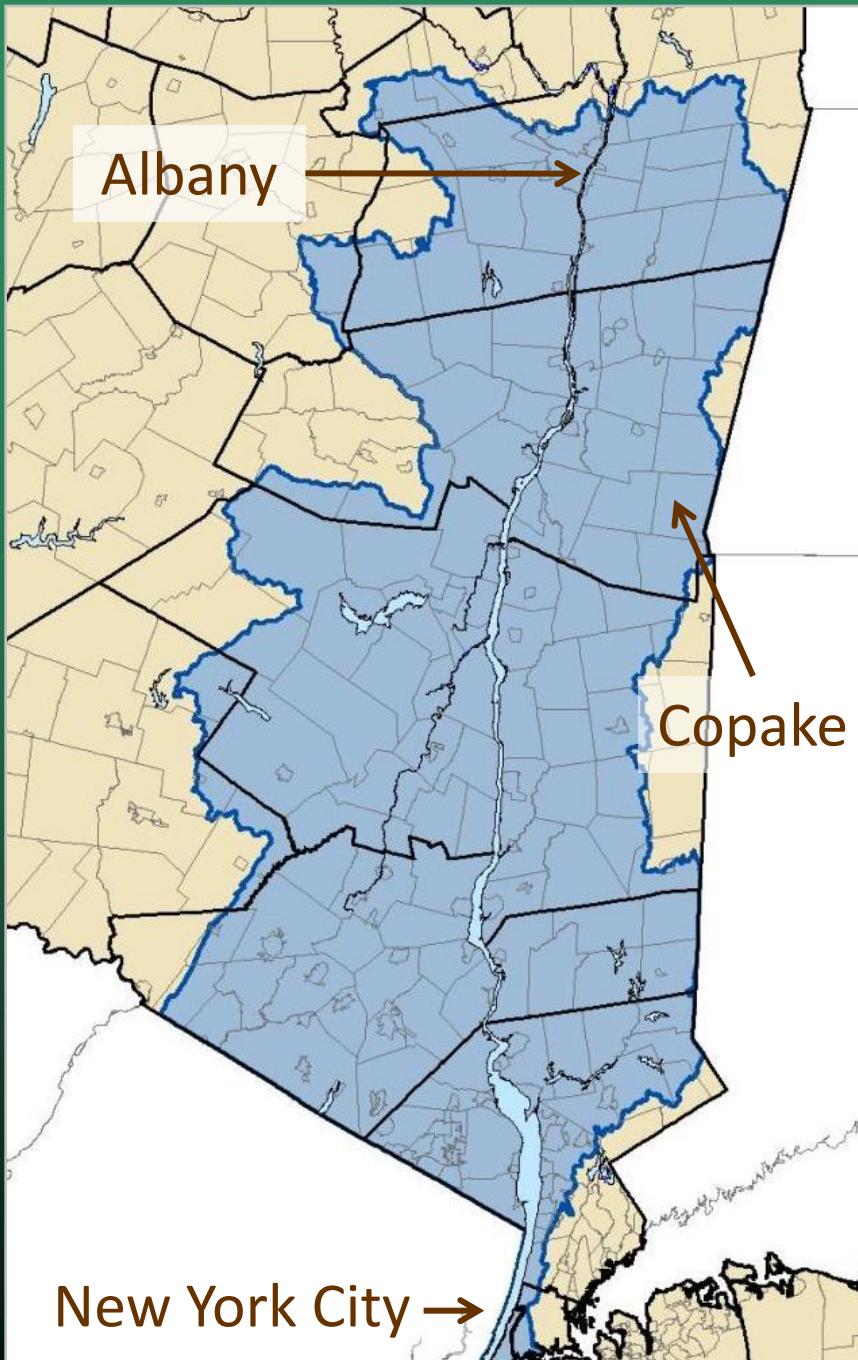


Hudson River Estuary Program

Core Mission

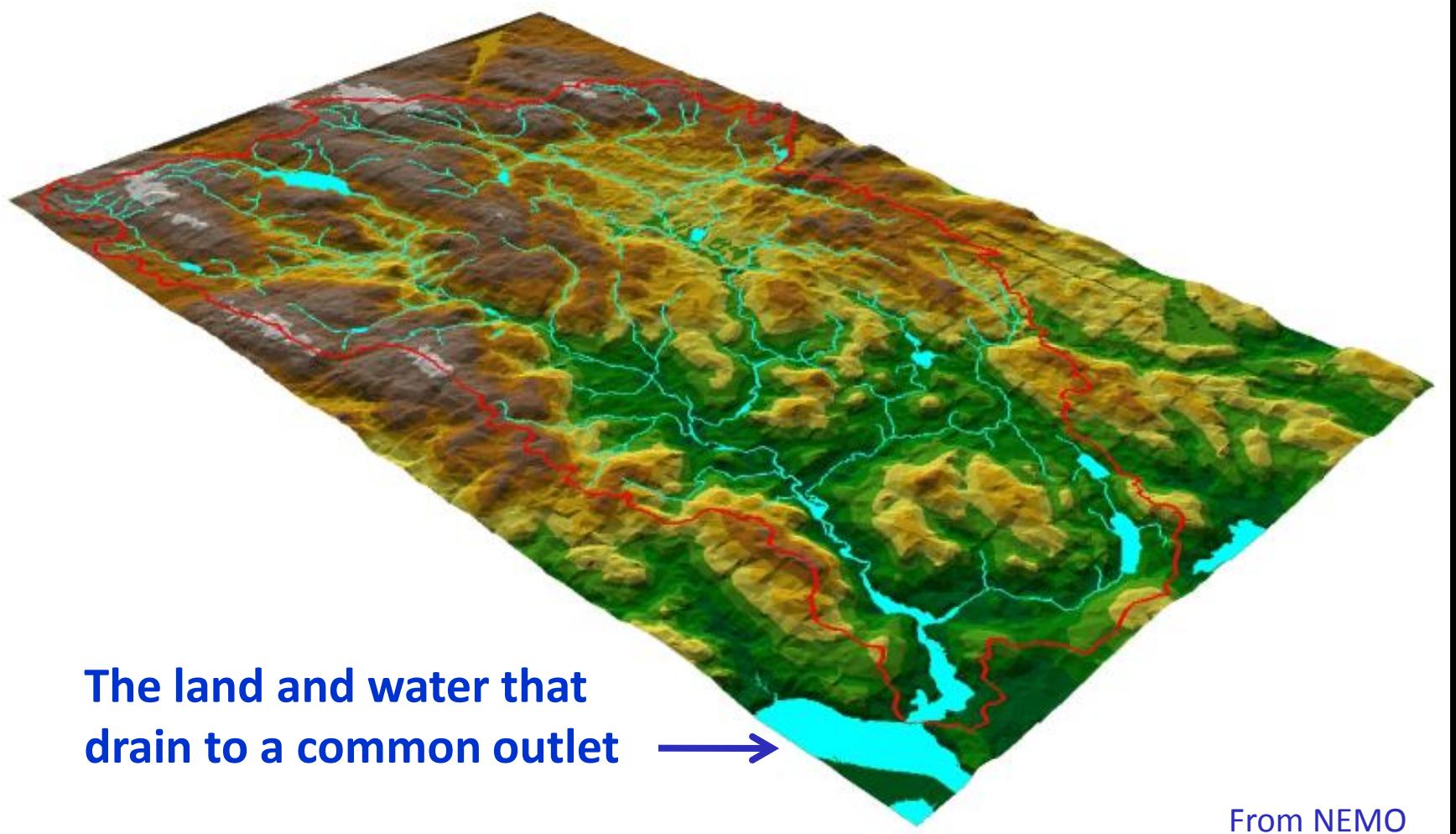
- Ensure *clean water*
- Protect and restore fish, wildlife, and their *habitats*
- Provide water recreation and river *access*
- Adapt to *climate change*
- Conserve world-famous *scenery*





Hudson River Estuary Program Area

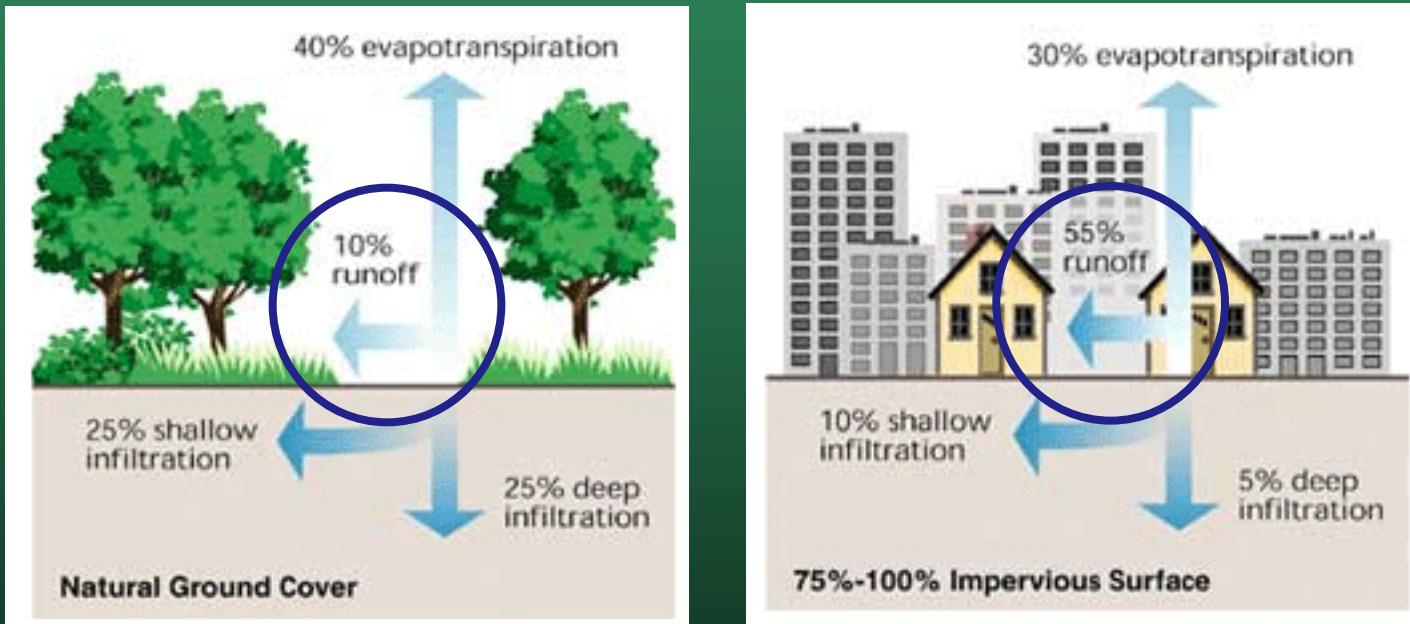
Importance of Watershed Thinking



The land and water that
drain to a common outlet →

From NEMO

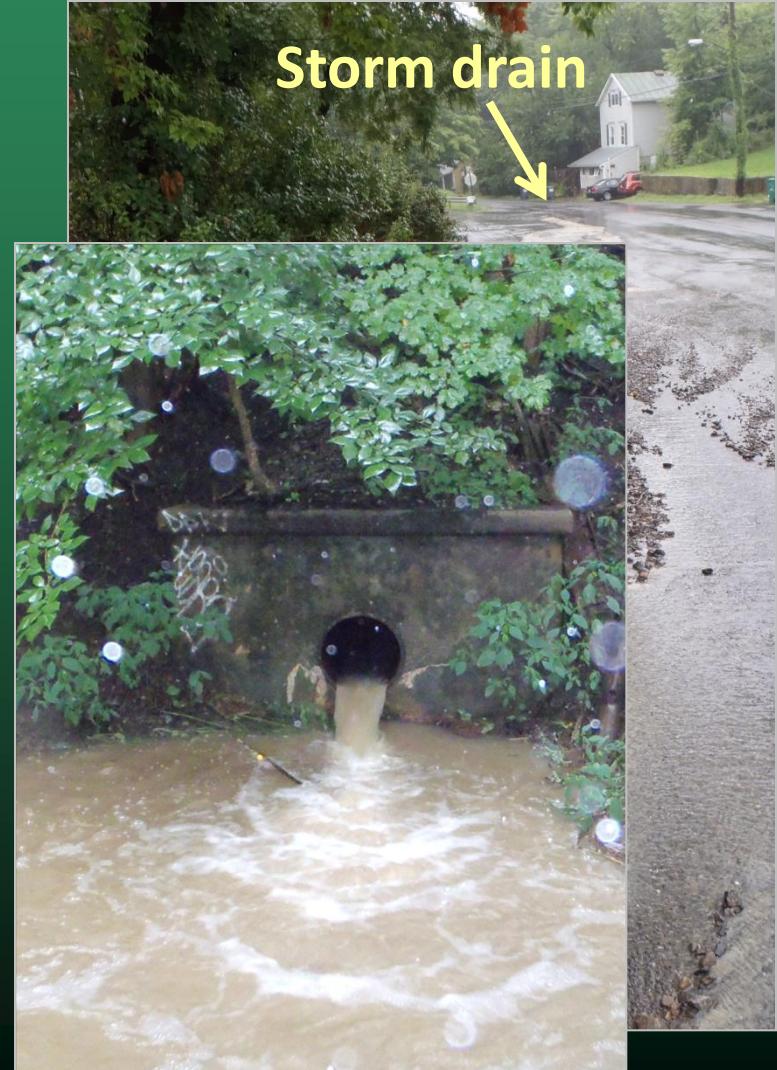
The Problem with Impervious Surfaces



National Research Council, "Stormwater Management in the United States" (2008)

Stormwater Carries Pollutants

- Most stream impairments in the region due to polluted runoff
 - Documented impacts for nearly 35% of waterbodies
- Traditional stormwater management
 - Impervious surface -> storm sewer -> streams



Stormwater Carries Pollutants

- Water *quality* problems

- Sediment
- Nutrients
- Road salt
- Oil/grease
- Trash



- Water *quantity* problems

- Flooding
- Erosion



Overflowing Sewage

- Wet weather leads to overflows – CSOs or SSOs
- Degrades water quality
- Impacts public health, water recreation



Impacts of Agriculture

- Agricultural runoff also impacts streams
 - Nutrients, sediment, pesticides, etc.
- Resources available:
 - Columbia County Soil & Water Conservation District
 - Farmscape Ecology Program at Hawthorne Valley Farm
 - Agriculture Environmental Management program



What is Green Infrastructure?

- Different approach to stormwater - natural and engineered systems that mimic nature
- Manage runoff by maintaining or restoring natural hydrology
 - Allows stormwater to ***infiltrate*** into the soil and be used by plants



Vassar College, Poughkeepsie

Gray vs. Green Infrastructure



Green Infrastructure

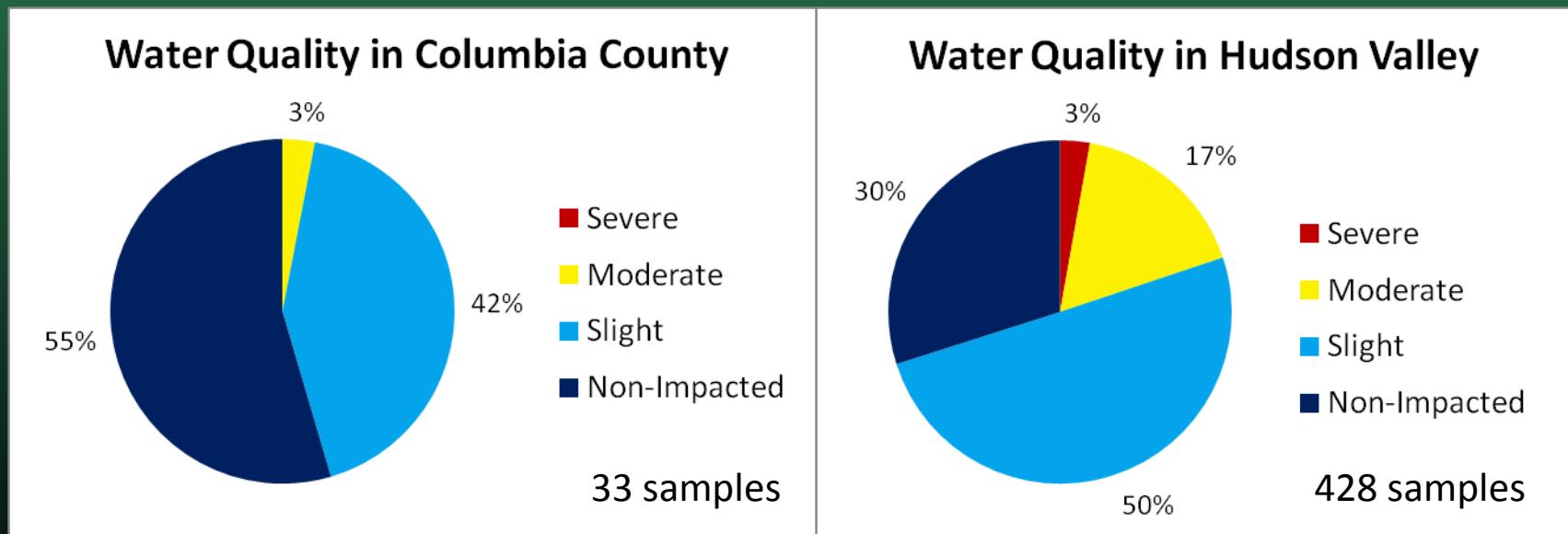
- Regional and local scales
- Includes “low impact development” projects
- Provides multiple benefits
 - Slows the flow of runoff
 - Removes pollutants
 - Keeps water out of the storm sewer system
 - Increases vegetation



Lower Esopus Creek

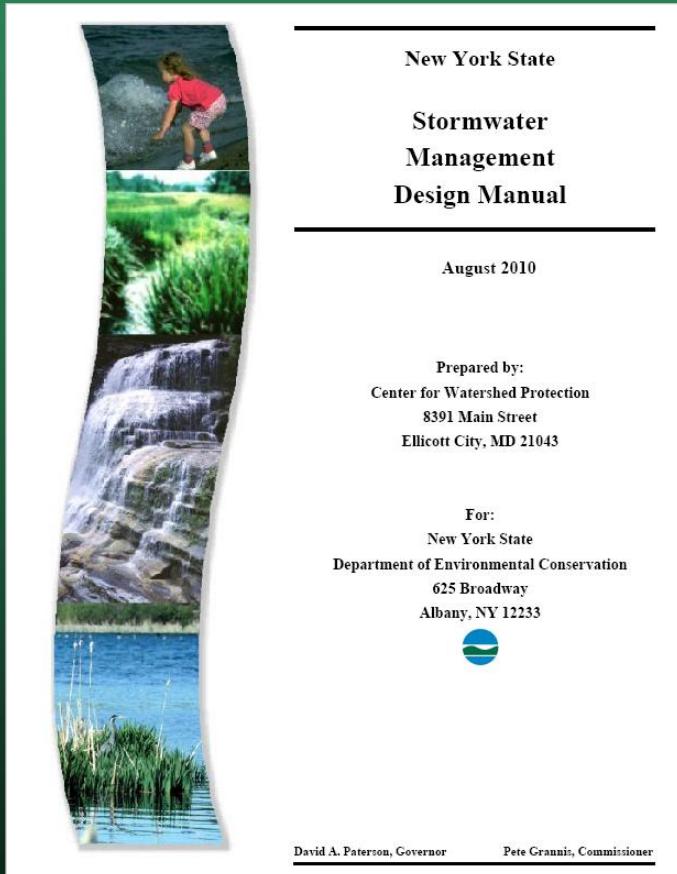
Why is green infrastructure important for Columbia County?

- Now in state-wide regs
- Includes natural and engineered systems
- Important to protect healthy streams



NYS DEC Stream Biomonitoring Unit Data, 1973-2011

Green Infrastructure Requirements



- August 2010 - Updated New York State Stormwater Design Manual
- Chapter 5 – Green Infrastructure
- **New** development – reduce runoff first using green infrastructure

NYS Stormwater Design Manual

1. Planning

- A. Preserving natural areas → Avoid stormwater
- B. Reducing impervious surface cover → Reduce stormwater
- 2. Green infrastructure → Manage stormwater practices

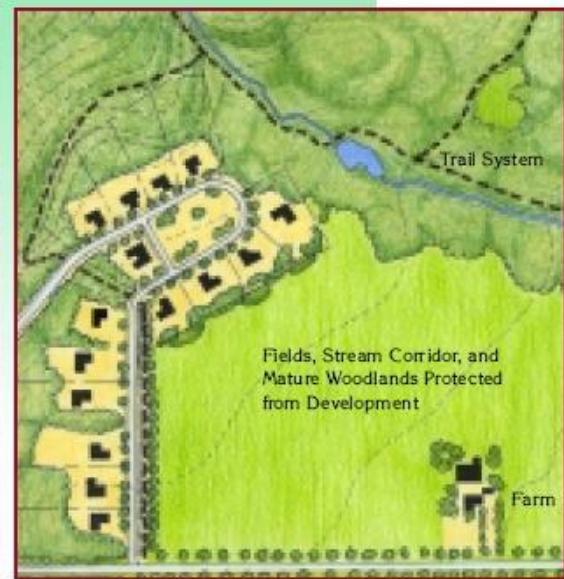
Green Infrastructure Planning

- Preserve natural areas – reduce disturbance, conservation design, developing in less sensitive areas

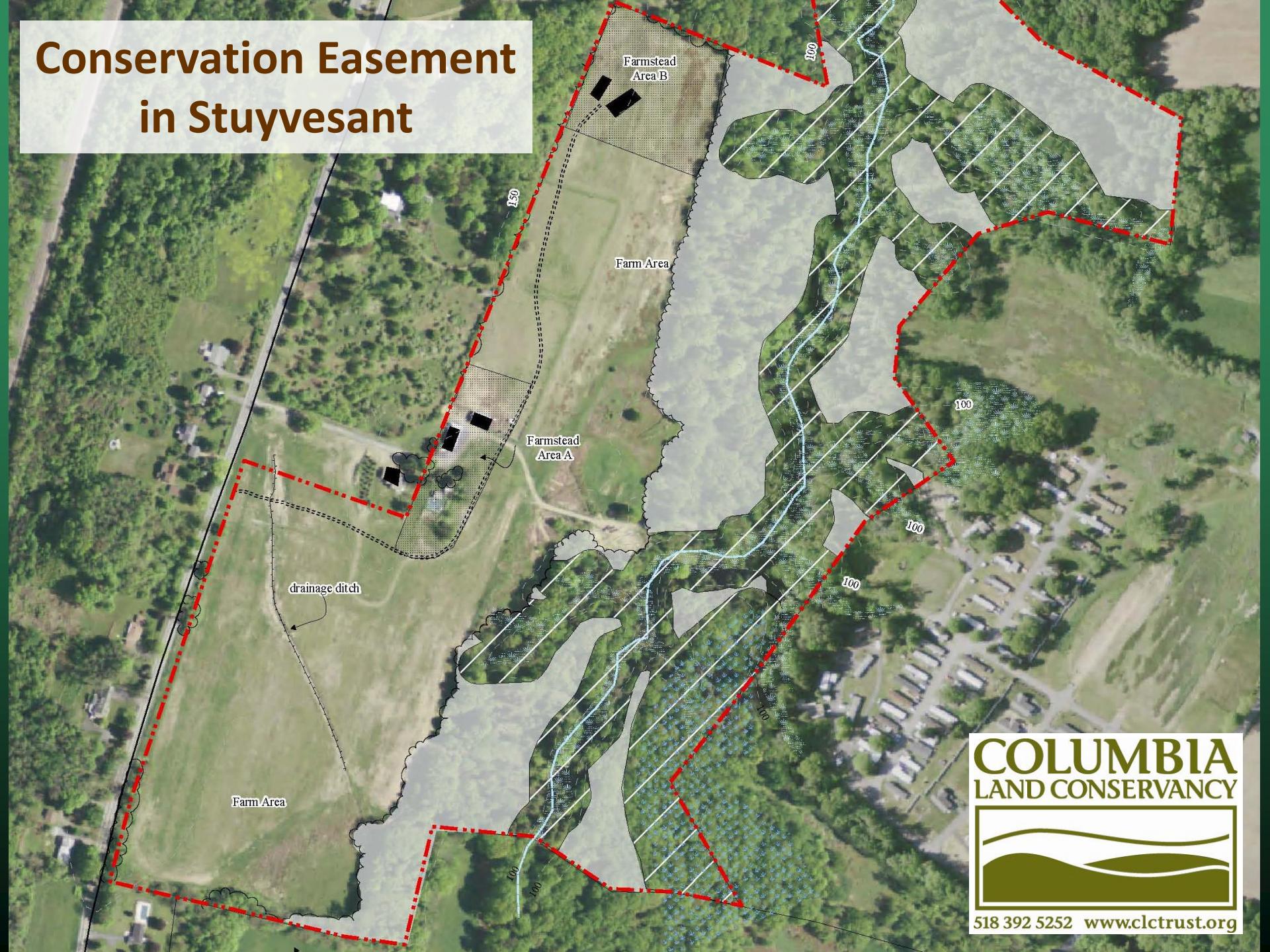
Traditional Subdivision



Conservation Subdivision



Conservation Easement in Stuyvesant



COLUMBIA
LAND CONSERVANCY



518 392 5252 www.clctrust.org

Green Infrastructure Planning

- Reduce impervious cover – smaller driveways, parking lots, roads, disturbance area



NYS Parks, Recreation & Historic Preservation, Staatsburg

Green Infrastructure Practices

- Natural features and engineered practices that infiltrate runoff on-site
 - Treat stormwater closer to where the rain falls
 - Several small practices instead of one large one
- Examples on HREP website:
<http://www.dec.ny.gov/lands/58930.html>



Rain Gardens & Bioretention Areas

- Shallow depression of soil and plants, filters runoff and slows its flow



Cornell Cooperative Extension's
Agroforestry Resource Center, Acra



Columbia County Soil & Water
Conservation District, Ghent

Vegetated Swales

- Natural drainage paths or vegetated channels used to transport water above ground



Subdivision, Pawling



Village Hall, Greenwood Lake

Green Roofs

- Layers of soil and vegetation on rooftops that capture runoff



Rensselaer County Master
Gardeners shed, Wynantskill



Hawthorne Valley Farm, Ghent

Porous Pavement

- Paved surfaces that allow stormwater to infiltrate



Columbia County Soil & Water
Conservation District, Ghent



NYS Parks, Recreation & Historic
Preservation, Staatsburg

Rain Barrels or Cisterns

- Capture and store rooftop runoff to re-use for watering plants and other uses



Children's Garden at Boyce Park,
Wingdale



Cornell Cooperative Extension's
Agroforestry Resource Center, Acra

Stream Buffer Restoration

- Vegetation along streams improves stream health, filters/slow runoff, many other benefits



Roeliff Jansen Kill



Taghkanic Town Hall

Other Green Infrastructure Practices

- Disconnecting rooftop runoff
- Stormwater planters
- Tree planting/street trees
- Stream daylighting



NYS Parks, Recreation & Historic
Preservation, Staatsburg



Bus Shelter, Ardsley

Residential Green Infrastructure



Rain Barrel – Millerton



Pervious Pavers
– Syracuse



Pervious Asphalt
– Poughkeepsie

Commercial Green Infrastructure



Pervious Asphalt –
Poughkeepsie



Pervious Pavers
– Landmark at
Eastview, Town
of Greenburgh



Bioretention – Middletown

Municipal Green Infrastructure



Rain Garden –
Mount Pleasant
Highway Garage



Rain Garden –
Town of Ulster



Rain Garden/Pervious Pavers – Greenwood Lake

Green Infrastructure - Redevelopment



Before



After

Bioretention – Vassar College, Poughkeepsie

Green Infrastructure - Redevelopment



Before



After

Vegetated Swale – Village of Greenwood Lake

Benefits of Green Infrastructure

- Manage stormwater (quality and quantity)
- Recharge groundwater
- Reduce CSOs
- Cool urban areas – energy savings
- Provide wildlife habitat
- Improve air quality
- Improve human health
- Increase land values
- Beautify neighborhoods



Implementing Green Infrastructure

- Homeowners, watershed groups, neighborhoods, regional planners, businesses, and
- Municipalities
 - Planning
 - Codes/ordinances to encourage, incentivize, or require
 - Demonstration sites



SUNY Orange, Middletown

Implementing Green Infrastructure

- Planning
 - County,
 - Watershed,
 - Municipal, or
 - Site scales
- Designing practices
- Constructing
- Maintaining



Needs maintenance

Implementing Green Infrastructure

- Harrier Hill Park, Stockport – Vegetated swale and stormwater pond



Before



After

Change in maintenance

What can you do?



- Planning for GI
 - Incorporate into CSO Long Term Control Plans
- Visit local green infrastructure practices
- Build demo projects
- Utilize resources offered by the Hudson River Estuary Program

Review Local Codes and Ordinances

- Codes and Ordinances
Worksheet for New York
State
- Town of Wappinger and
Town of Clinton case
studies

[http://www.dec.ny.gov/
lands/42053.html](http://www.dec.ny.gov/lands/42053.html)

Town of Wappinger

Recommended Model Development Principles
for Conservation of Natural Resources
in the Hudson River Estuary Watershed
Consensus of the Local Site Planning Roundtable



A partnership among:
Town of Wappinger, Dutchess County, New York
Dutchess County Environmental Management Council
Wappinger Creek Watershed Intermunicipal Council
NYSDEC Hudson River Estuary Program
Center for Watershed Protection, Maryland



June 2006

Green Infrastructure Examples in the Hudson Valley

<http://www.dec.ny.gov/lands/58930.html>

The screenshot shows the official website of the New York State Department of Environmental Conservation (DEC). The header features the DEC logo and the text "DEPARTMENT OF ENVIRONMENTAL CONSERVATION". A banner image of a river valley is visible. The main navigation menu includes links for "Outdoor Activities", "Animals, Plants, Aquatic Life", "Chemical & Pollution Control", "Energy and Climate", "Lands and Waters", "Oceans & Estuaries", "Hudson River Estuary Program", "Green Infrastructure Examples for Stormwater Management in the Hudson Valley", "Vassar College Rain Garden", "Education", "Permits and Licenses", "Public Involvement and News", "Regulations and Enforcement", "Publications, Forms, Maps", and "About DEC". Below the menu, there are links for "Printer-friendly", "A-Z Subject Index", a search bar, and a "Search DEC" button. The main content area is titled "Vassar College Rain Garden". It includes sections for "Description", "Site Location", "Practice Information Details", and "Related Links". A photograph of a rain garden with a blue car parked nearby is shown. A map indicates the location along the Hudson River. The "Page Applies To" section highlights the Hudson River area. The "Related Links" section includes the Better Site Design Program for the Hudson River Estuary, NYSDEC Construction Stormwater Toolbox, NYSDEC Stormwater Public Review Documents, and Offsite Links to the Low Impact Development Center and Beacon Institute for Rivers and Estuaries. The "NEMO National Low Impact Development Atlas" is also mentioned. A "PDF Help" link is at the bottom.

DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

Printer-friendly || A-Z Subject Index || Enter search words | Search DEC

Home » Lands and Waters » Oceans & Estuaries » Hudson River Estuary Program » Green Infrastructure Examples for Stormwater Management in the Hudson Valley » Vassar College Rain Garden

Vassar College Rain Garden

Description

This rain garden is an example of green infrastructure in an institutional setting. The runoff from the maintenance building is directed to the rain garden where it infiltrates into the ground.

Site Location

- Site Address:** Hooker Ave. Poughkeepsie, NY 12601
- Town:** Poughkeepsie
- County:** Dutchess
- Land Use of Site:** College Campus
- Can Site be visited?:** Check with College
- Location on Site:** North of first building on the right after entering the athletic complex from Hooker Avenue

Practice Information Details

- Intent of Design:** Treat parking lot runoff through infiltration and biological uptake.
- Stormwater Management Capacity:** 152 Cubic Feet
- Year of Installation:** 2007
- Plant Material Used:** Unknown
- Annual Operational and Maintenance:** Weeding and replacement of any dead vegetation.
- Required Zoning Change or Special Permit:** None

Page Applies To:

Hudson River

Related Links:

- Better Site Design Program for the Hudson River Estuary
- NYSDEC Construction Stormwater Toolbox
- NYSDEC Stormwater Public Review Documents

Offsite Links:

- Low Impact Development Center
- Beacon Institute for Rivers and Estuaries
- NEMO National Low Impact Development Atlas

PDF Help:

Filter Projects

 All Projects

809

<input type="checkbox"/>	Swale/Bioswale	146
<input type="checkbox"/>	Bioretention/Rain Garden	357
<input type="checkbox"/>	Cistern/Rain Barrel	146
<input type="checkbox"/>	Stormwater Wetlands	76
<input type="checkbox"/>	Green Roof	110
<input type="checkbox"/>	Permeable Pavement	246
<input type="checkbox"/>	Water Conservation	73
<input type="checkbox"/>	Green Streets	1
<input type="checkbox"/>	Other	69
<input type="checkbox"/>	Multiple Practices	187

State:

New York

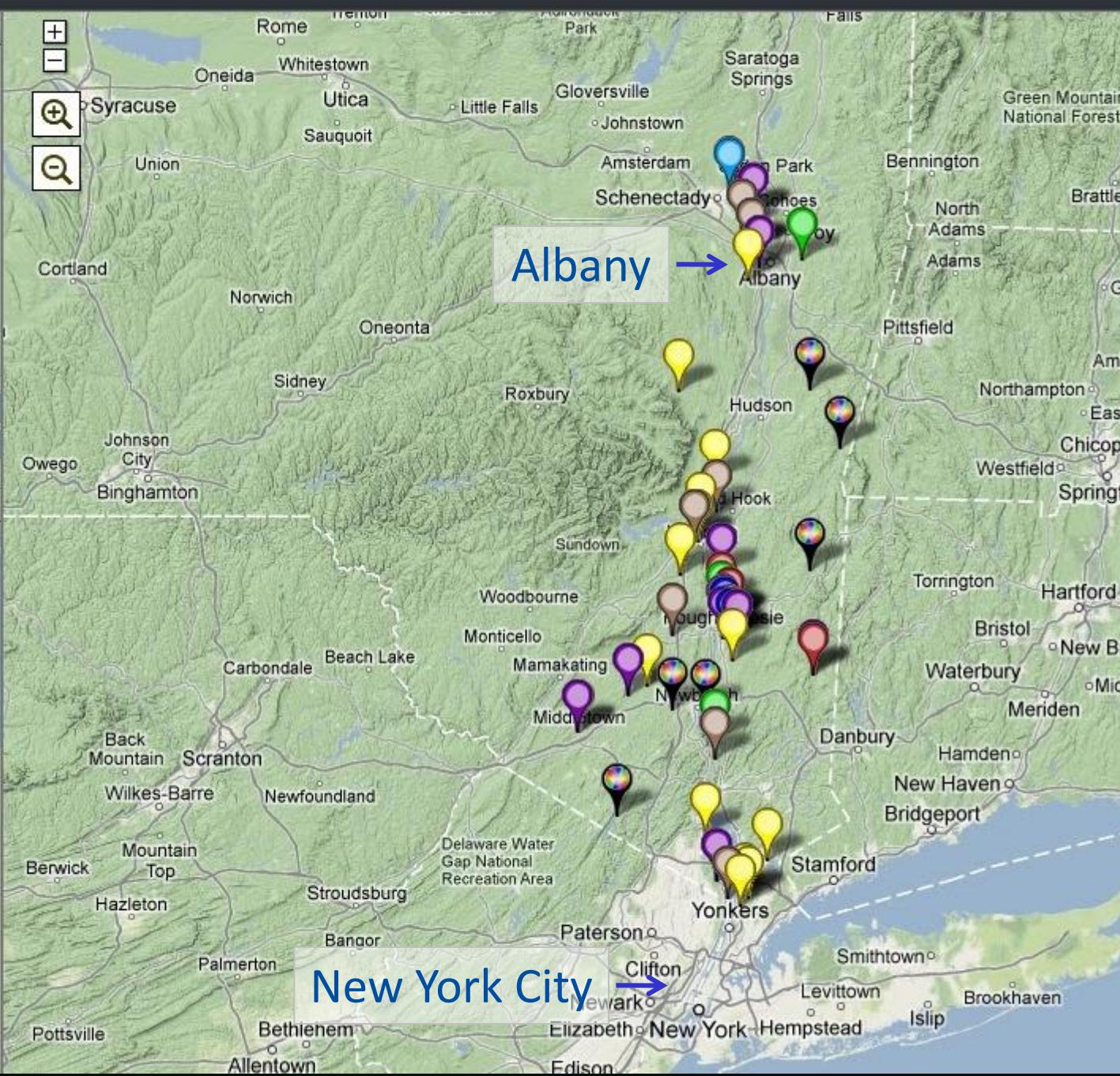
Land Use Type:

All Types

Currently Showing (56 Projects)

Show All Projects

- 43 British American Blvd. Infiltration E Latham, NY
- 43 British American Blvd. Wet Swale Latham, NY
- Albany Pine Bush Discovery Center P Albany, NY
- Ardsley Bus Shelter Stormwater Plan Ardsley, NY
- Ashford Park Rain Garden Ardsley, NY
- Beacon Institute Green Infrastructure Beacon, NY
- Benedict Farm: Muddy Kill River Pres. Montgomery, NY
- CCE Master Gardeners Rosendale Lit Rosendale, NY
- CCE Master Gardeners Saugerties Se Saugerties, NY
- CCE Master Gardeners Ulster Town t



Participate in Trees for Tribs



[http://www.dec.ny.gov/lands/
43668.html](http://www.dec.ny.gov/lands/43668.html)





New York State Water
Resources Institute

Emily Vail
Watershed Outreach Specialist
eevail@gw.dec.state.ny.us
(845) 256-3145

Hudson River Estuary Program
New York State Department of Environmental Conservation
In cooperation with Cornell University NYS Water Resources Institute

