

Learning Group #3 - June 19, 2017 Meeting Summary

Overview

The Sea Level Rise Implementation Learning Group held its third session June 19, 2017, with representatives from Piermont, Stony Point, Kingston, and Catskill meeting with the project planning team (NYS DEC Hudson River Estuary Program [HREP], Consensus Building Institute [CBI], Scenic Hudson) to continue coordinating work to implement recommendations from sea level rise (SLR) Task Force reports along with other flooding adaptation and mitigation initiatives. The City of Kingston is participating in the project both as a SLR task force community and a member of the project planning team (as the HREP grant recipient and administrator). The meeting was held at the River Center at Long Dock Park, Beacon, NY.

Analyses to Support Local Adaptation Strategies

Donna Verna with Crawford & Associates presented on two projects she has been leading in the Village of Catskill, both funded by Hudson River Estuary Program grants and recommended by the Catskill Waterfront Resilience Task Force

1. Zoning Code Analysis for Flood Resiliency. Crawford & Associates reviewed the Flood Damage Prevention Law (FDPL), zoning code, and NYS Uniform Code. Based on the review they recommend a Flood Overlay District based on the 0.2% annual chance flood area (aka 500-yr floodplain), and changes to standards, allowed uses and processes associated with implementing these laws.

2. Risk and Engineering Review of Waste Water System. This review included the waste water treatment plant (WWTP), combined sewer overflows (CSO), and pumping stations in the village. For each of these components, Crawford & Associates developed an elevation-based analysis that compared the year when the asset (and its components) will become vulnerable (based on high SLR projections) to the end of the service life of that asset. They reviewed adaptation options and are making recommendations, including a design to adapt the WWTP itself in its existing location.

The next step for the zoning analysis is implementation. Nancy Richards with Catskill reported that she is working on grant funding to support implementation but that while the planning board is supportive of this, it is taking more effort to get the village board behind the need to implement the consultant's recommendations. Gaby Weiss with HREP pointed out that having a plan for adaptation "on the books" can allow a community to use post-disaster funding to re-build to the plan's standards (rather than to the previous state)

Managing runoff with Green Infrastructure (GI)

Emily Vail from the Hudson River Estuary Program (HREP) gave a presentation overviewing green infrastructure approaches for managing stormwater, which aim to reduce rainwater runoff by allowing it to infiltrate into the ground. The presentation included many examples of these practices, highlighted

other benefits of green infrastructure, and referenced additional resources. Gaby Weiss (also from HREP) then led an exercise in siting green infrastructure. She explained the main considerations for siting green infrastructure (such as topography, soil type, and land ownership), and provided large maps for each community showing a portion of the community with overlaid data that is useful for siting GI. The representatives from each community worked with the planning team and Emily to identify potential locations for GI projects on the maps. Each community was asked to review the potential locations with others in their municipality and identify the most viable GI infrastructure by late July to inform follow-up discussions at Learning Group #4.

Strengthening Community Engagement

Liz LoGiudice led a discussion about effective outreach/engagement strategies. Each community described the general engagement level and challenges it faces, revealing notable differences in these areas. For instance, Catskill has difficulty with volunteer recruitment and retention for climate adaptation efforts in contrast to a generally highly engaged community in Piermont. Kingston has a large Spanish-speaking community that is under-engaged and city leaders are seeking ways to outreach effectively to that community. Groups shared elements of past successful engagement efforts, such as Piermont's newsletter (which is written and distributed by a private citizen rather than the Village) and the Kingston Land Trust's new "tierra y comida" events. Liz suggested that climate change adaptation could be incorporated into the work of existing community groups.

The group began a discussion about municipal websites and other social media as engagement tools. Again, there has been some success, but also reports of information being difficult to find on these websites. It was noted that both Piermont and Stony Point are in the process of updating their websites and there was an interest in developing broad content that could be customized by each community. The project team provided a handout with ideas for content topics, and asked that attendees 1) visit their municipal websites by the next meeting and identify where climate resilience (or flood resilience) information is located, 2) identify a potential way to incorporate a link to resilience web content from the home page, and 3) choose from the list of content topics (and any others) so we can work to create common but customizable web content. There was brief discussion of the merit of a stand-alone site (vs. pages within the municipal site), and a general agreement that the group would also like more information on social media.

Key outcomes, decisions, next steps

The meeting generated several specific outcomes and next steps outlined below.

- Participants from Piermont, Stony Point, and Kingston were introduced to zoning code and waste water systems analyses (from Catskills) which may be of use in their own planning.
- Participants learned about Green Infrastructure and began to identify potential sites for such projects in their communities. Specifically, each community was asked to identify and inform the planning committee of what it see as its most viable sites six weeks prior to the August 29 Learning Group #4.
- Each community will consider possible website content elements and how they might fit in to the structure of its municipal websites for the next meeting. The planning team (led by Liz) will follow up with participants and suggest a web structure and basic content.

The planning team will include the presentation slides with meeting materials for participants (and absentee participants) reference. Bennett reminded attendees of meeting #4 (the final in the series) scheduled for August 29th, but suggested re-polling the group to ensure good attendance. The planning team will consult with municipality representatives to craft the next meeting's agenda.

Supplementary materials

- Meeting agenda
- Handouts
 - updated financing fact sheet
 - constructed stormwater green infrastructure techniques
- Presentation slides
 - zoning code and wastewater infrastructure analyses in Catskill
 - green infrastructure basics
 - green infrastructure siting

Meeting Participants

Piermont

Usha Wright

Stony Point

Jake Cataldo

Jim Monaghan

Kingston

Kevin McEvoy

Julie Noble

Catskill

Liz LoGiudice (also a consultant for the planning team)

Nancy Richards

Hudson River Estuary Program

Kristin Marcell

Emily Vail

Gabrielle Weiss

Consensus Building Institute

Bennett Brooks

Scenic Hudson

Nava Tabak

Cornell Cooperative Extension

Michelle Gluck

Crawford & Associates Engineering & Land Surveying

Donna Verna

Sea Level Rise Implementation Learning Groups
Learning Group #3

12:30 to 4:00 p.m. – Monday, June 19, 2017
Scenic Hudson River Center, 8 Long Dock Road, Beacon NY

AGENDA

- 12:30-1:00 PM** **Informal Gathering**
- Lunch will be available starting at 12:30 p.m. and throughout the afternoon
- 1:00-1:10 PM** **Getting Started**
- Welcoming remarks
 - Introductions, agenda review and discussion protocols
- 1:10-2:10 PM** **Managing Runoff with Green Infrastructure**
- Introduction to Green Infrastructure
 - Community breakout sessions to identify potential candidates for green infrastructure within each community
 - Strategies and next steps to pursue green infrastructure
- 2:10-3:00 PM** **Strengthening Community Engagement**
(Participants take break, as needed)
- Developing effective webpages and social media
 - Brainstorming effective outreach/engagement strategies to address communities' core concerns; draw from matrix case studies as possible
- 3:00-3:30 PM** **Analyses to Support Local Adaptation Strategies**
- Overview of Crawford & Associates recent work in Catskill
 - Wastewater treatment plant vulnerability analysis
 - Land use analysis
 - Opportunity for questions and comments
- 3:30-3:50 PM** **Updates**
- Consolidated Funding Application Release
 - April Waterfronts conference
 - Regional Plan Association Peer-to-Peer Network
- 3:50-4:00 PM** **Next Steps and Reflections**
- Review next steps; elicit feedback on Learning Group discussions
- 4:00 PM** **Adjourn**

FINANCING WATERFRONT RESILIENCE



Hudson River Estuary Program

State and federal resources for communities

2017 Summary of financial assistance programs

State and federal agencies offer financial assistance to municipalities and non-profit organizations for activities building resilience to waterfront flooding, sea level rise and other climate risks. This document provides an overview of these assistance programs and how to apply. Eligible activities include municipal planning, improving the resiliency of structures, emergency management planning, waterfront revitalization, public outreach, and floodplain protection. A summary table of all resources, organized by agency, areas of assistance and deadlines, can be found at the end of this document.



View of flooded road in Stony Point following Hurricane Sandy in 2012 (L. Konopko)

- **NYS Department of Environmental Conservation (DEC):** Hudson River Estuary Grants, Climate Smart Communities Grants, Water Quality Improvements Program, Trees for Tribs
- **Environmental Facilities Corporation (EFC):** Wastewater Infrastructure Engineering Planning, Clean Water Revolving Loan Fund, Green Innovation Grant Program
- **Federal Emergency Management Agency (FEMA):** Hazard Mitigation Assistance, Public Assistance, Community Rating System
- **Department of State (DOS):** Local Waterfront Revitalization Program

• Other Financial Assistance Programs

- **New York State Energy Research and Development Authority (NYSERDA):** Clean Energy Communities Program
- **NYS Office of Parks, Recreation and Historic Preservation (OPRHP):** Parks, Preservation and Heritage
- **US Housing and Urban Development (HUD)** Community Block Grant Program
- **Empire State Development (ESD)** Grant program for infrastructure investment
- **Hudson River Greenway** Communities and Compact Grant Programs
- **Open Space Funding Options**

[NYS Consolidated Funding Application](#)

New York State's Consolidated Funding Application (CFA) allows communities to design comprehensive projects and with one application, apply to multiple state funding sources. Communities may not apply to federal programs such as FEMA through the CFA. You can download [the 2017 CFA Available Resources \(PDF\)](#) online.

LOCAL EXAMPLE: CONSOLIDATED FUNDING APPLICATION



Kingston received a \$1.2 million grant for a public-private intermunicipal partnership to design and build a one mile promenade along the Hudson River. The promenade will feature green infrastructure and offer public access and recreation and keep open space along the waterfront. The funds were awarded from the Department of State's Local Waterfront Revitalization Program through a CFA application.

Overview of Financial Assistance Programs

Below is a summary of financial assistance programs identified by their funding categories related to flood resilience.



Municipal planning



Collaboration and public outreach



Resilient structures



Waterfront economy



Emergency management



Floodplain protection

CFA = grants included in the NYS Consolidated Funding Application

New York State Department of Environmental Conservation (NYS DEC)

The NYS DEC is a state agency focused on the conservation, enhancement, and enjoyment of environmental resources.



Hudson River Estuary Program Grants

The [2017 Request for Applications \(RFA\) for Hudson River Estuary Grants](#) (\$670,000) cover *Local Stewardship Planning* and *River Access Improvements for People of All Abilities*. These Requests for Applications (RFAs) implement priorities of the [Hudson River Estuary 2015-2020 Action Agenda](#). Grant awards range from \$10,500 to \$50,000 and require a 15% match. All prospective applicants must register in advance in the [New York State Grants Gateway](#) where they can also search and download the full RFA by searching for 'Hudson River Estuary.' Funding for the grants is provided by the New York State Environmental Protection Fund (EPF). For more information on these opportunities, contact HREPGGrants@dec.ny.gov and sign up for our [Climate Resilience Newsletter](#).

Local Stewardship Planning

Up to \$450,000 is available to help communities and local organizations advance six categories of local projects and programs through planning, feasibility studies, and/or design:

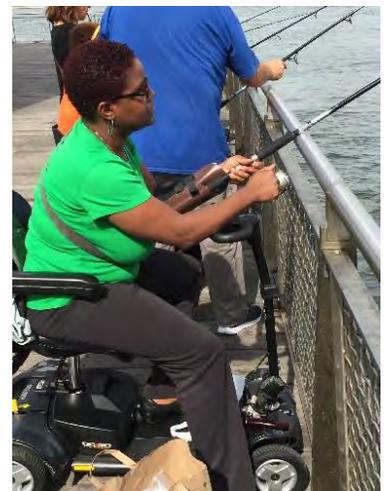
- Climate adaptation along the Hudson River
- Water supply and waste-water infrastructure resiliency
- Green infrastructure to reduce combined and separated sewer overflows
- Watershed planning and management
- Conservation of natural resources and open space planning
- Natural scenery stewardship planning

Deadline: 3:00 pm, July 12, 2017

River Access Improvements for People of All Abilities

Up to \$220,000 is available to local organizations and communities to improve accessibility at existing river access sites for boating, fishing, swimming, wildlife-dependent recreation, or educational interpretation. Projects may include construction of physical improvements, purchase of adaptive equipment, or development of accessibility improvement plans. Accessibility projects should include accessible parking and pathway to the new element or a reference that these already exist. Incorporating principles of universal design is strongly encouraged.

Deadline: 3:00 pm, July 12, 2017



Climate Smart Communities (CSC) Grants

Climate Smart Community (CSC) grants (\$9.5M) will support municipal projects that implement certain CSC actions and help them become certified in the program. 50% match required.



Implementation projects fund \$10,000 and \$2 million to:

- Flood risk reduction
- Extreme event preparation
- Reduction of vehicle miles travelled
- Reduction of food waste, landfill methane leakage or hydrofluorocarbons emissions

Certification projects fund \$10,000 to \$100,000 to:

- Adaptation, land use, transportation and organic waste management planning
- Inventory and assessment actions aligned with [CSC certification](#) requirements

Contact: Climatechange@dec.ny.gov, 518-402-8448

Deadline: 4:00 pm, July 28, 2017, CFA

Water Quality Improvement Project

The WQIP program (\$87M) is a competitive, reimbursement grant program that directs funds from the New York State Environmental Protection Fund to projects that reduce polluted runoff, improve water quality and restore habitat in New York's waterbodies. High priority wastewater treatment improvement projects require a 15% match. Land acquisition for source water protection, salt storage, aquatic habitat restoration, municipal separate storm sewer system (MS4), and non-agricultural nonpoint source abatement and control projects require a 25% match. General wastewater infrastructure improvement projects require a 60% match.

Contact: User.Water@dec.ny.gov

Deadline: 4:00 pm, July 28, 2017, CFA

Trees for Tribs

Do you own or manage land along a stream? You can apply for free native plants to help reduce erosion and improve habitat along your stream! The [Hudson Estuary Trees for Tribs](#) Program offers free native trees and shrubs for planting along the tributary streams in the [Hudson River Estuary watershed](#). Our staff can help you with a planting plan and work with your volunteers.

Contact: Beth Roessler, NYS DEC, 845-256-2253, HudsonEstuaryTFT@dec.ny.gov

Deadline: Apply by March 1, 2017 for Spring plantings, August 1, 2017 for Fall plantings



Environmental Facility Corporation (EFC)

The EFC is a state agency that assists public and private entities to comply with federal and state environmental quality standards through technical assistance, low cost financing, and green innovation grants.



Wastewater Infrastructure Engineering Planning Grant

The EFC, in cooperation with NYS DEC, offers WIEPG grants (\$3 million) for engineering and consulting services to produce engineering reports to construct or improve municipal wastewater systems. A maximum of \$100,000 in funding is available for communities with median household income of \$85,000 or less in Mid-Hudson and NYC regions and \$65,000 or less in the Capital District region; the municipality must provide a 20% match. The final engineering report can be implemented using EFC or other financing sources.

Contact: Susan Van Patten, NYS DEC, 518-402-8267,
CFAWater@gw.dec.state.ny.us

Deadline: 4:00 pm, July 28, 2017, CFA

Clean Water State Revolving Fund

The EFC provides various forms of project finance for water-quality protection projects through the Clean Water State Revolving Fund (CWSRF). A variety of publicly-owned water quality improvement projects are eligible for financing, including point source projects such as wastewater treatment facilities, and nonpoint source projects such as stormwater management projects and landfill closures, as well as certain habitat restoration and protection projects in national estuary program areas. Short and long-term loans are available at no interest and low interest rates.

Contact: Dwight Brown, EFC, 518-402-7396, CWSRFinfo@efc.ny.gov

Deadline: Open enrollment

Green Innovation Grant Program

The Green Innovation Grant Program (GIGP, \$15M) funds projects across New York State that utilize unique stormwater infrastructure design and create cutting-edge green technologies. 10% to 60% match required. GIGP funds highly-visible projects that are directly attributable to the improvement or protection of water quality and integral to the success of the following eight specific green infrastructure practices:

- Bioretention
- Downspout disconnection
- Establishment or Restoration of, Floodplains, Riparian buffers, Streams or Wetlands
- Green roofs
- Green walls
- Permeable pavements
- Stormwater Harvesting and Reuse, e.g. Rain Barrel and Cistern Projects
- Stormwater Street Trees / Urban Forestry Programs Designed to Manage Stormwater

Contact: Suzanna Randall, EFC, 518-402-7461, GIGP@efc.ny.gov

Deadline: 4:00 pm, July 28, 2017, CFA

LOCAL EXAMPLE: WASTEWATER INFRASTRUCTURE ENGINEERING PLANNING



The City of Kingston received a \$25,000 grant to examine long-term adaptive planning for their wastewater treatment plant. They will implement the plan using low interest loans from the CWSRF.

Federal Emergency Management Agency (FEMA)

FEMA is a national agency that administers programs providing flood insurance, hazard mitigation assistance, and public assistance grants.



Hazard Mitigation Assistance

FEMA currently provide three types of hazard mitigation assistance (HMA):

- Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures. HMGP funds are triggered by a declared disaster and funneled to individual municipalities through the NYS Division of Homeland Security and Emergency Services (DHSES).
- Pre-Disaster Mitigation (PDM) provides funds on an annual basis for hazard mitigation planning and projects.
- Flood Mitigation Assistance (FMA) provides funds on an annual basis for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP).

Public Assistance Grant Program

Through the Public Assistance (PA) Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly- owned facilities, and the facilities of certain private Non-Profit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.

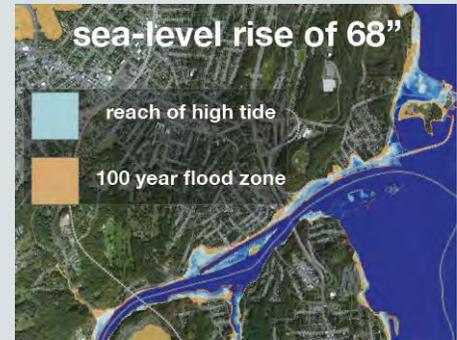
Contact: FEMA grants are administered by NYS Division of Homeland Security and Emergency Services (DHSES). Visit their website for current grant opportunities: <http://www.dhSES.ny.gov/grants/>

Community Rating System

FEMA also administers the National Flood Insurance Program (NFIP) and the related Community Rating System (CRS), which allows municipalities to reduce flood insurance rates for all policyholders by instating community-scale projects and policies regarding flood resilience.

Contact: 317-848-2898, nfipcrs@iso.com

LOCAL EXAMPLE: HAZARD MITIGATION GRANT



Kingston applied for a \$5 million grant from Hurricanes Irene and Sandy Relief Funds to implement Task Force recommendations for riparian buffers, buyouts, the adaptation and fortification of infrastructure, and the purchase emergency generators for pumping stations. The City is awaiting notification of the application's status.

LOCAL EXAMPLE: COMMUNITY RATING SYSTEM



The Village of Scarsdale is Class 8 certified in the Community Rating System (CRS), which means the village residents receive a 10% discount on flood insurance. The Village of Hyde Park is currently seeking CRS certification.

Department of State (DOS)

The DOS is a planning agency that focuses on economic revitalization and resilient, livable communities.



Local Waterfront Revitalization Program

The Local Waterfront Revitalization Program (LWRP) provides technical assistance, and matching grants (\$15.2M) on a reimbursement basis to villages, towns, cities, and counties located along New York's coasts or designated inland waterways, to prepare or implement strategies for community and waterfront revitalization. Funds require a 25% match (15% for environmental justice communities) and the grant categories currently are:

- Preparing or Implementing a Local Waterfront Revitalization Program (LWRP)
- Updating an LWRP to Mitigate Future Physical Climate Risks
- Redeveloping Hamlets, Downtowns and Urban Waterfronts
- Planning or Constructing Land and Water-based Trails
- Preparing or Implementing a Lakewide or Watershed Management Plan
- Implementing a Community Resilience Strategy

Contact: Jamie Ethier, NYS DOS, (518) 473-3656,
Jaime.Ethier@dos.ny.gov

Deadline: 4:00 pm, July 28, 2017, CFA

LOCAL EXAMPLE: LOCAL WATERFRONT REVITALIZATION PROGRAM



The Village of Piermont received a \$35,000 grant to update its Local Waterfront Revitalization Plan, first written in 1992, to include strategies from the Task Force's final Resilience Roadmap Report.

Additional Financial Assistance Resources

New York State Energy Research and Development Authority (NYSERDA)

NYSERDA is a state authority dedicated to promoting energy efficiency and renewable energy sources.



Clean Energy Communities Program

Municipalities that complete four of 10 priority actions will be considered Clean Energy Communities, and eligible for grants up to \$250,000 with *no match requirements*. Locally based outreach and implementation coordinators will provide free, on-demand technical assistance, including step-by-step guidance, case studies, and template contracts to help municipalities implement the Climate Smart Communities and Clean Energy Communities programs.

Contact: cec@nyserda.ny.gov

Deadline: Open application until September 30, 2019, or once funds run out

NYS Office of Parks, Recreation & Historic Preservation (OPRHP)

THE NYS OPRHP is a state agency dedicated to preserving and enhancing parks, historic assets and heritage areas.



Grant Program for Parks, Preservation and Heritage

The OPRHP is providing grants (\$20M) for acquisition, planning, development, and improvement of parks, historic properties, and heritage areas. Project awards up to \$500,000 with 50% required match, or 25% match for projects that are located in high-poverty district.

Contact: Erin Drost, NYS OPRHP, (845) 889-3866

Deadline: 4:00 pm, July 28, 2017, CFA

US Department of Housing and Urban Development (HUD)

HUD is a federal agency aimed to support sustainable, inclusive and affordable communities.



Community Development Block Grant Program (CDBG)

HUD is offering competitive grants (\$20M) for community development projects. Resilient drinking water, clean water and/or stormwater infrastructure projects could be applied for under Category 1: Public Infrastructure (\$750,000 max, \$900,000 for joint applicants, no match required), construction and renovation under Category 2: Public Facilities (\$300,000 max), and risk assessment and engineering projects could be applied for under Category 4: Community Planning (\$50,000 per project, 5% match).

Contact: 518-474-2057, HCR_CFA@nyshcr.org

Deadline: 4:00 PM, July 28, 2017, CFA

Empire State Development (ESD)

ESD is the New York state agency focused on economic development.



Empire State Development Grant Funds

The ESD is offering grant funds (\$150M) in the 2017 consolidated funding application. Category 2 is for infrastructure investment that can foster new economic development (grant funds cover up to 25% of project soft costs).

Contact: 845-567-4882, nys-midhudson@esd.ny.gov

Deadline: 4:00 pm, July 28, 2017, CFA

LOCAL EXAMPLE: PARK DEVELOPMENT



The Village of Freeport received a \$250,000 Parks grant to replace over 1,000 feet of bulkhead at Waterfront Park to reduce soil erosion and improve public safety and recreational access.

NYS Hudson River Valley Greenway

The Greenway is state agency focused on using regional collaboration to conserve and enhance the natural, scenic and historic resources of the unique Hudson River Valley.



Greenway Communities Grant Program

Financial assistance for planning (\$5,000 to \$10,000 per project, more if multiple municipalities involved) is available to designated “Greenway Communities” within the Greenway Area. Projects funded under this program include those that relate to community planning, economic development, natural resource protection, cultural resource protection, scenic resource protection, and open space protection. Greenway Compact communities are eligible for greater funds to develop, approve, and implement a regional compact strategy consistent with the Greenway criteria and the Greenway act.

Contact: 518-473-3835, hrvg@hudsongreenway.ny.gov

Deadline: 4:00 pm, September 8, 2017

Open Space Funding Options



Preserving land as open space in floodplains and in coastal areas is an important aspect of flood resilience recommendations. Here are several options for municipalities looking to preserve open space in their community:

LOCAL EXAMPLE: GREENWAY COMMUNITIES GRANT



The Village of Ossining received a \$15,000 grant to create a Waterfront Recreational Resource Plan to identify ways to promote water-related uses on their 3 miles of Hudson River waterfront, and to outline strategies to increase public access, catalog existing recreational assets, and engage stakeholders to determine demand for possible upgrades.

LOCAL EXAMPLE: REAL ESTATE TRANSFER TAX



The Town of Warwick passed a 0.75% Real Estate Transfer Tax and the Town of Red Hook a 2% tax to create a conservation fund to help provide financial support for their Open Space Plans.

- The municipality can advocate to have their land included in the NYS Open Space Plan that is updated every 5 years. This helps the community to show that the land has value outside of traditional development and is a good way to prepare for purchase of the land for open space. The State receives annual funding to purchase lands specifically mentioned in the plan. Municipalities can also seek grant funds to write or update their own Open Space Plan and include floodplain protection as one of the important values that open space provides.
- The municipality can work with a private land trust, like the Walkkill Valley Land Trust or the Open Space Institute to purchase the land using easements if it has scenic, ecological and/or agricultural value. Then, the community may be able to work with the land trust to make the property more valuable as floodplain protection.
- The municipality can purchase the land for open space by taking on debt (bonds) or instigating a tax levy. One example of a relevant tax levy is called a Real Estate Transfer Tax, which has been passable by local law since NYS passed the Hudson Valley Community Preservation Act of 2007. This tax is applied to mortgages on local real estate and is used to create a conservation fund for the community, which can be used to preserve open space.

Summary table of all funding assistance programs

Agency	Assistance Program	Priority Funding Categories	Grant amounts, required match	Deadline, CFA
DEC	✓ Estuary Grants		\$10,500-\$50,000, 15%	7/12/17
	✓ CSC Grants		\$10,000-\$2M, 50%	7/28/17 ☑CFA
	✓ WQIP		15-60%	7/28/17 ☑CFA
	✓ T4T		N/A	3/1, 8/1/17
EFC	✓ WIEP		≤\$100,000, 20%	7/28/17 ☑CFA
	✓ CWRLF		N/A	Open
	✓ GIGP		10-60%	7/28/17 ☑CFA
FEMA	✓ HMGP, PDM, FMA		N/A	Trigger by natural disaster
	✓ PA, CRS		N/A	Open
DOS	✓ LWRP		15-25%	7/28/17 ☑CFA
OTHER	✓ NYSERDA		≤\$250,000, 0%	Open until 9/30/19
	✓ OPRHP		≤\$500,000, 25-50%	7/28/17 ☑CFA
	✓ HUD		\$50,000 - \$900,000, 0-5%	7/28/17 ☑CFA
	✓ ESD		75% for soft costs	7/28/17 ☑CFA
	✓ Greenway		\$5,000 - \$10,000+	9/8/17
	✓ Open Space		N/A	N/A

CONTACT INFORMATION

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Constructed Stormwater Green Infrastructure (CSGI) Techniques

Constructed stormwater green infrastructure (CSGI) techniques consist of practices that manage stormwater runoff, or water from rain or snow that “runs off” across the land, primarily by promoting or mimicking natural rainwater infiltration into soils and groundwater.

CSGI practices are designed to mimic the infiltration processes of natural areas at a smaller scale. Infiltration allows water to soak into the ground rather than running off into low-lying areas or flowing directly into streams. Many CSGI practices are supported by soil and vegetation which absorb water and improve water quality through filtration and biogeochemical processes. Several CSGI, like daylighting, rely on access to sunlight, which can kill bacteria and viruses, to improve water quality.

CSGI practices are generally preferred over hard stormwater management infrastructure (e.g. curbs, catch basins, sewer mains, tunnels, outfalls or detention ponds). CSGI practices that reduce runoff identified in the NYSDEC Stormwater Management Design manual are listed below. Other CSGI practices exist and there is a lot of room for innovation in this arena.

Detailed specifications for all practices can be found in the NYS Stormwater Management Design Manual (NYSDEC 2015).

http://www.dec.ny.gov/docs/water_pdf/swdm2015entire.pdf

Examples of CSGI

Types of constructed stormwater green infrastructure techniques include, but are not limited to, the following:

- Tree planting/street tree pit
- Vegetated swale
- Bioretention
- Raingarden
- Disconnecting rooftop runoff
- Stream daylighting
- Green roofs
- Stormwater planters
- Rain barrels and cisterns
- Porous pavement
- Infiltration or recharge basins

Tree planting/street tree pit: This technique consists of planting or conserving trees to can reduce stormwater runoff, increase nutrient uptake, and provide bank stabilization. Trees can be used for applications such as landscaping, stormwater management

practice areas, conservation areas and erosion and sediment control. Stormwater street tree pits reduce stormwater volumes and velocities discharging from highly impervious areas through rainfall interception and evapotranspiration.

Vegetated swale: This technique uses natural drainage paths, or vegetated channels, to slow water moving over land, reduce peak discharge, and provide infiltration into the soil instead of constructing underground storm sewers or concrete open channels.

Bioretention: This technique captures stormwater in a shallow depression underlain by a deep (4 feet or greater) planting bed with engineered soils. It is planted with vegetation that can tolerate both wet and dry conditions and includes an underdrain and a pretreatment area to capture sediment (Figure 1). Bioretention can be designed to treat up to 5 acres of contributing drainage area.

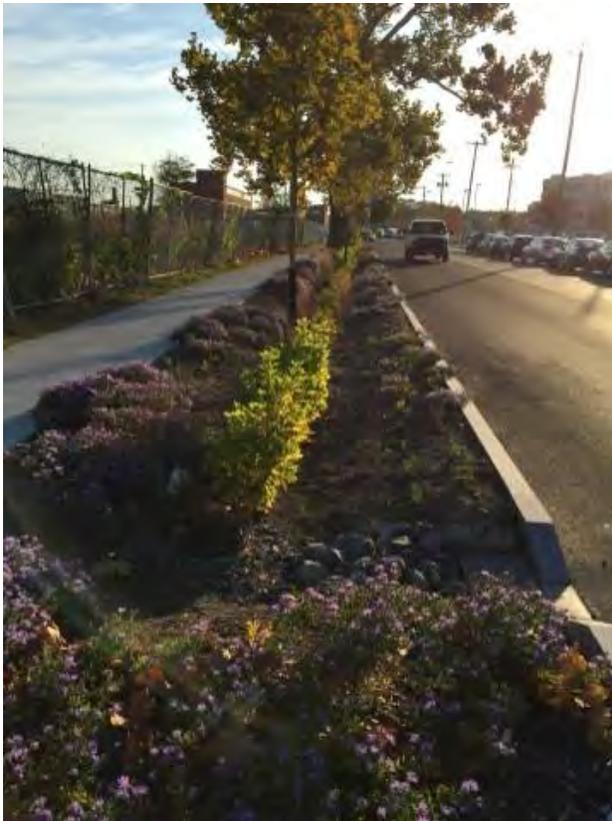


Figure 1. Bioretention area capturing runoff from street in Syracuse, NY. Credit: NYS Environmental Facilities Corporation.

Rain garden: This technique uses a conditioned planting soil bed and planting materials in a shallow depression to store, manage and filter small volumes of stormwater runoff. Rain gardens can be designed to treat up to 1,000 square feet of contributing drainage area (Figure 2).

Disconnecting rooftop runoff: This technique directs runoff from residential rooftop areas and upland overland runoff flow to designated pervious areas, ideally with vegetation, to reduce runoff volumes and rates (Figure 2).



Figure 2. Cistern collecting rooftop runoff and diverting it to a rain garden in Troy, NY. Credit: NYS Environmental Facilities Corporation

Stream Daylighting: This technique uncovers previously-culverted/piped streams to restore natural habitats, better attenuate runoff by increasing water storage, promote infiltration, and help reduce pollutant loads (Figure 3).



Figure 3. Daylighting of the Saw Mill River in Yonkers, NY. Credit: NYS Environmental Facilities Corporation

Green roofs: This technique captures runoff with a layer of vegetation and soil installed on top of a conventional flat or sloped roof. The rooftop vegetation allows evaporation and evapotranspiration processes to reduce the volume and discharge rate of runoff entering conveyance system (Figure 4).



Figure 4. Green roof on at SUNY ESF. Credit: NYS Environmental Facilities Corporation

Stormwater planters: This technique consists of small landscaped stormwater treatment devices, like large planters, that can be designed as infiltration or filtering practices.

Rain barrels and cisterns: This technique includes practices that capture and store stormwater runoff to be used for irrigation systems or filtered and reused for non-contact activities where it can infiltrate into the ground (Figure 2 and 5).



Figure 5. Rain barrel capturing rooftop runoff. Credit: NYS Environmental Facilities Corporation

Porous pavement: This technique is an alternative to conventional paved surfaces. It is designed to infiltrate rainfall through the surface, thereby reducing stormwater runoff from a site and providing some pollutant removal in the underlying soils (Figure 6).



Figure 6. Porous pavement and a demonstration of infiltration in Lake George, NY
Credit: NYS Environmental Facilities Corporation

Infiltration or recharge basins: This technique diverts stormwater into temporary storage, where it gradually infiltrates into the ground. They provide increased stormwater storage capacity, reduce flow rates into collector systems and surface water bodies, and

may be combined with natural resource restoration or other floodplain restoration (Figure 7). In dense urban areas large concrete basins may be sited under other structures such as parking lots.



Figure 7. Constructed wetland recharge basin in Long Island, NY Credit: NYS Environmental Facilities Corporation

Examples of specific locations where CSGI has been implemented

There are many examples of CSGI throughout New York State. Several websites offer case studies of a variety of project types:

- Environmental Facilities Corporation Green Innovation Grant program: www.efc.ny.gov
- Hudson River Estuary Program Green Infrastructure Program: <http://www.dec.ny.gov/lands/58930.html>
- NYC GreenStreet Program: http://www.nyc.gov/html/dep/html/stormwater/using_green_infra_to_manage_stormwater.shtml
- Onondaga County Save the Rain Program: <http://savetherain.us/>
- Buffalo Sewer Authority Green Infrastructure Program: <http://raincheckbuffalo.org/>

- NYS Department of Environmental Conservation Water Quality Improvement Grants: <http://www.dec.ny.gov/pubs/4774.html>

Site-Specific examples

- Rain garden: Kingston Library <http://www.dec.ny.gov/lands/86684.html>
- Vegetated swale: Village of Greenwood Lake <http://www.dec.ny.gov/lands/73096.html>
- Stream Daylighting: Saw Mill River, Yonkers <http://daylightyonkers.com/>
- Pervious Pavement: Lake George's Beach Road Project: www.efc.ny.gov/Default.aspx?tabid=452
- Green Roof: Logan Gardens, Manhattan <http://www.dec.ny.gov/lands/101086.html>
- Stormwater Planter: Ardsley Bus Shelter <http://www.dec.ny.gov/lands/74996.html>
- Cisterns: SUNY New Paltz <http://buoy.newpaltz.edu/cisterns.php>
- Green Streets: Quail Street www.efc.ny.gov/Default.aspx?tabid=452

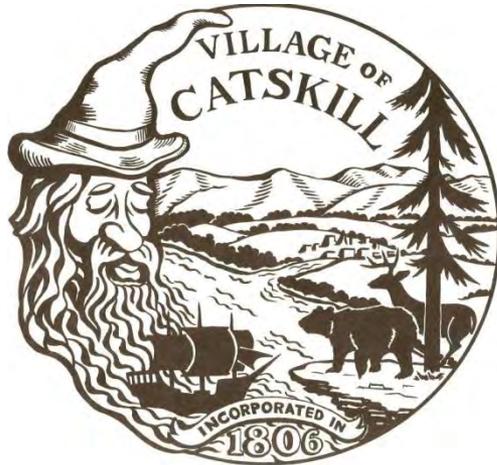
Factors to consider in design, engineering and maintenance for restoration or construction

CSGI or drainage that is undersized for the location and the volume of water can be overwhelmed in smaller storms. CSGI that is oversized can result in loss of vegetation, if the vegetation doesn't have access to enough water. Water control structures may be needed to manage water storage and rate of release.

CSGI must be designed with consideration for drainage area characteristics including runoff volume, runoff composition, including particular pollutants of concern, soils, depth to groundwater and bedrock. Consideration must be given to the location and depth of other infrastructure underneath (electric, water utilities, etc.) if water will be infiltrating through the ground.

Constructed practices that infiltrate potentially contaminated road runoff shouldn't be too close to a well-field or drinking water sources. Road salt and other deicers can affect water quality and vegetation.

Vegetation must be adaptable to both very wet and very dry conditions. Lack of maintenance can result in vegetation, debris or sediment blocking necessary conveyance paths (e.g. drainage pipes, clogged pores in porous pavement, downspouts from green roofs). Detailed specifications for all practices can be found in the NYS Stormwater Management Design Manual (NYSDEC 2015). http://www.dec.ny.gov/docs/water_pdf/swdm2015entire.pdf



Village of Catskill

Draft Zoning Code Analysis For Flood Resiliency and Risk and Engineering Review of WW System

June 19, 2017

Background



RESILIENT CATSKILL

*Report of the Catskill Waterfront
Resilience Task Force*

ZONING CODE ANALYSIS FOR FLOOD RESILIENCY



Update Zoning and Codes

The Village of Catskill should plan for resilient land use patterns and encourage safe, resilient structures in the waterfront area through planning, zoning, permitting and building codes in existing and new development.

SHORT/MEDIUM TERM ACTIONS & STRATEGIES

14. **Convene a working group including representation from Village boards, committees, officials and municipal planners to review the Task Force Report and identify which/ how local codes can be modified to better weather and adapt to future storms and account for sea level rise (possibly with a consultant). Considerations may include:**
- ▶ Revisions to zoning and codes to more specifically address flood risk areas and extend those areas to reflect projected sea level rise and future conditions; this could include:
 - Special floodzone or waterfront overlay district that corresponds to floodway, 10-year and 100-year flood areas, and future SLR areas, with a corresponding building permit process
 - Preferred shoreline treatments for sea level rise and flood resilience
 - Resilient building standards
 - Steep slopes ordinance
 - Stormwater management techniques
 - Code for securing fuel tanks and other potentially bouyant tanks/structures
 - ▶ Consider requiring property owners in flood-prone areas to include additional flood-proofing and adaptive measures for new, substantially damaged or substantially improved buildings above the FEMA standard (for example, by exceeding the 2-foot freeboard requirement in local code); *NOTE - upon consultation with the state and the floodplain manager.*

LEAD IMPLEMENTER: **VILLAGE BOARD (INITIATE AND APPOINT)**



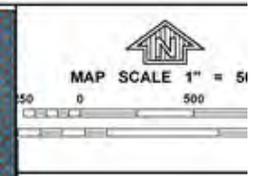
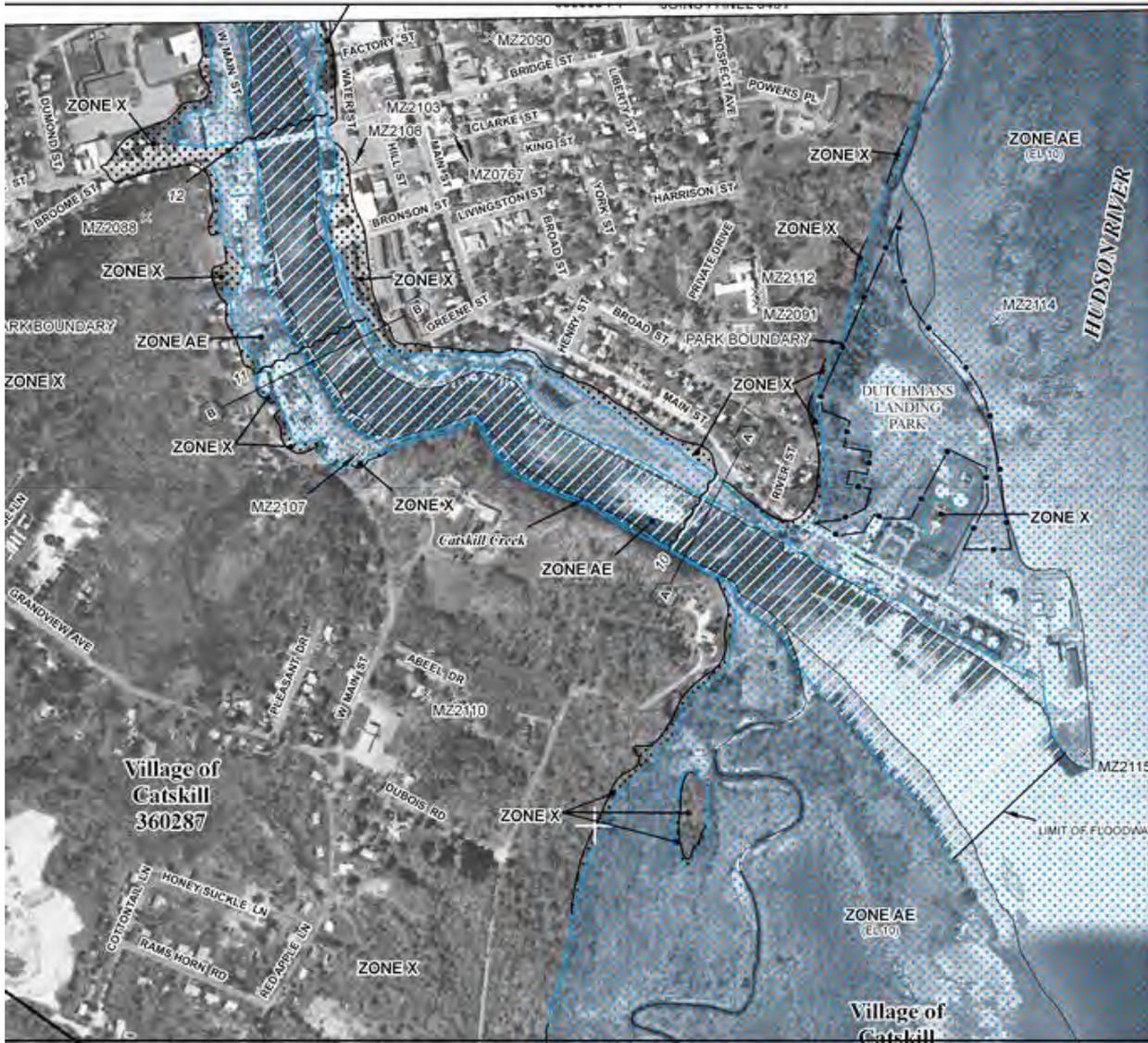
Existing Village Regulations That Address Flooding

- ▶ Village of Catskill Flood Damage Prevention Law (FDPL)
- ▶ Village of Catskill Zoning Code
- ▶ NYS Uniform Code
 - Includes specific provisions related to construction in a flood area



Zoning

- **Boundaries**
- **Uses allowed within districts**
- **Standards pertaining to development in districts**
- **Process for attaining approval of development in districts**



NFP PANEL 045

FIRM
 FLOOD INSURANCE RATE MAP
 for GREENE COUNTY, NY
 ALL JURISDICTIONS

CONTAINS:
 COMMUNITY
 CATSKILL, TOWN OF
 CATSKILL, VILLAGE

PANEL 453 OF 531
 MAP SUFFIX: F
 USE MAP INDEX FOR FIRM PANEL

Notice to User: The Map Number used when ordering map sheets is shown above, should be used on the subject community.



EPI
 Federal Emergency Management Agency

This is an official copy of a portion of the above as well as exhibited using FEMA's Conformance. This map is subject to amendments which may have been made since this block. For the latest product information and Program Flood maps check the FEMA Flood Map

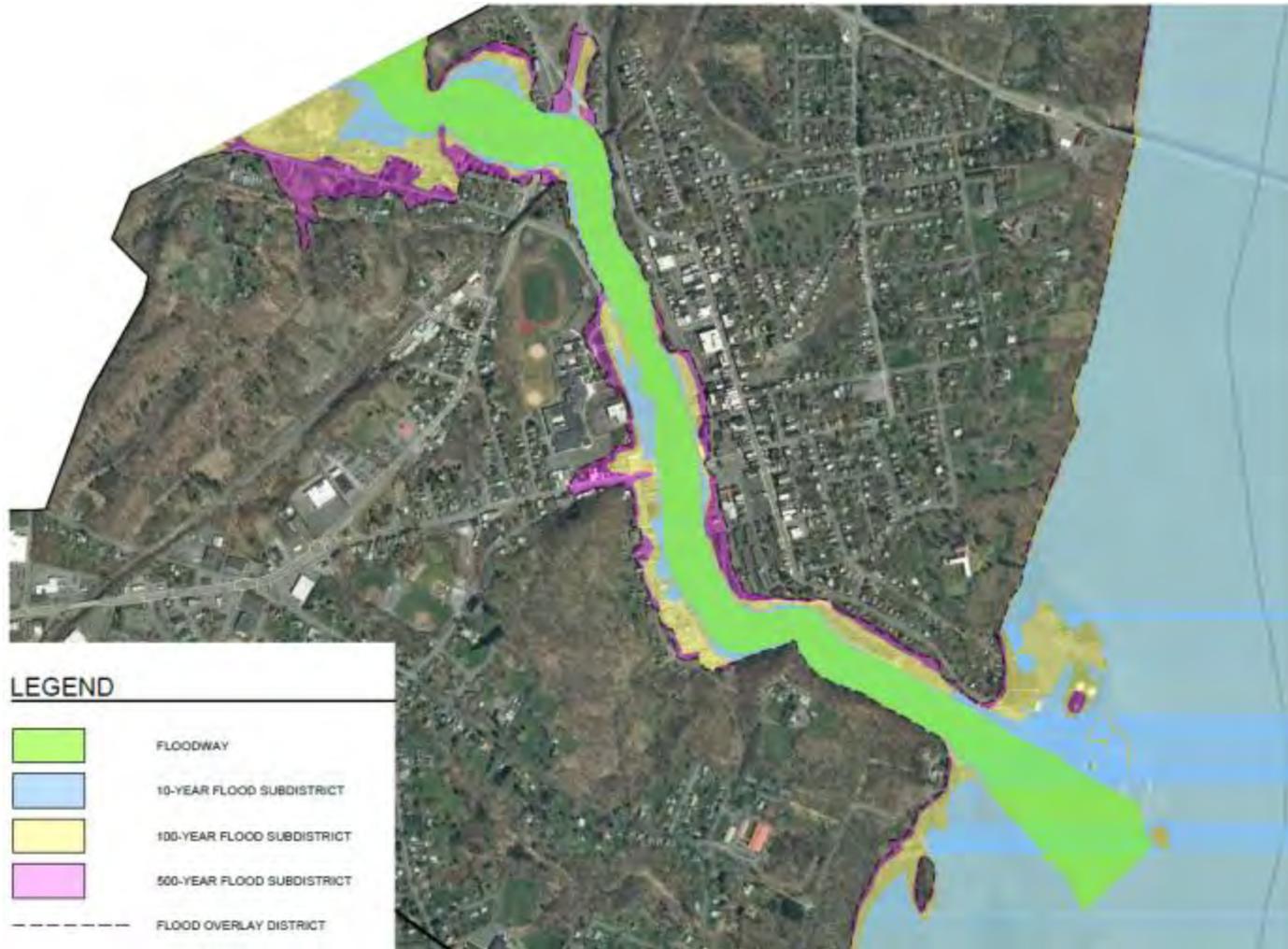


Use of 0.2% Annual Chance Flood Area as Boundary of Flood Overlay District

- ▶ The use of the 0.2% annual chance flood area is advantageous for the following reasons:
 - 1) Boundaries already established and depicted on FIRMS
 - 2) Most buildings at risk of flooding per the Task Force report are within the 0.2% area
 - 3) Ensures conformance with NFIP
 - 4) Legal precedent



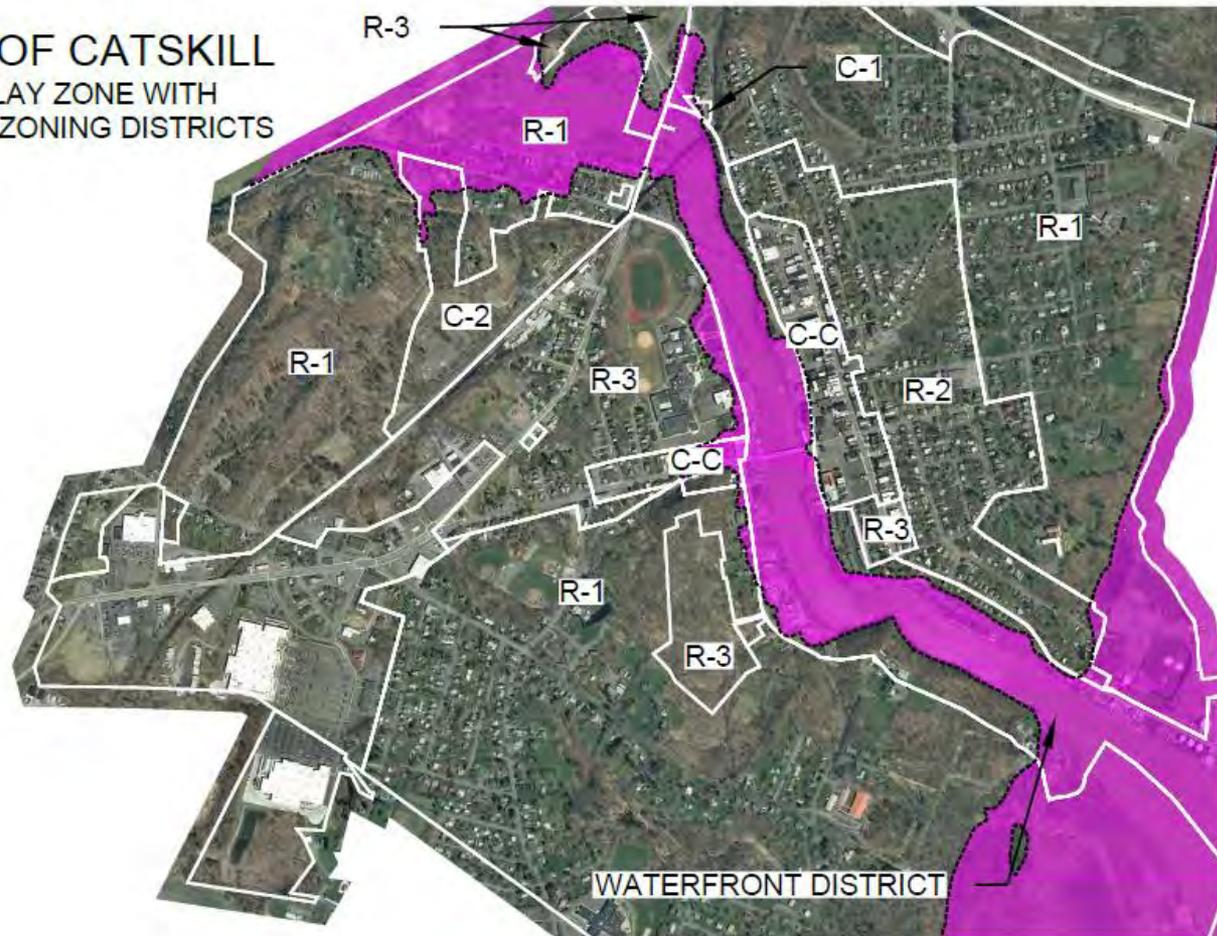
Flood Overlay District



Flood Overlay with Underlying Districts

VILLAGE OF CATSKILL FLOOD OVERLAY ZONE WITH UNDERLYING ZONING DISTRICTS

MARCH 8, 2017



Use Consideration

The allowance of existing uses within the potential Flood Overlay sub-districts can be based on weighing the risk to public health and safety, damage to assets, business downtime, and accessibility, risky and costly rescue efforts, future blight, with the proposed use currently allowed in the Zoning Regulations.

The Village may decide to allow a use in consideration that, when flood resilient standards (such as building size and elevation) are applied, the risk of flooding is sufficiently reduced.



Applicability and Process

- ▶ All development as defined in the FDPL, construction and substantial improvement of buildings and structures within the Flood Overlay District shall be required to obtain:
 - FDPL permit
 - Special Use Permit and Site Plan Review by Planning Board



Standards for Flood Overlay District

- **Setbacks**
- **Building Size and Height**
- **Building Elevation and Floodproofing**
- **Fuel Tanks**
- **Flood Resilient Construction**
- **Utilities**



Building Elevation & Floodproofing

All new and substantially improved residential structures within the Flood Overlay District shall be elevated such that their lowest floor (including basement) is elevated to the (0.2% annual chance flood level, or BFE + med 2080 level (3') + 2 feet, or other, whichever is stricter).



Next Steps

- 1. Continue the process begun by the Task Force and the Climate Adaptive Design Studio of envisioning a resilient waterfront, possibly through a Comprehensive Planning process.**



Next Steps

2. Using the draft Section 3.10 Flood Overlay District included in this report as a guide, include in the planning process, discussions that focus on a potential flood overlay district with consideration of the following:

Next Steps

- **acceptable uses to be allowed on the waterfront in consideration of future flood risk**
- **appropriate standards that can mitigate potential flood risk**
- **an appropriate boundary for a Flood Overlay District**
- **application of the regulations to non-conforming buildings and uses.**

Next Steps

3. When available, consider the flood management guidelines and model local laws being developed by the State under the Community Risk and Resiliency Act (CRRRA), particularly in regard to the elevation of buildings in flood areas and the adoption of more stringent building standards.



Next Steps

- 4. Consult the State Floodplain Manager to ensure that any desired revisions are conformant with NFIP standards and the NYS Uniform Code.**
- 5. Officially revise the Zoning Regulations that result from the planning process.**

RISK AND ENGINEERING REVIEW WWTP AND PUMP STATIONS



VILLAGE OF CATSKILL
WASTEWATER
TREATMENT PLANT SITE

HUDSON RIVER

CATSKILL CREEK





Reduce Infrastructure Risks

The Village of Catskill should ensure that critical infrastructure and services are robust and resilient - able to function during and after major events with minimal damage or downtime.

IMMEDIATE ACTIONS

11. Work through the Greene County Multi-Hazard Mitigation Plan to position Catskill for resiliency actions and funding opportunities:

- ▶ Update the plan to identify coastal hazards specific to the Village of Catskill, including shoreline erosion, sea level rise, and hurricanes
- ▶ Use the plan to propose retrofits for flood vulnerable infrastructure in the village

(NOTE - these updates will make the community eligible for hazard mitigation funds.)

LEAD IMPLEMENTER: **FLOODING AND STORM RESILIENCE COMMITTEE/JOINT CONSERVATION COMMISSION AND VILLAGE BOARD**

IMPLEMENTATION TIMEFRAME GOAL: **NEXT 6 MONTHS**

12. Conduct a risk and engineering review of key municipal infrastructure to identify adaptation needs/options/plans for:

- ▶ Wastewater treatment plant
- ▶ Pump stations
- ▶ Primary roadways
- ▶ Water supply
- ▶ MainCare (oil terminal)
- ▶ Greene County Highway Department
- ▶ Other municipal facilities

LEAD IMPLEMENTER: **VILLAGE BOARD (WITH CONSULTANT)**

▶ III. APPROACH TO FLOOD RESILIENCE

The process used to review the wastewater treatment system follows the Flood Resilience Guide for Water and Wastewater Utilities published by the United States Environmental Protection Agency (USEPA) in 2014 , as summarized in Figure 1.

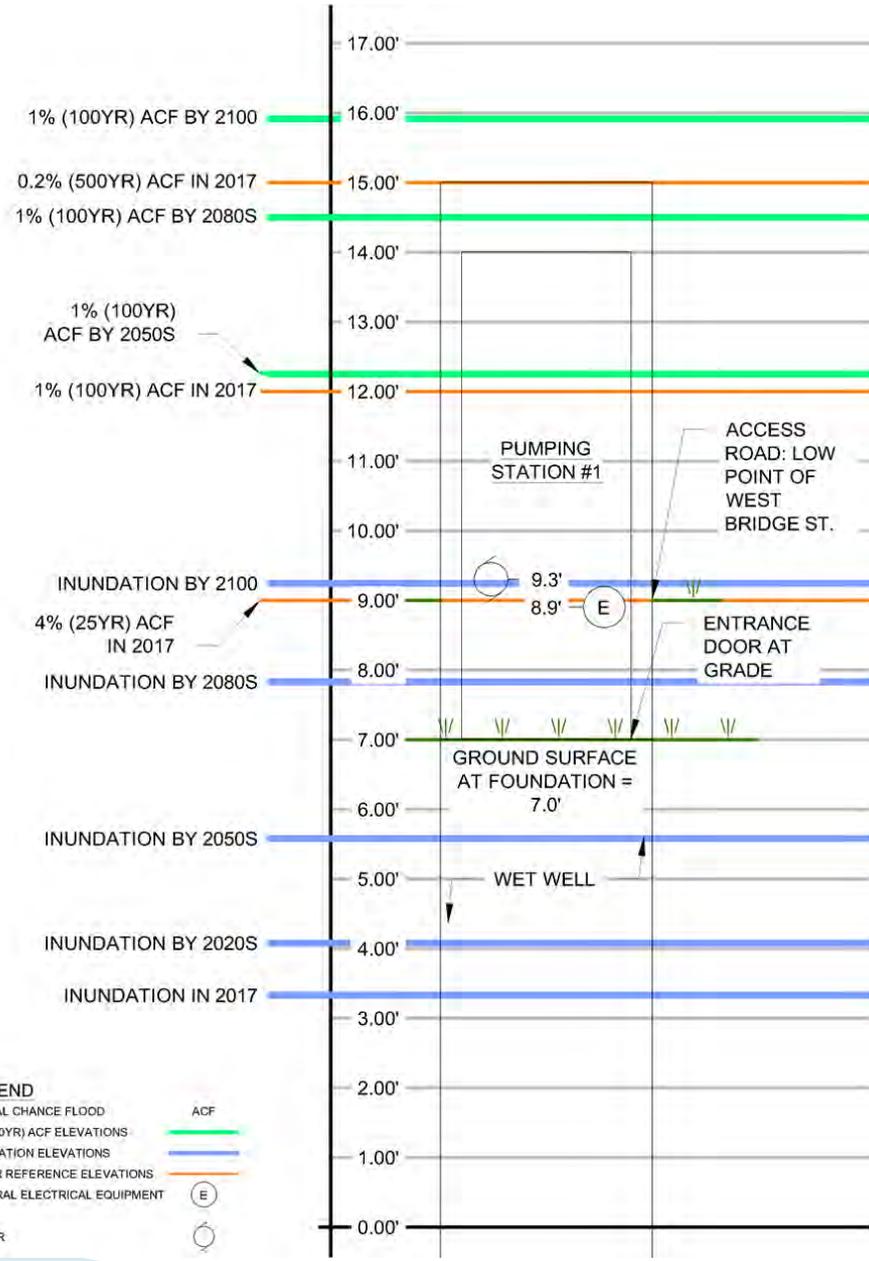


- ▶ Vulnerability was considered to be the propensity to be adversely affected by flooding.
 - Structures and equipment must be below the flood elevation, must have a pathway for water to reach it, and must have the potential to be damaged by water to be considered vulnerable.

Table 1: NYS Sea Level Rise (SLR) Projections for the Mid-Hudson Region

Time Interval	<i>Low Projection</i>	<i>Low-Medium Projection</i>	<i>Medium Projection</i>	<i>High-Medium Projection</i>	High Projection
2020s	<i>1 inch</i>	<i>3 inches</i>	<i>5 inches</i>	<i>7 inches</i>	9 inches
2050s	<i>5 inches</i>	<i>9 inches</i>	<i>14 inches</i>	<i>19 inches</i>	27 inches
2080s	<i>10 inches</i>	<i>14 inches</i>	<i>25 inches</i>	<i>36 inches</i>	54 inches
2100	<i>11 inches</i>	<i>18 inches</i>	<i>32 inches</i>	<i>46 inches</i>	71 inches





► Pump Station 1

Vulnerable Component	Elevation at Which Equipment is Vulnerable to Flooding (ft)	Vulnerable Year	End of Service Life
LIFT PUMP	8.9	2017	2050
MDP	8.9	2017	2050
LIFT PUMP	9.0	2017	2050
LIFT PUMP MOTOR	9.3	2017	2030
LIFT PUMP MOTOR	9.3	2017	2030
PUMP DISCONNECT	9.5	2017	2050
VFD	9.5	2017	2030
VFD	9.5	2017	2030
PUMP DISCONNECT	9.5	2017	2050
PUMP CONTROLLER	9.5	2017	2030
SUBPANEL	11.0	2017	2050
JUNCTION BOX	11.0	2017	2050

I. ADAPTATION DESIGN CONSIDERATIONS

In order to improve the resiliency of the wastewater treatment system, the Village can adapt to future flood conditions. Adaptation options include projects such as floodproofing structures, elevating equipment, relocating facilities, and more. The following codes, standards, and guidelines are applicable to the design and permitting of wastewater system components:

- The New York State Uniform Fire Prevention and Building Code
- The Draft New York State Flood Risk Management Guidance for the Implementation of the Community Risk and Resiliency Act
- The 10 States Recommended Standards for Wastewater Facilities









- ▶ Equipment and Structures Currently Vulnerable to Flooding
 - Pump Station #1
 - Pump Station #3
 - The main WWTP building, which houses the WWTP headworks, disinfection equipment, sludge disposal equipment, maintenance workshop and administrative offices.
 - The WWTP final settling tank
 - The WWTP backup generator
 - Access to the vulnerable buildings and structures

- ▶ Adaptation Options for WWTP
- ▶ Moving the WWTP
- ▶ Decentralize wastewater treatment
- ▶ Fill and Soft Shoreline
- ▶ Barriers: Levees and Floodwalls

▶ Lessons Learned



**Department of
Environmental
Conservation**



New York State
Water Resources Institute
Cornell University

Green Infrastructure Intro

Emily Vail

Hudson River Estuary Program

NYS Department of Environmental Conservation

New York State Water Resources Institute at
Cornell University

June 19, 2017

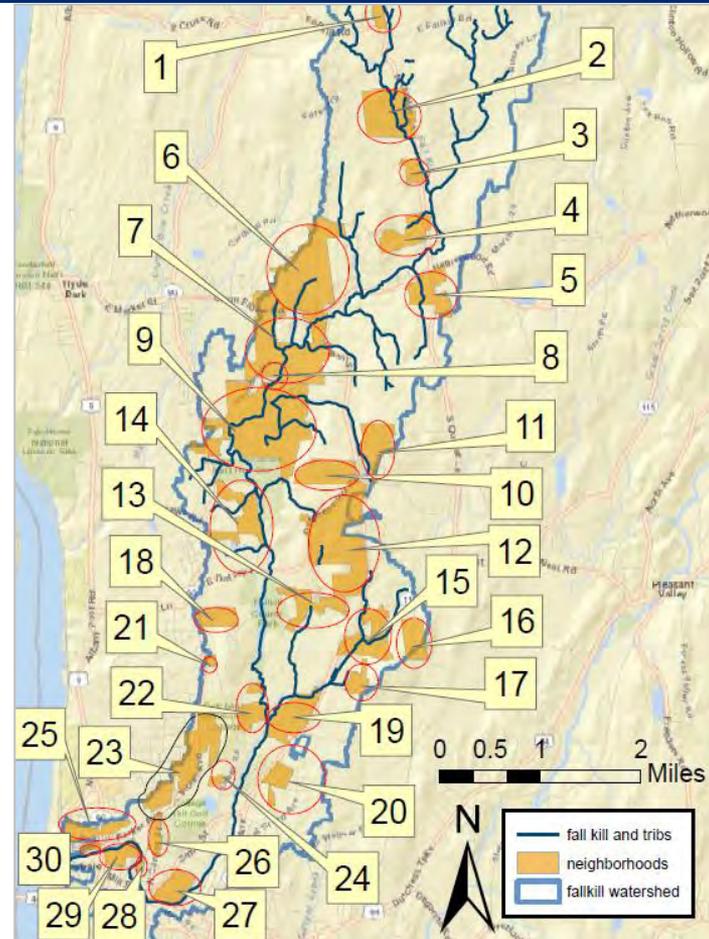
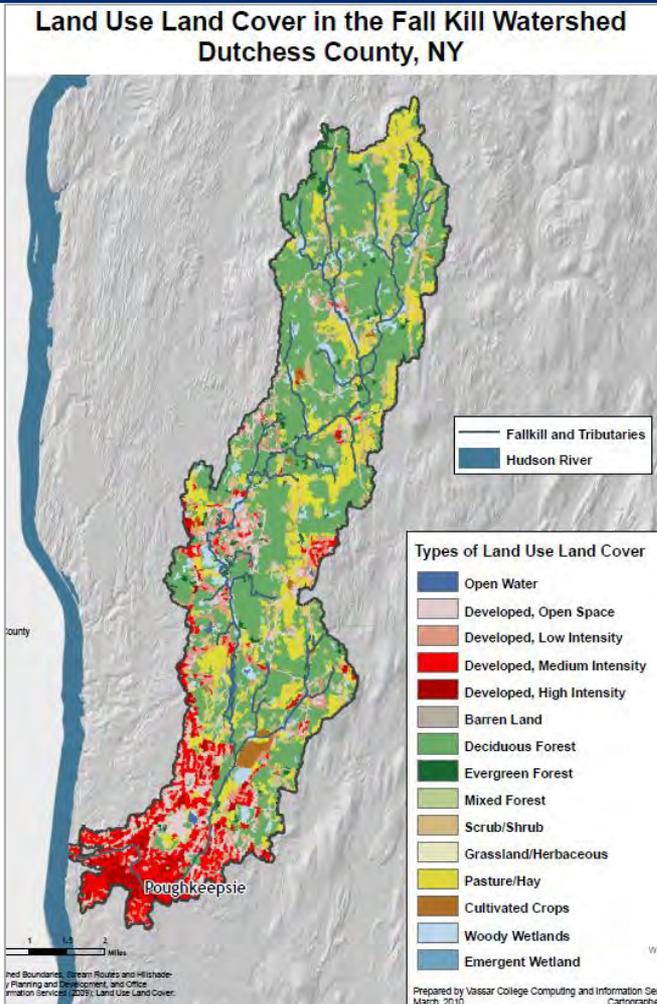
Presentation Outline

- Stormwater runoff
- Green infrastructure
- Examples of practices
- What you can do
- Resources



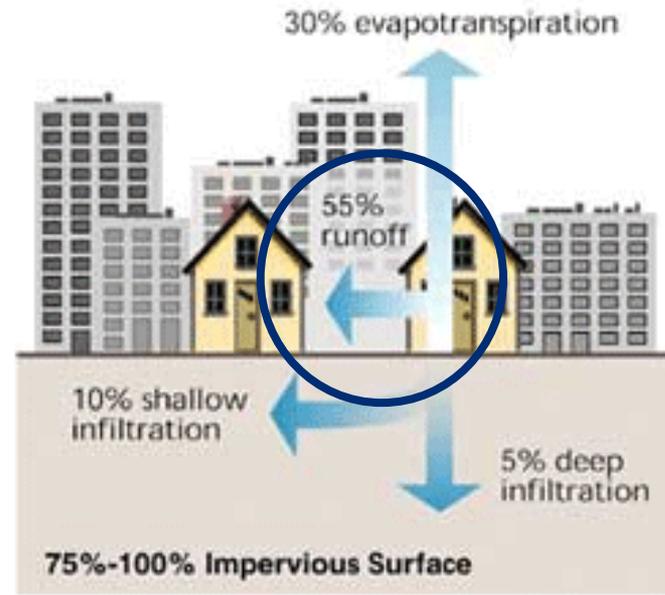
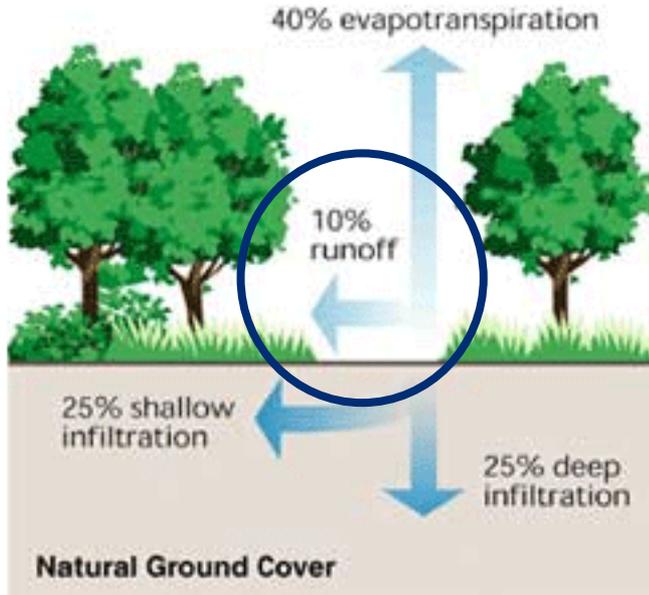
Rain Garden at Piermont Library

Watershed Thinking



Fall Kill Neighborhood Source Assessment

Impervious Surfaces and Stormwater Runoff



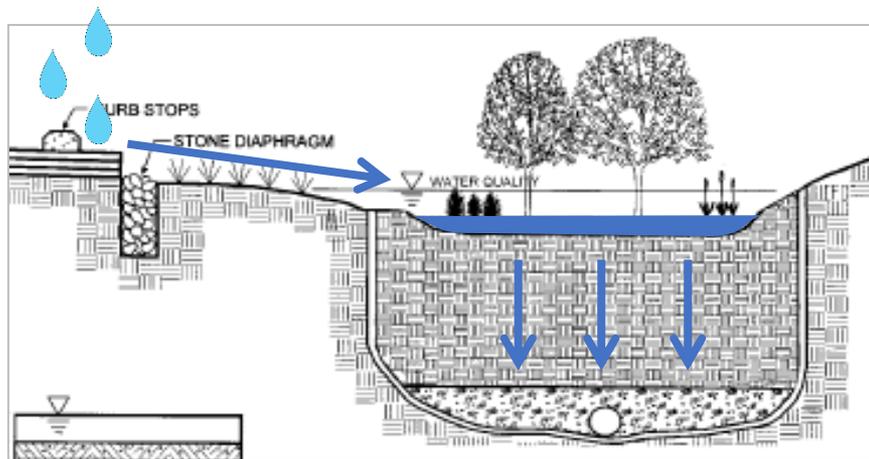
Stormwater Carries Pollutants

- Polluted runoff causes most stream impairments in the Hudson Valley
- Traditional stormwater management
 - Impervious surface -> storm sewer -> streams



What is green infrastructure?

- Different approach to stormwater – natural & engineered systems
- Reduce runoff by allowing stormwater to infiltrate and be used by plants



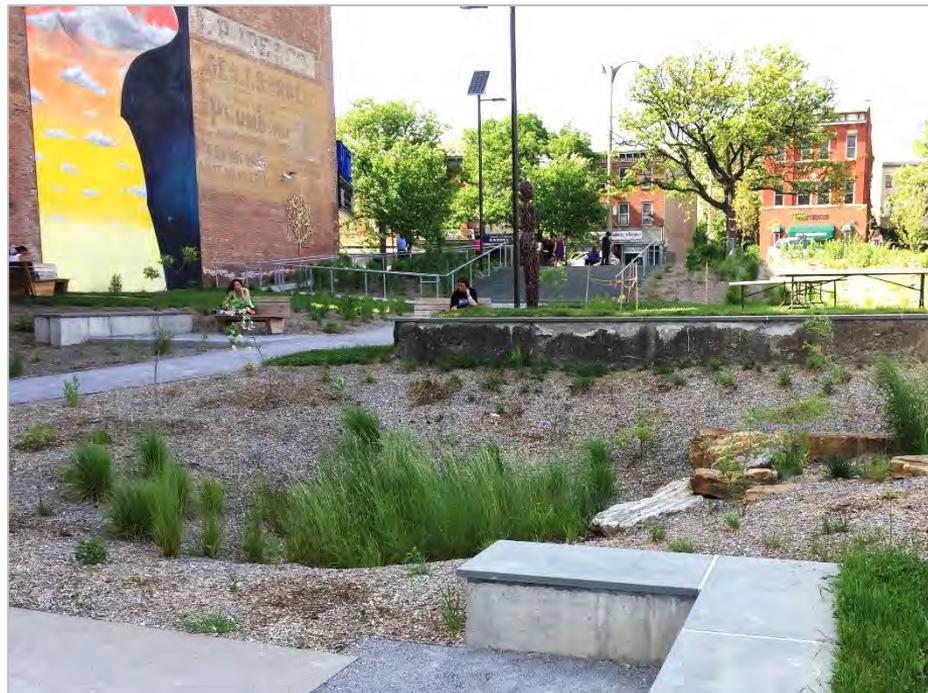
NYS Stormwater Management Design Manual



Bioretention area, Vassar College

Green Infrastructure

- Scales – site, neighborhood, sewer-shed, municipality, watershed, region
- Provides multiple benefits by
 - Slowing runoff
 - Removing pollutants
 - Keeping water out of the sewer system
 - Adding vegetation to the landscape

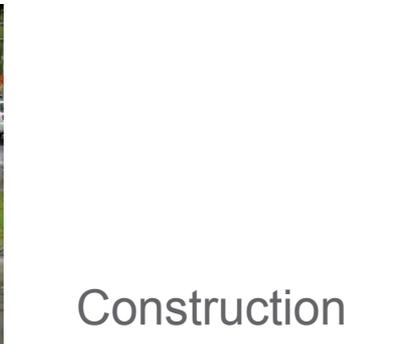


Safe Harbors Park, Newburgh

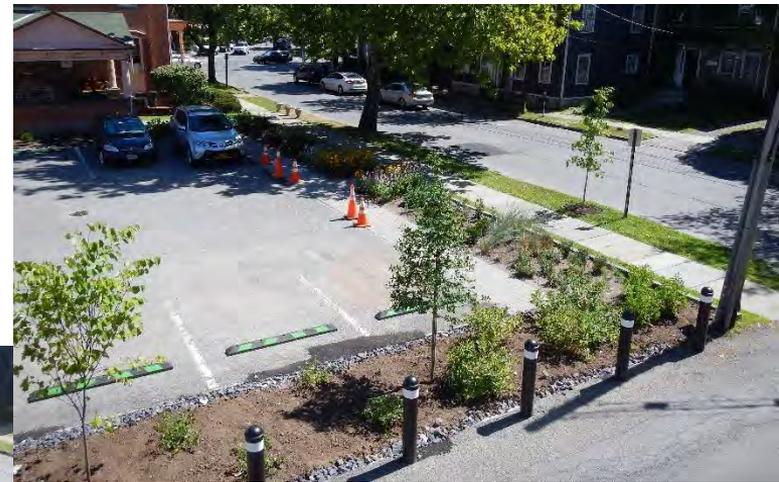
Green Infrastructure at Ulster County Lot



Before



Construction



After

Why Use Green Infrastructure?

- New development – required to reduce runoff with green infrastructure (if >1 acre of disturbed soil)
- Redevelopment – more lenient
- Retrofits – generally not required, improving existing infrastructure



DEC Construction
Stormwater Permit



What is the problem
you want to solve?

NYS Stormwater Management Design Manual

1. Planning

Preserve natural areas



Avoid stormwater

Reduce impervious surface cover

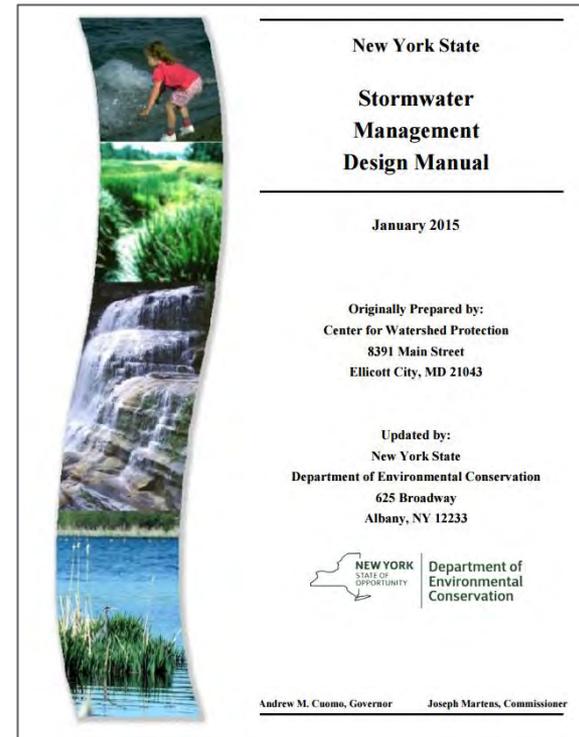


Reduce stormwater

2. Green infrastructure practices



Manage stormwater



Green Infrastructure Principles

- Wide range of practices for different applications
- Infiltrate or store runoff for reuse
- Treat stormwater closer to where rain falls
- Several small practices instead of one large one



Pervious Pavement and Vegetated Swale,
Roeliff Jansen Community Library

Rain Garden/Bioretention Area

- Shallow, vegetated depression, stores waters and filters it through soil



Kingston Library



Uptown Municipal Lot, Kingston

Vegetated Swale

- Linear, vegetated channel



Bard College, Red Hook



Village Hall, Greenwood Lake

Green Roof

- Layers of soil and vegetation on rooftops that capture runoff



SUNY Orange, Newburgh



Marist College, Poughkeepsie

Porous Pavement

- Paved surfaces that allow stormwater to infiltrate



Pervious pavers at Kingston municipal lot



Lamont-Doherty Earth
Observatory, Orangetown

Rain Barrel or Cistern

- Capture and store roof runoff to re-use (non-contact)



Wooster Hall, SUNY New Paltz



Private home in Orangetown

Infiltration Practices

- Focus on infiltration, can be underground



StormChamber, Orangetown
Highway Department



Dry Well, Kingston Municipal Lot



Other Green Infrastructure Practices

- Street trees
- Stormwater planters
- Stream daylighting
- Stream buffer restoration



Tree pit, Troy



Bus Shelter, Ardsley

Potential Benefits of Green Infrastructure

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



Rain Garden at Vassar College

Green Infrastructure Success

- What is the goal?
- Select appropriate sites
- Projects need to be:
 - Designed,
 - Installed, and
 - Maintained properly



What you can do

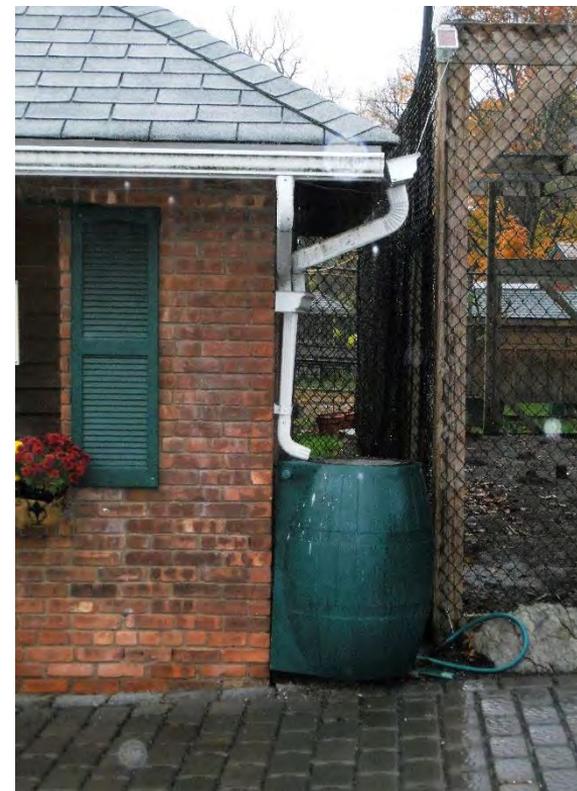
- Identify potential sites (now and with other local experts)
- Consider opportunities for implementation
- Grants to help
 - Planning: Hudson River Estuary Grants
 - Implementation:
 - DEC Water Quality Improvement Program
 - EFC Green Innovation Grant Program



Rain Garden at Cornell Cooperative Extension's Agroforestry Resource Center

Resources

- Hudson River Estuary Program
 - [Green Infrastructure Examples](#)
 - [Grants](#)
- [Lower Hudson Coalition of Conservation Districts guide for planning boards](#)
- [Pace University guide for CACs](#)
- [EPA Stormwater Planning guide](#)
- [EPA economic benefits case study: Lancaster, PA](#)
- [NRDC The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value](#)



Rain Barrel, Forsyth
Nature Center, Kingston

Thank You!

- Emily Vail
- Watershed Outreach Specialist
- Hudson River Estuary Program
- emily.vail@dec.ny.gov
- (845) 256-3145

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New York State
Water Resources Institute
Cornell University



Department of
Environmental
Conservation



Green Infrastructure



Siting



Factors for green infrastructure siting

Topography

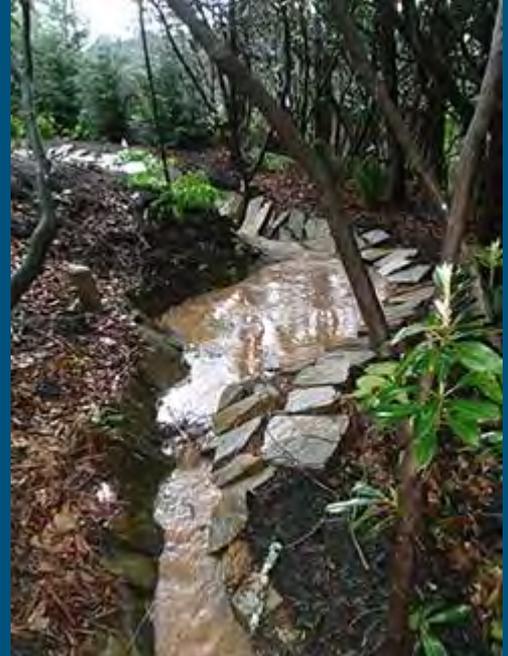
Wetlands and streams

Land use and ownership

Soil type + Groundwater depth

Topography

- Retain and infiltrate water in flat areas
- Slow water on steep slopes

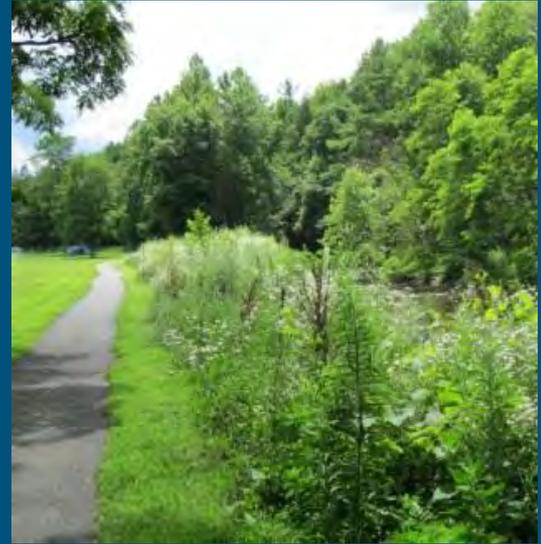


Topography

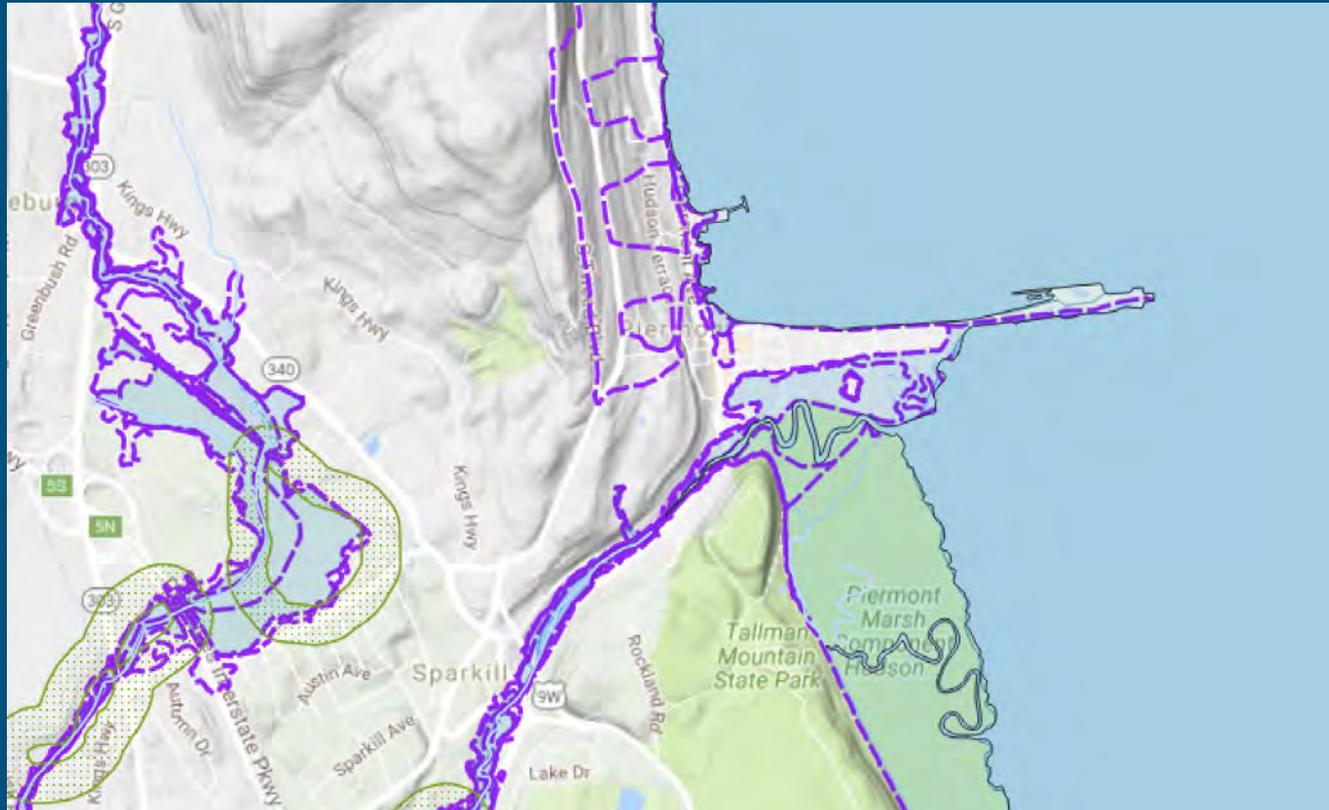


Wetlands and streams

- Protect with buffers
- Can you restore or improve the site?
- Erosion control on banks

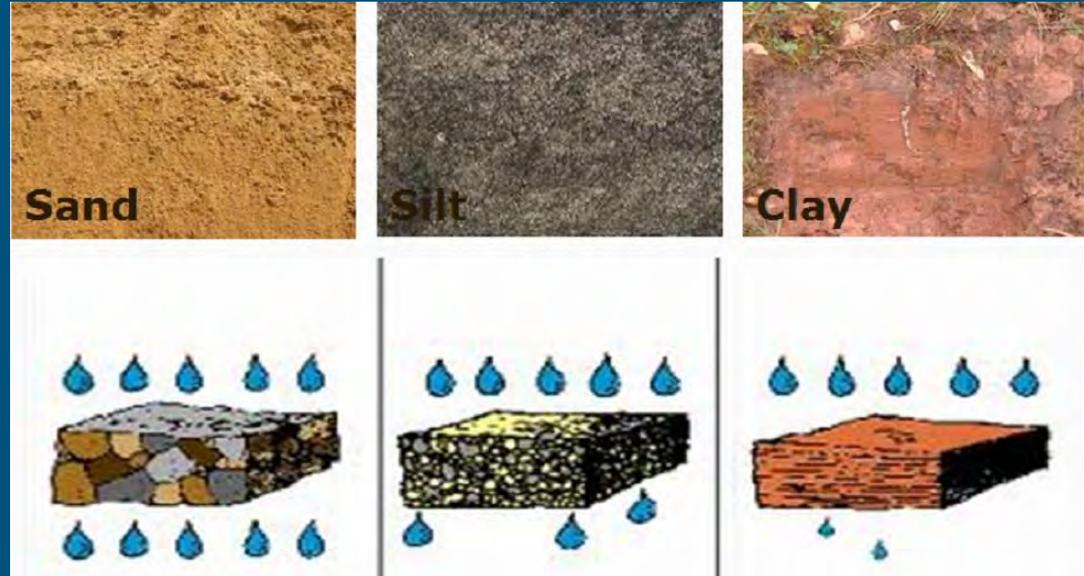


Wetlands and streams



Soil type

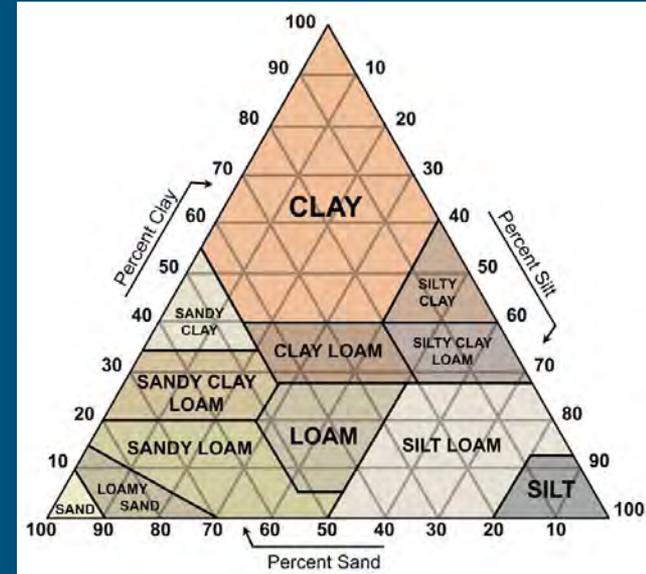
- Higher sand content usually means better infiltration rates, but each site needs to be tested.
- Less than 3' of depth to groundwater or bedrock won't infiltrate



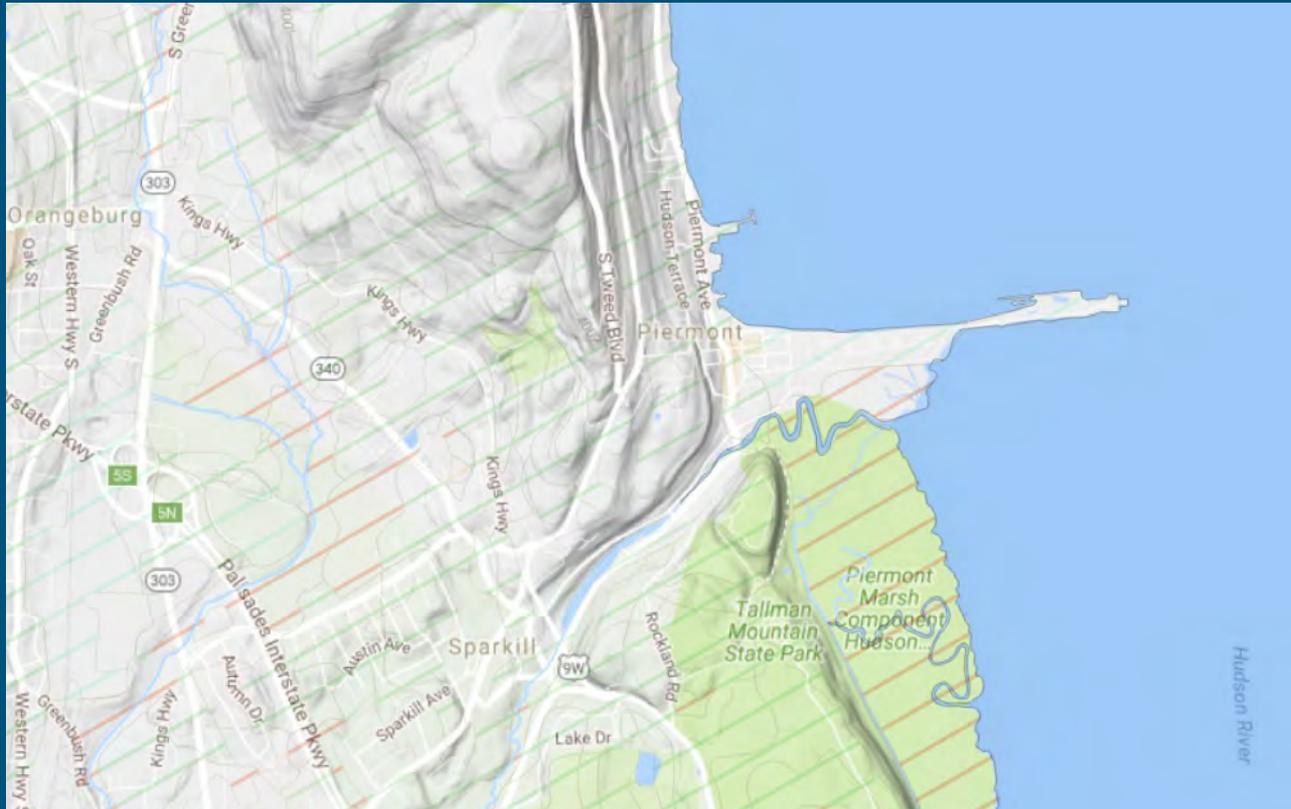
Soil type + groundwater depth

- Does the soil drain well, and groundwater/bedrock is more than 3' below the surface?
Infiltrate!
- Does the soil drain poorly or there's groundwater/ bedrock near the surface?

Build a constructed wetland or swales to clean and slow down



Soil type + groundwater depth



Land use and ownership

- Who owns the site?
- How big is the site?
- Can you disconnect impervious areas within or adjacent to the site?



As you're working

- What are problem areas that either produce a lot of runoff or flood now?
- Who owns the land?
 - Could they work with you on this project? (Schools, large property owners)
- Are there projects coming up that could incorporate green infrastructure?

Decision Process

