Runoff Reduction Recommendations for the Town of Coventry - Fall 2021

University of Connecticut Stormwater Corps
https://ecorps.initiative.uconn.edu

Benjamin Gardiner
Environmental Science 2022

Emma Morgan
Environmental Science 2022

Lake Wangumbaug - Coventry Lake

SUMMARY

During the fall of 2021, a team of UConn students and Extension faculty performed an evaluation of potential stormwater enhancement opportunities in the town of Coventry, CT. The process involved a desktop analysis and field visits to determine where potential green stormwater infrastructure installation opportunities existed on publicly owned land parcels. Calculations were performed to determine the potential stormwater and pollution reduction benefits from each of the proposed installations. **6 locations** were determined with **10 separate disconnections**.

If all projects identified in the report are implemented, over **110,200** sq ft of impervious cover will be disconnected from the stormwater drainage system. This means that over **2,902,100** gallons of untreated stormwater, about **30.2** pounds of nitrogen, and **4** pounds of phosphorus will be prevented from entering local water bodies annually.

IMPERVIOUS SURFACES & RUNOFF

Impervious surfaces, including roads, rooftops, parking lots, and other developments do not allow water to penetrate through them. Natural surfaces, such as grass, leaf litter, vegetated areas, or dirt areas absorb a significant portion of water from precipitation and runoff. Once water penetrates the ground, it then flows into surface water bodies or is recharged into groundwater aquifers. When natural surfaces are replaced with impervious surfaces, the water cycle is disrupted. As a result, soil infiltration decreases, while surface runoff increases substantially, and is often diverted into stormwater management systems and discharged directly into the local water bodies.

Runoff over impervious surfaces collects pollutants, and causes flooding and erosion that negatively affect the water quality of local water bodies. To prevent a decrease in water quality, runoff can be disconnected from the stormwater management system by implementing green infrastructure practices that reduce or convert impervious practices. For instance, downspouts on buildings and large areas of impervious surface can be designed to direct runoff into rain gardens and bioretention areas, box planters, tree box filters, or rain barrels. Previously impervious surfaces (roads, parking lots, pathways) can be converted into pervious surfaces using pervious alternatives to traditional materials.

COMMON GREEN INFRASTRUCTURE PRACTICES

Rain Gardens and Bioretention

Pervious Pavement

Tree Box Filters

Rainwater Harvesting

Planters

Green Infrastructure Practices - Rain Garden / Bioretention

A rain garden is a green infrastructure practice designed to capture precipitation runoff from an impervious surface. By doing so, water is allowed to percolate into the ground rather than directly entering stormwater management systems. They are usually built adjacent to the impervious area in question and are depressed approximately around 6 inches, depending on how much area is available. Rain gardens not only help to reduce pollution of local waters, but also add to the aesthetic appeal and biodiversity of urban areas.

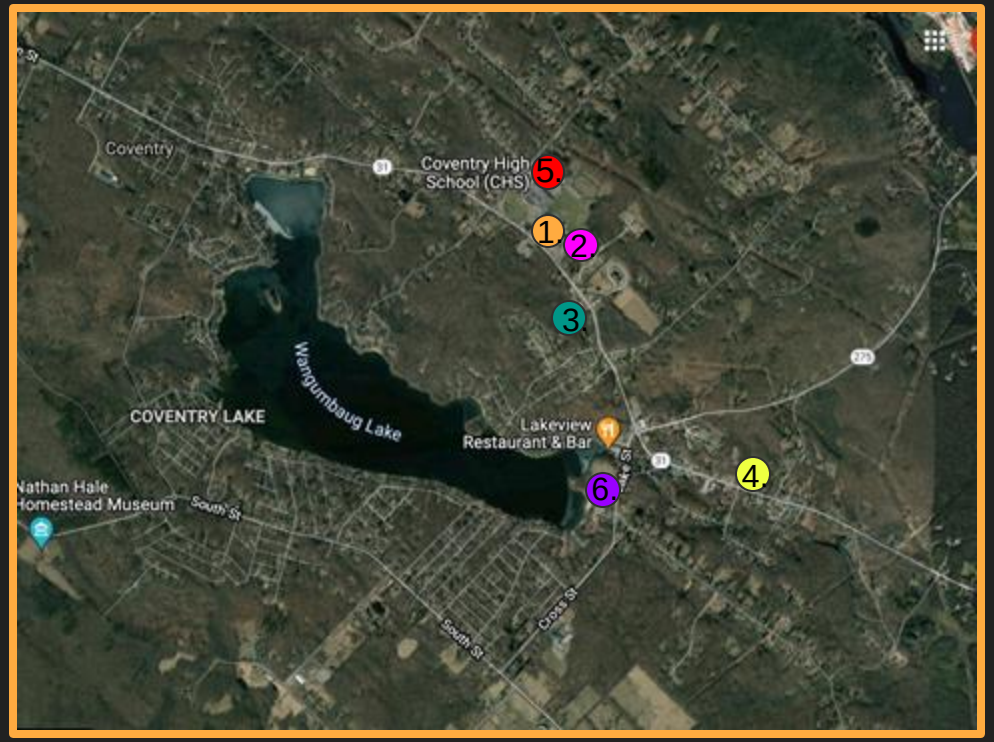
When built next to a parking lot, one or more sections of curb is cut and water is directed through a path composed of cobble or gravel to minimize erosion. If implemented next to a building, gutters can direct water into the garden. From here, the water is either taken up by plants or enters the soil, and eventually, the water table via percolation. Appropriate plants for a rain garden tend to be shrubs or grasses that are tolerant to drought, flooding, and exposure to high salt concentrations. Ideally, these gardens are planted with hardy native perennials to minimize the need for maintenance. A ***bioretention*** is an enlarged rain garden specifically engineered to handle larger quantities of water.

Green Infrastructure Practices - Permeable Pavement

Permeable Pavement is a green infrastructure practice designed to capture precipitation runoff from an impervious surface. By doing so, water is allowed to percolate into the ground through the pavement rather than directly entering stormwater management systems. Pervious Pavements can include Permeable interlocking concrete pavers (PICPS), asphalt, or concrete.

The most important aspect of a permeable concrete is the base. Proper infiltration requires that the base is NOT compacted. The base includes multiple layers of open grated sub layers at different sizes to evenly distribute water throughout the area. Some permeable paver locations also include a sub layer drainage pipe under a geotextile for overflow. This is not required.

Site Location Map



1. Town Hall
2. Administration
3. Police Station
4. Booth and Dimock Memorial Library
5. Coventry High School
6. Patriots Park/Senior Center

Selection Criteria

- Municipally-controlled sites
- Education potential
- Impervious surface disconnection
- Water quality & quantity impacts
- Cost effectiveness
- Maintenance concerns
- Taking advantage of current redevelopment, repaving, and removal projects

Coventry Village

Town Hall: Option #1

Pros:

- located next to entrance, very visible along road
- can disconnect large area of parking lot

Cons:

- will require rock channel to navigate around existing tree
- will require berm to facilitate drainage
- maintenance will need to be modified

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
21,780	Rain garden	573,479	5.97	0.76	6 inch depth: 3,616

Town Hall: Option #1

Town Hall: Option #2

Pros:

- prime location in front of building by entrance
- very visible along the road

Cons:

- will require berm to prevent runoff into road
- will need curb cut

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
23,609	Rain garden	621, 629	6.47	0.82	6 inch depth: 3,919

Town Hall: Option #2

Administration

Pros:

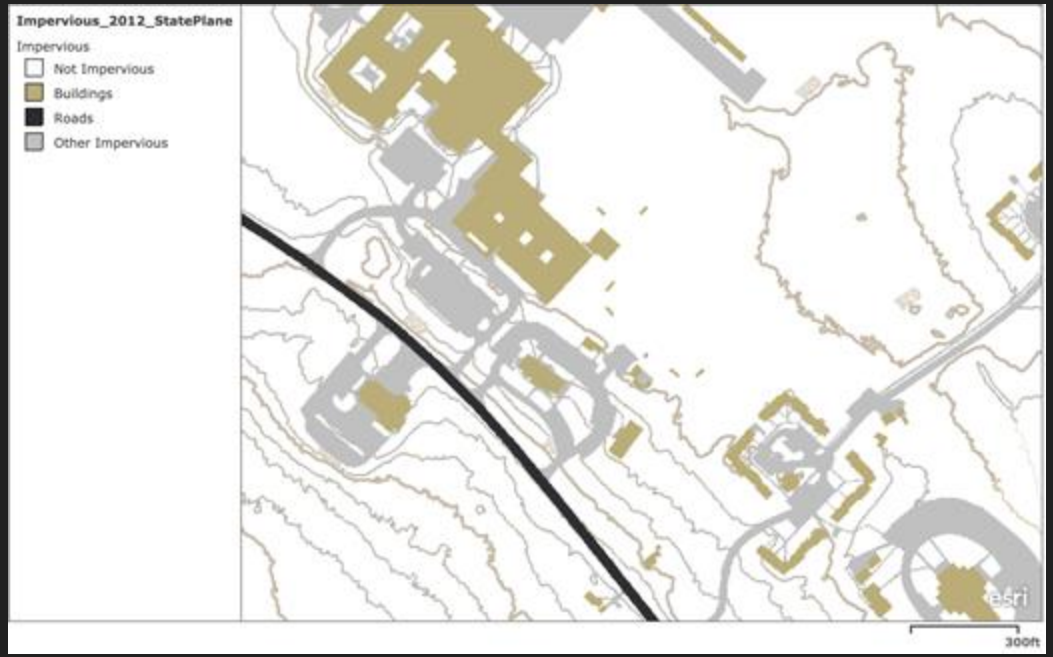
- excellent location at entrance of administration
- easy installation- extension of existing garden

Cons:

- need to disconnect downspout on corner of building
- modify maintenance

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
1045	Rain garden	27,526	0.29	0.036	6 inch depth: 174

Administration



Police Station

Pros

- Easy installation, already constructing parking lot extension
- Good location, near entrance of police station, visitor lot.

Cons

- Wetland upland review area

Existing storm drain:
Drainage Area:
GSI practice area:
Flow direction:

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
7,840	Rain garden	206,445	2.15	0.29	1,301 (6 inch depth)

Police Station

Booth and Dimock Memorial Library

Existing storm drain:
Drainage Area:
GSI practice area:
Flow direction:

Planned Practice Size: 972 sq. ft.

Pros

- Great educational opportunities
- Already planned in construction

Cons

- The recommend ratio (impervious:pervious) for pavements is 4:1, currently the design is around a 15:1.
- Some of the runoff will not be collected, will overflow into the wetland.
- Possibility for clogging, must be kept up accordingly
- Consider converting more existing stalls to permeable pavement to expand capacity

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
15,394	Permeable Pavement	405,320	4.22	0.58	3,849 (1:4 ratio)

Booth and Dimock Memorial Library

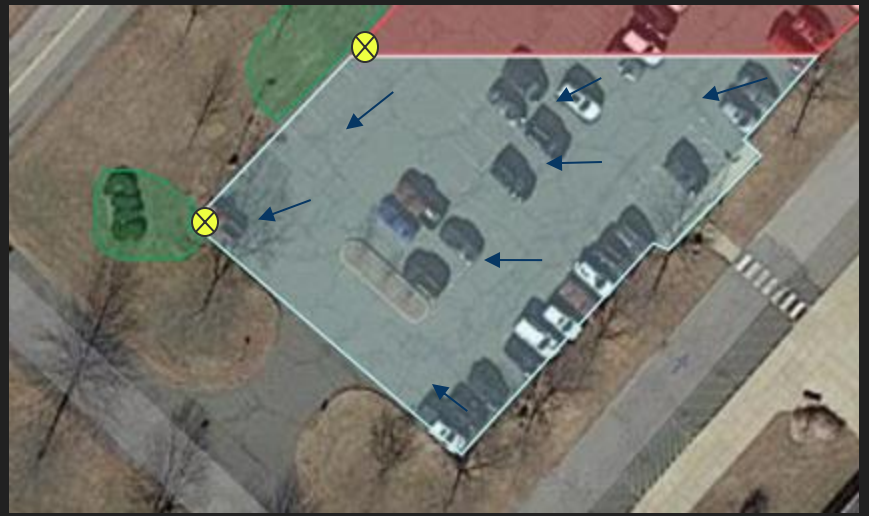
Coventry High School Main Entrance #1

Existing storm drain:
Drainage Area:
GSI practice area:
Flow direction:

Southern half of the front parking lot

Pros

- Easy curb cut before the storm drain
- at the front of the building for easy viewing and educational opportunities
- Can be added to the current shrubbery



Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
15,638	Rain Garden	314,244	3.27	0.45	991 (12 inch depth)

Coventry High School Main Entrance #2

Northern half of the front parking lot

Pros

- Easy curb cut before the storm drain
- at the front of the building for easy viewing and educational opportunities

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
11935	Rain Garden	411,743	4.28	0.58	1,298 (12 inch depth)

Coventry High School

Patriots Park

Rain Garden off of the long driveway

Pros

- Directly connected to lake
- Educational opportunities (park)

Cons

- Needs to be short shrubbery, to not obstruct the bandshell
- Takes away from bandshell seating area

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
11,064	Rain garden	291,317	3.03	0.41	1,837 (6 inch depth)

Patriots Park

Senior Center: Option #1

Pros:

- easy disconnect: downspouts on front of building
- modify existing garden at entrance
- very visible at entrance

Cons:

- will require additional landscaping

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
1220	Rain garden	32,114	0.33	0.042	6in depth: 203

Senior Center: Option #1

Senior Center: Option #2

Pros:

- right next to picnic area
- preventing excess runoff into lake

Cons:

- challenging to disconnect entire roof because there are electrical units on either side of downspout in middle of roof
- need to pipe water under sidewalk to rain garden along stone wall

Drainage Area (sq. ft)	Suggested Practice	Annual Gallons treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb N/yr)	Suggested practice size (sq. ft)
697	Rain garden	18,351	0.19	0.03	6 in depth: 116

Senior Center: Option #2

Estimated Cost Per Site

Site	Practice	Low Price Range	High Price Range	Drainage Area (sq. ft.)
Town Hall: Option #1	Rain Garden	$7,230	$25,300	21,780
Town Hall: Option #2	Rain Garden	$7,840	$27,430	23,609
Administration	Rain Garden	$700	$1,220	1,045
Senior Center: Option #1	Rain Garden	$810	$3,230	1,220
Senior Center: Option #2	Rain Garden	$462	$1,851	697
Patriots Park	Rain Garden	$3,673	$14,693	11,064
Police Station	Rain Garden	$2,603	$10,412	7,840
Booth and Dimock Memorial Library	Permeable Pavement	$3,402 (Asphalt)	$7,776 (Asphalt)	15,394
High School Main Entrance #1	Rain Garden	$3,962	$15,849	15,638
High School Main Entrance #2	Rain Garden	$5,191	$20,767	11,935
TOTAL		**$35,873**	**$128,528**	**110,200**

Note: Pricing based off of 6in deep rain gardens, except High School #1 and #2 (12 inch)

CONTACT & PARTNERS

This project was completed by students enrolled in the Stormwater Corps course at the University of Connecticut as part of the University's E-Corps Program, funded by the National Science Foundation. For more information, visit the websites and contacts below.

Stormwater Corps Contacts:
https://nemo.uconn.edu
Mike Dietz, UConn CLEAR, michael.dietz@uconn.edu, 860-486-2436
Dave Dickson, UConn CLEAR, david.dickson@uconn.edu, 860-345-5228

CLEAR
Center for Land Use Education & Research

UConn Environment Corps

From our classrooms to your community

E-Corps Contacts:
https://ecorps.initiative.uconn.edu
Chet Arnold, UConn CLEAR, chester.arnold@uconn.edu