Runoff Reduction Recommendations for the City of Groton

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SUMMARY

During the fall of 2020, a team of UConn students and Extension faculty performed an evaluation of potential stormwater enhancement opportunities in the City of Groton, 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. If all projects identified in the report are implemented, 21,477 sq ft of impervious cover will be disconnected from the stormwater drainage system. This means that 565,510 gallons of untreated stormwater, 5.88 pounds of nitrogen, and 1.27 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

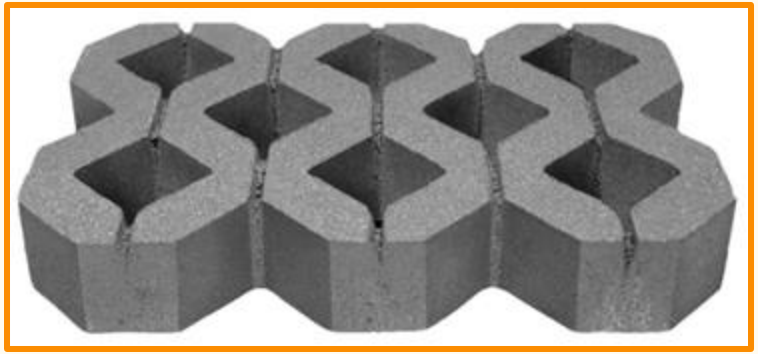
Rain Garden: A rain garden is a green infrastructure practice designed to capture precipitation runoff from an impervious surface. By doing so, water is allowed to percolate into the ground rather than directly entering stormwater management systems. They are usually built adjacent to the impervious 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.

Tree box filters are an aesthetically pleasing green infrastructure practice that directs stormwater runoff through soil and other substrates with excellent filtration qualities before allowing it to enter municipal stormwater systems. Stormwater runoff flowing over impervious sidewalks and roads enter the tree filter box through a grate. Once inside the box, the water infiltrates through a special soil mixture, a mulch layer, and a shrub or tree root system that are specifically designed to filter out pollutants and contaminants.

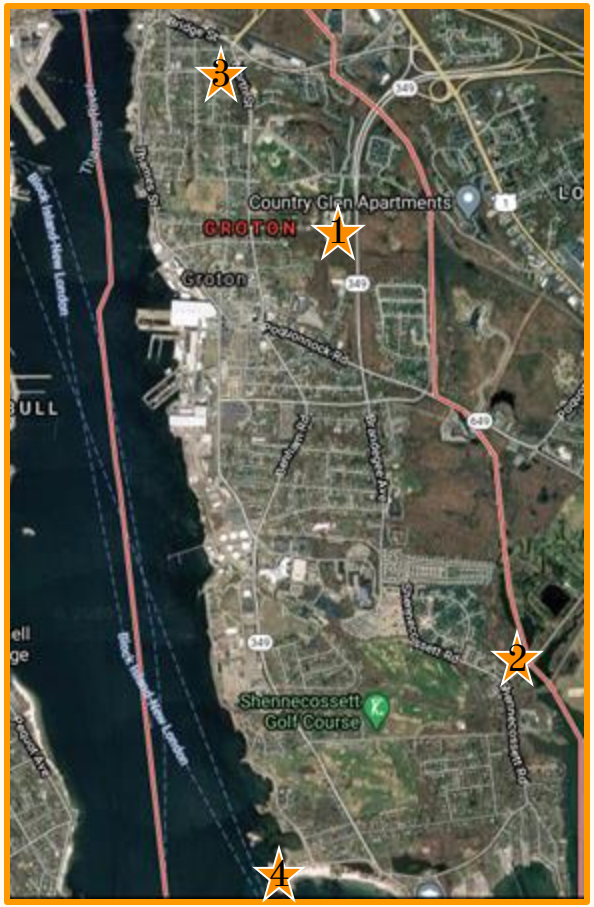
Turfstone pavers stabilize soil erosion by allowing rainwater to gradually filter back into soil. Its eco-friendly design reduces run-off while allowing greenery to grow through it, creating a unique natural look.

Applications: Walk ways, Patios, Driveways, Boat ramps, RV/Boat Parking



https://www.mutualmaterials.com/products/turfstone-pavers/
https://www.belgard.com/products/permeable-pavers/turfstone

Project Location Map



1. City of Groton Police Department, City Clerk, and Utilities Complex
2. City of Groton Birch Plain Creek Wildlife Area
3. Groton City Fire Department
4. Eastern Point Park

City of Groton Police Department, City Clerk, and Utilities Complex:

Address: 295 Meridian Street

Police Department, City Clerk, Utilities Complex Impervious Cover

- Not Impervious
- Buildings
- Roads
- Other Impervious

Location of the 3 Suggested Practices:

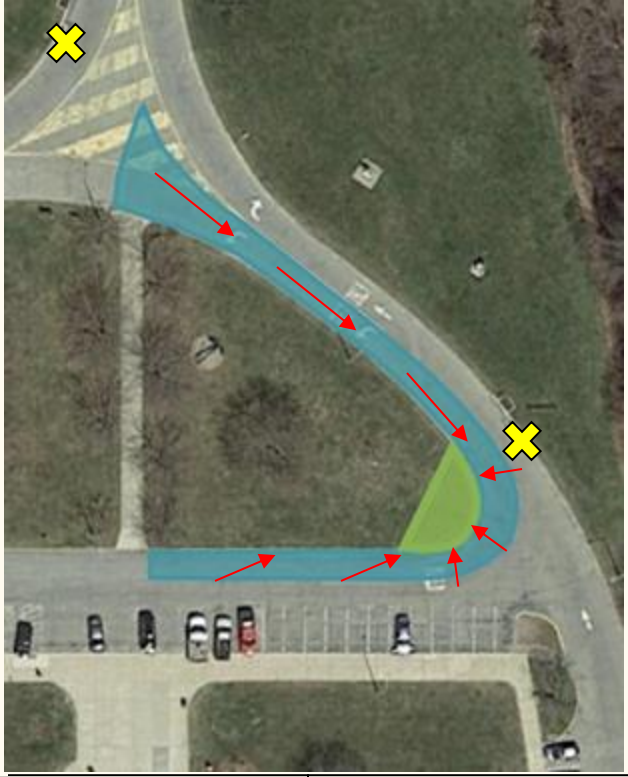
Police Department: Rain Gardens

Example of Practice

Police Department: Option 1

- This location offers the largest drainage area with multiple entrance points for the water to enter the rain garden.

- Pros
  - Largest drainage area.
  - Multiple entrance points for stormwater.
  - Practice would be in a high traffic area which would make it visible and it could be an education opportunity.
- Cons
  - A rain garden would need regular maintenance to remove sediment.
  - Lawn maintenance would need to work around the unit.



Drainage Area (sq ft)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice Size [6 Inch Depth] (sq ft)
5,968	Rain Garden	157,127	1.63	0.207	990.64

Police Department: Option 2

- A rain garden at the entrance of the property would be a great opportunity to show off the practice and raise awareness. Signage could educate people on the benefits of green stormwater practices.

- Pros
  - High traffic area that would show off the practice to a large number of people.
  - A rain garden would add landscaping aesthetic.
- Cons
  - This location does not offer the largest drainage area to capture water.
  - Regular maintenance to remove sediment build up and lawn care maintenance would be needed around the practice.

Drainage Area (sq ft)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice Size [6 Inch Depth] (sq ft)
2,090	Rain Garden	81,431	0.847	0.107	513.40

Police Department: Tree Box Filter

Example of Practice

Police Department: Option 3

- A tree box filter in this location would capture a large amount of stormwater runoff. Adding another tree box filter would fit right in and further help disconnect impervious cover.

- Pros
  - There are already a number of tree box filters at this property.
  - No special maintenance, it would require the same as the other tree box filters.
- Cons
  - Potential for high sediment build up due to the slope and location.

Drainage Area (sq ft)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice Size (sq ft)
3,093	Tree Box	55,052	0.573	0.072	N/A

City of Groton Birch Plain Creek Wildlife Area

Address: 25 Thomas Rd, Groton,CT

City of Groton Birch Plain Creek Wildlife Area

Impervious Cover

Impervious

- Not Impervious
- Buildings
- Roads
- Other Impervious

Contour lines

City of Groton Birch Plain Creek Wildlife Area

Example of Practice

City of Groton Birch Plain Creek Wildlife Area

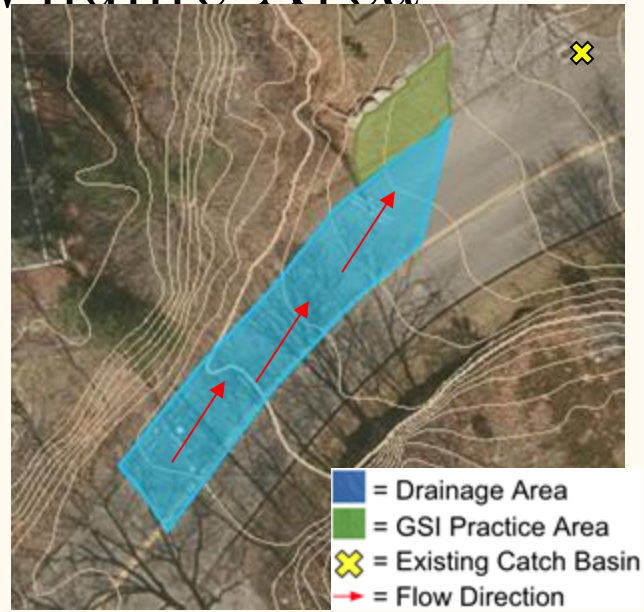
- This area is a small watershed that disconnects a portion of road. Primarily an educational area at the entrance to the Wildlife Area.

Pros:

- Educational opportunity for Wildlife entrance.
- Aesthetic view leading up to the small Birch Plain Creek bridge.

Cons:

- A small drainage area being disconnected.
- Limited access to the area, high traffic area on Thomas Road.



Drainage Area (sq ft)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice Size (sq ft)
1,684	Bioretention	44,339.05	0.461	0.058	279.54

Groton City Fire Department

Address: 140 Broad Street, Groton,CT

Groton City Fire Department

Impervious Cover

Impervious
- Not Impervious
- Buildings
- Roads
- Other Impervious

Groton City Fire Department

Example of Practice

Groton City Fire Department

- This region is intended for a bioretention with a depth of 6 inches for safety purposes in front of the firehouse for emergency vehicles.

- When visiting the site it was witnessed that a portion of the area is run over for a turn around.

- If the planned area is prefered to be smaller, the bioretention can be made deeper at a 9 or 12 inch depth to limit the area of free green space that would be taken up.

- This site offers a large Impervious cover disconnection from municipal property.

Groton City Fire Department

Pros:

- Offers 227,561.47 gallons of treatment per year.
- Aesthetic appeal to property.
- Stop erosion of front area.
- Educational opportunity.

Cons:

- May conflict with unofficial turn around practice.
- Will require new maintenance for the area.
- Will take up a portion of free green space that may be used to firehouse activities.

Drainage Area (sq ft)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice Size (sq ft)
8,642.6	Bioretention	227,561.47	2.367	0.299	1,434.67

Eastern Point Park: No Recommendation

Center Grass Island

Main Parking lot

Reasons for not suggesting any practices

- We did not suggest any practices at Eastern Point Park because the large main parking lot was sloped to allow water to drain to storm drains in the center of the parking lot. This makes it very difficult to implement a GSI practice without repaving the lot with permeable pavement or sacrificing parking spaces.
- Sediment buildup from the beach sand would also make permeable pavement clog quickly if it were installed. A lot of maintenance would be required.
- The pavement surrounding the grass center island at the entrance of the park was not sloped in a favorable way to allow stormwater to flow into a practice if one were installed there.

Possible Practices for Eastern Point Park

- If the roadway leading into the park was to be repaved, it could be re-sloped to allow a larger drainage area to flow towards the center grass island, which would make a practice more practical in that location.
- If the main parking lot were to be repaved, permeable pavement could be installed but frequent maintenance would be needed due to sand build up.
- If parking spaces are willing to be given up, a bioretention strip could be added along the center of the main parking lot where the storm drains are.

Pros

- High traffic area, good for educational purposes and signage.

Cons

- Repaving needed for practices to be worth installing.
- Heavy maintenance would be required.

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.

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