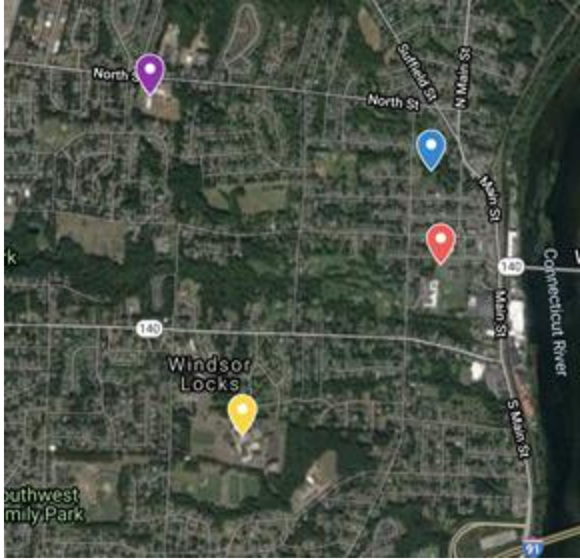
Runoff Reduction Recommendation Windsor Locks



By: Tyler Metsack and Sarah Schechter

Top Four Sites for Windsor Locks

These four sites were recommended by Windsor Locks as locations to check for potential stormwater disconnections. These areas are heavily used by the community, that could benefit from low-impact development (LID) practices.

1. Town Hall - 50 Church St, Windsor Locks, CT 06096
2. School District - 58 S Elm St, Windsor Locks, CT 06096
3. North Street School - 325 North St, Windsor Locks, CT 06096
4. Pesci Park - On Center Street 103,684

If all top four site projects were implemented, 103,684 square feet of impervious cover will be disconnected from the stormwater drainage system. This means that 1,578,129 gallons of untreated stormwater, 25.77 pounds of nitrogen, and 3.59 pounds of phosphorus will be prevented from entering local water bodies annually.

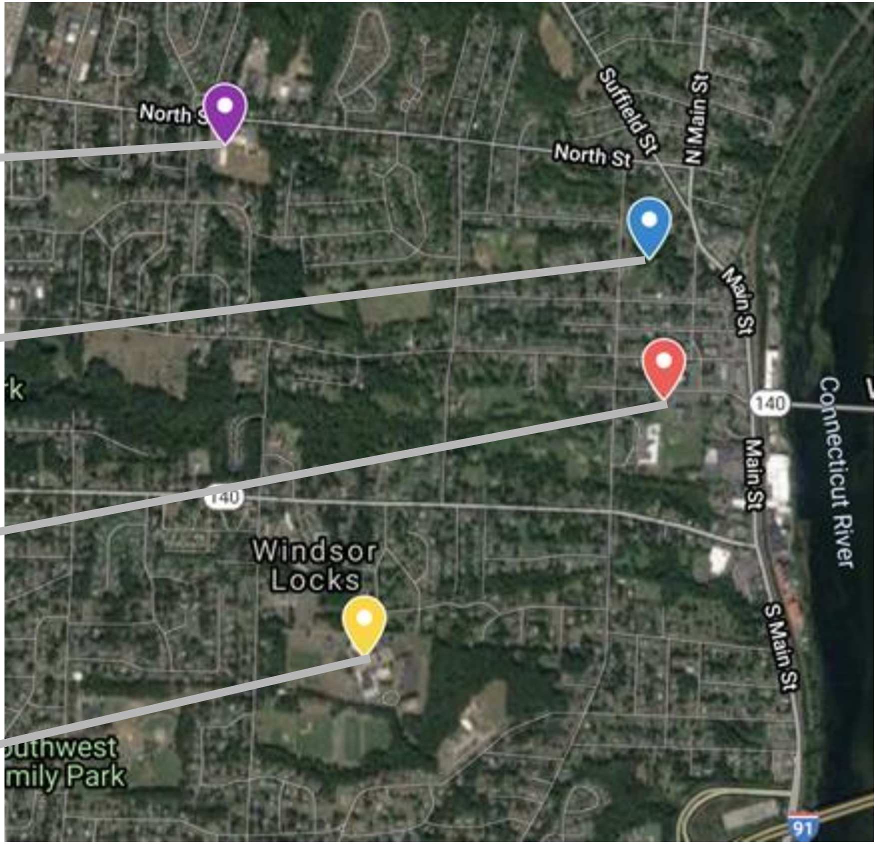
Sites Map

North Street School - 325 North St, Windsor Locks, CT 06096

Pesci Park - On Center Street

Town Hall - 50 Church St, Windsor Locks, CT 06096

School District - 58 S Elm St, Windsor Locks, CT 06096



Impervious Surfaces and 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 to 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

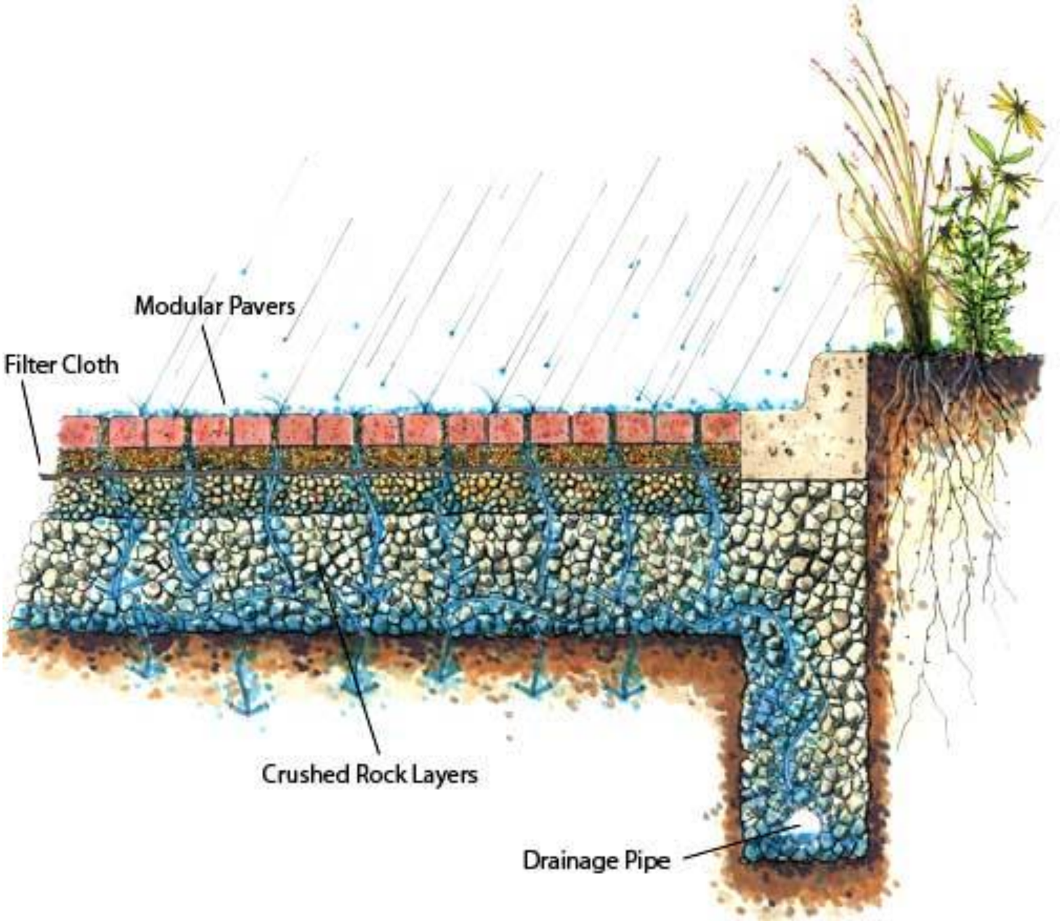
Rain Gardens

A **rain garden** is a piece of green infrastructure 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.


BUFFER
The buffer surrounds a rain garden, slows down the flow of water into the rain garden, filters out sediment, and provides absorption of pollutants in stormwater runoff.
DEPRESSION
The depression is the area of the rain garden that slopes down into the ponding area. It serves as a holding area and stores runoff awaiting treatment and infiltration.
PONDING AREA
The ponding area is the lowest, deepest visible area of the rain garden. The ponding area should be level so that the maximum amount of water can be filtered and infiltrated. It is very important that this area drains within 24 hours to avoid problems with stagnant water that can become mosquito breeding habitat.
PLANTING SOIL LAYER
This layer is usually native soil. It is best to conduct a soil test of the area checking the nutrient levels and pH to ensure adequate plant growth.
BERM
The berm is a constructed mound, or bank of earth, that acts as a barrier to control, slowdown, and contain the stormwater in the rain garden. The berm can be vegetated and/or mulched.
SAND BED
If drainage is a problem, a sand bed may be necessary to improve drainage. Adding a layer of coarse sand (also known as bank run sand or concrete sand) will increase air space and promote infiltration. It is important that sand used in the rain garden is not play box sand or mason sand as these fine sands are not coarse enough to improve soil infiltration and may impede drainage.
ORGANIC MATTER
Below the ponding area is the organic matter, such as compost and a 3" layer of triple shredded hardwood mulch. The mulch acts as a filter and provides a home to microorganisms that break down pollutants.
INLET
The inlet is the location where stormwater enters the rain garden. Stones are often used to slow down the water flow and prevent erosion.
OVERFLOW
The overflow (outlet) area serves as a way for stormwater to exit the rain garden during larger rain events. An overflow notch can be used as a way to direct the stormwater exiting the rain garden to a particular area surrounding the rain garden.

Pervious Pavement



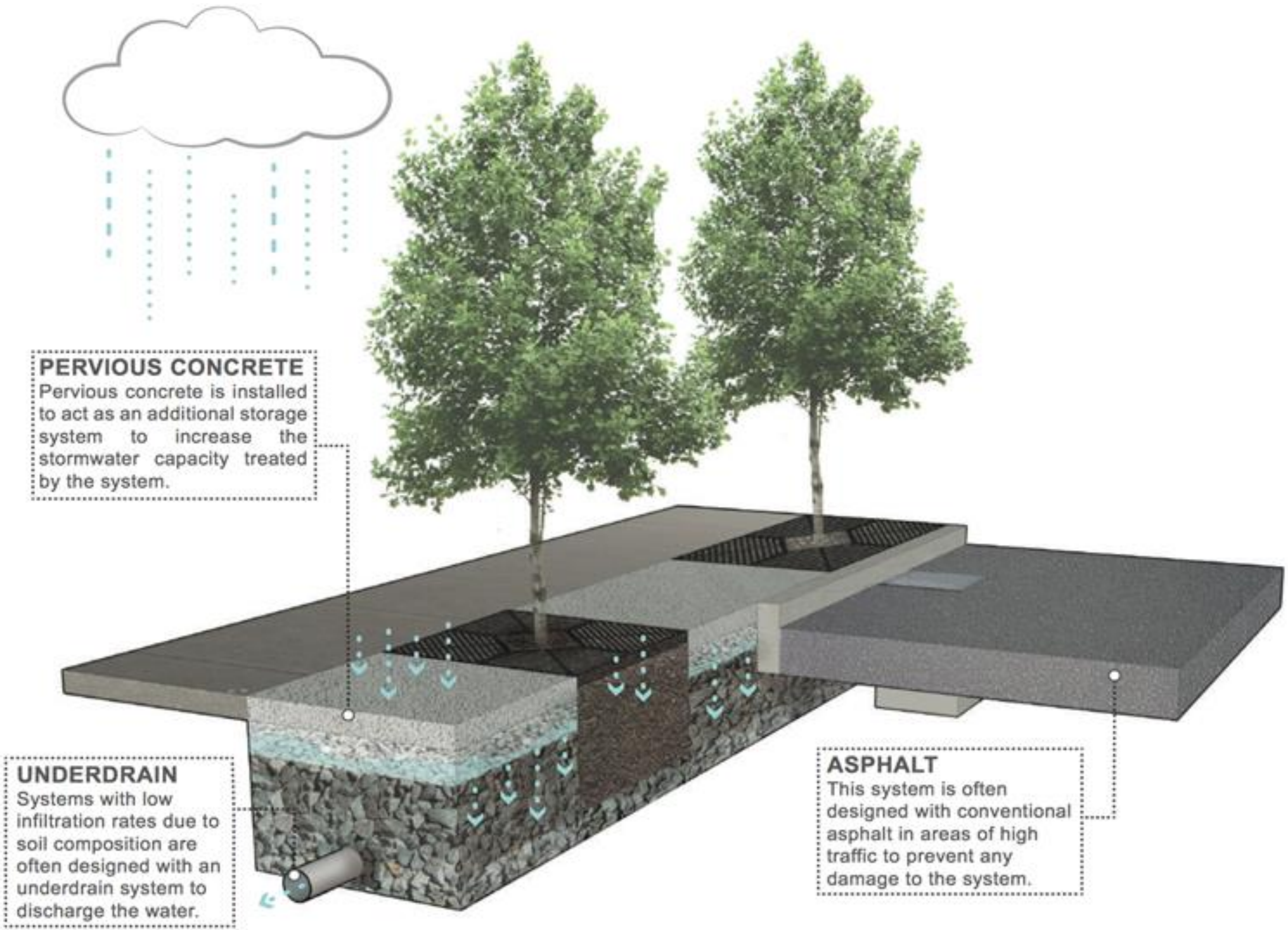
Pervious paving is an alternative to traditional asphalt or concrete that allows for the infiltration of water. Ideal locations for pervious paving are relatively flat areas that take on a fair amount of water from surrounding impervious surfaces during storm events. Pervious asphalt needs to be replaced less often than traditional asphalt. As a result of the material being porous, it is less susceptible to seasonal expansion and contraction than traditional asphalt. This reduces the occurrence of frost heaves and seasonal cracks and prolongs its lifespan. Pervious paving is the most costly green infrastructure practice as it covers a large area and maintenance is required. Maintenance practices include cleaning techniques such as pressure washing and vacuum sweeping to dislodge sand, dirt, leaves and other debris that infiltrate the void structure of the pervious concrete and inhibit its permeability.

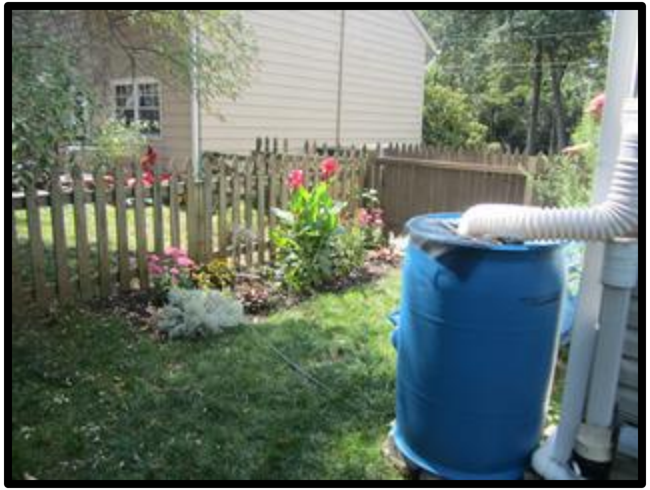
Pervious paving often reduces the need for snow removal as well. With traditional concrete and asphalt, water from melted snow cannot infiltrate so it often freezes into black ice or acts as runoff and takes salt with it. Pervious paving allow this water to enter the ground, resulting in a decreased need for salting as well as less cost for snow removal maintenance. This not only puts less stress on the stormwater management system, but relevies local aquatic ecosystems as well.

Tree Box Filters

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.


PERVIOUS CONCRETE
Pervious concrete is installed to act as an additional storage system to increase the stormwater capacity treated by the system.
UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

Rainwater Harvesting



Rainwater harvesting is the diversion of water from gutters and downspouts which would otherwise end up in the municipal stormwater management system. Roof runoff is fed into large **cisterns** which retain the water until it can be repurposed for garden watering, domestic use, fire protection and a variety of other ways. Not only does this aid in reducing runoff and the issues that come with that, but it also reduces stress on private well and municipal water supplies. Cisterns are usually situated beside buildings where gutters drain water from the roof.

Both the amount of water needed as well as the area of impermeable surface are important to pay attention to when deciding how large a cistern to install. The size of the cistern also dictates what material it should be made of. For small drainage areas, PVC is appropriate, but as the size increases steel or even concrete may be necessary. Depending on the anticipated use of the water, a filter may be imperative to prevent contaminants from entering the cistern. Maintenance practices include relocation of cisterns in the winter months to prevent them from freezing.

Site 1: Windsor Locks Town Hall

Location

50 Church St, Windsor Locks, CT 06096

Impervious Area

102,677 Square Feet

Total Area Disconnected

51,635 Square Feet

Key

Red - Option 1: Large Garden with Riprap Channel

28,740 Square Feet

Brown + Yellow - Option 2: Front Parking Stalls

9,364 Square Feet

Blue - Option 3: Back Parking Area

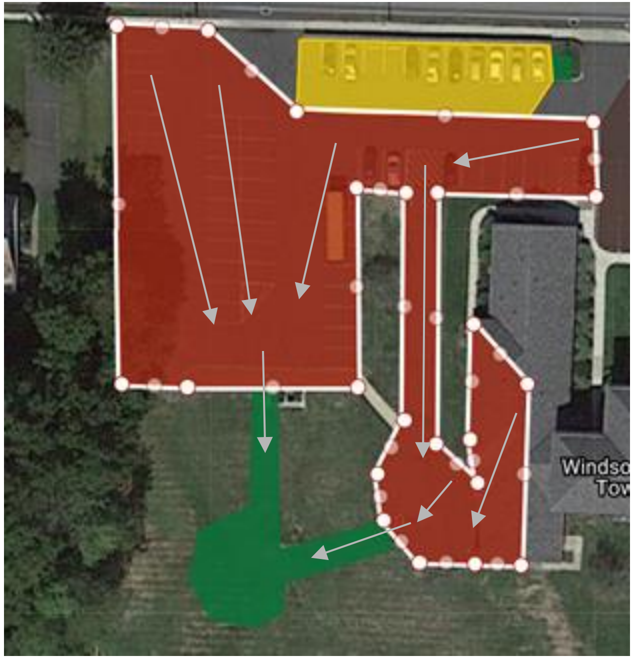
13,531 Square Feet

Green - Rain Garden

Pink - Tree Box Filters

Option 1: Large Garden with Riprap Channel

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 (cubic ft.)
28,740	Rain Garden and Riprap (Red)	114,963	7.9	0.99	4,770



Currently when looking at the Southwest parking lot of the town hall, there is a single catch basin that collects much of the runoff from the upper parking lot. This has led to erosion in the hill near the catch basin, which is dangerous and not aesthetically appealing.

Pros:

- Aesthetically appealing
- Will halt the present erosion
- Adds educational aspect - signage can also be placed

Cons:

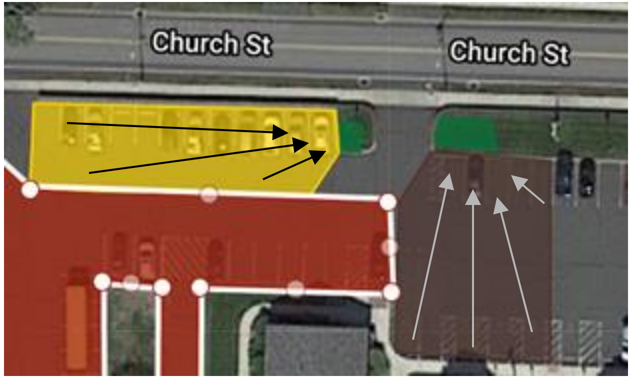
- Maintenance will be required
- Mowing must be altered

Catch basin - overloaded by runoff from the parking lot

Erosion caused by the overflow in the catch basin

Option 2: Front Parking Stalls

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 (cubic ft.)
9,364	Rain Gardens (near road)	280,212	2.6	0.33	1,555



There is a parking lot in the front of the town hall, which has a great deal of runoff. Much of this ends up exiting out of the parking lot and onto the sidewalk and road. Making curb cuts would allow some of the water to flow into the grassy area and adding a rain garden on either side of the entrance would allow for the water to infiltrate.

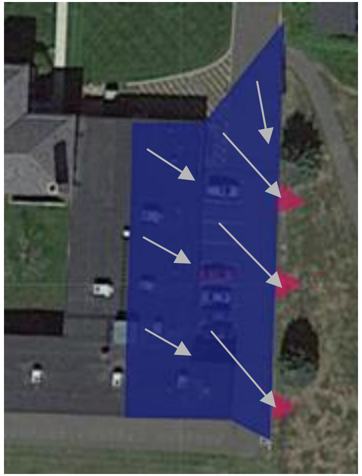
Pros:

- Aesthetic appeal - in the front of the building
- Educational opportunity

Cons:

- Maintenance
- Smaller gardens - wouldn't capture all the water

Option 3: Back Parking Area



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 (cubic ft.)
13,531	Tree Box Filters	54,118	3.7	0.47	2,245

The blue section on the map is the watershed that flows towards the Southeast corner, which is also leading to an erosion problem. Runoff from a parking lot and a portion of the building drains to this areaThis runoff could be directed into the treebox filters that will be placed in the grass and will allow some of the water to infiltrate rather than rushing down the hill, leading to erosion and pooling.

Pros:

- Easy to install
- Standardized designs - fairly simple
- Cost effective

Cons:

- Limits the area that snow can be plowed into
- Special maintenance required
  - Cleaning out leaves and sediment regularly
- Salt injuring trees if the lot is salted

Possible Tree Box Line

Erosion at the corner of the building

Site 2: School District

Location

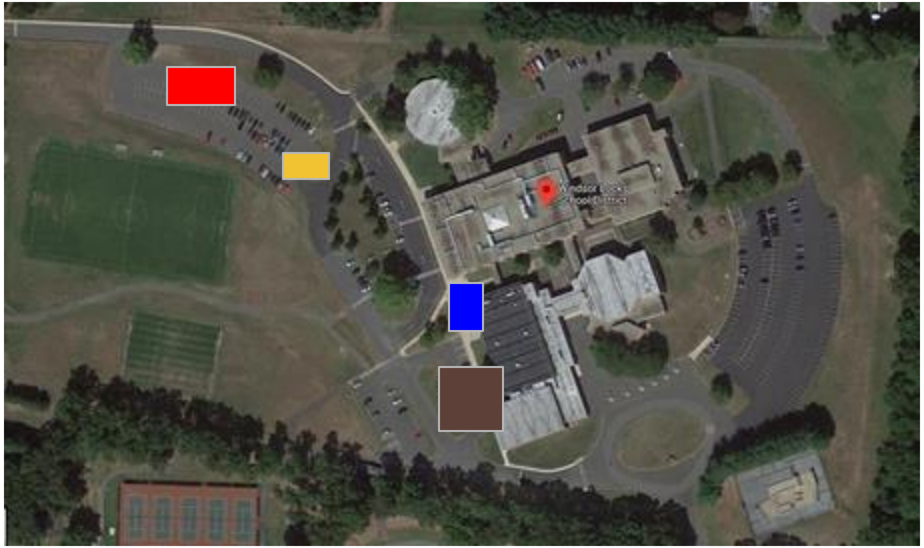
58 S Elm St, Windsor Locks, CT 06096

Impervious Area

552,559 Square Feet

Total Area Disconnected

21,713 Square Feet



Key

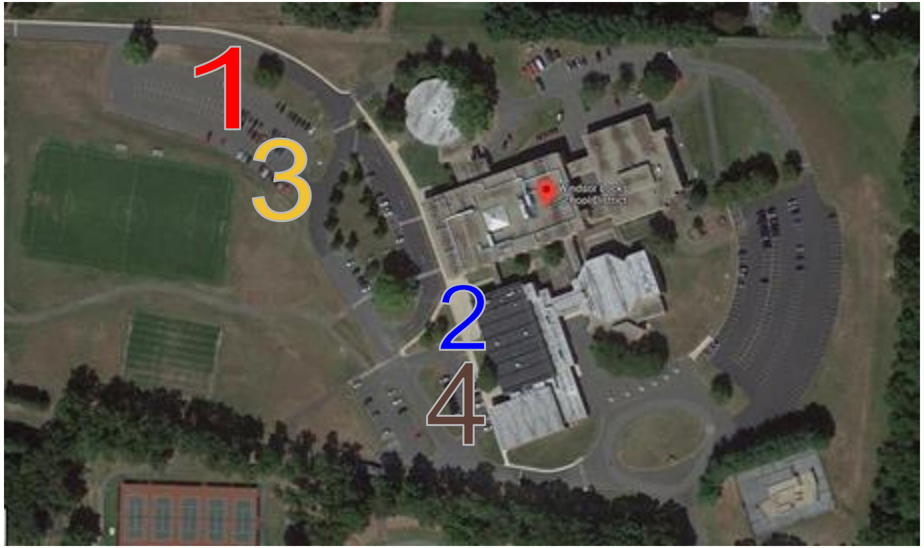
Red - Drainage Area 1: Student Lot
6,206 Square Feet

Blue - Drainage Area 2: Front Sidewalk
3,267 Square Feet

Yellow - Drainage Area 3: Senior Rock
5,532 Square Feet

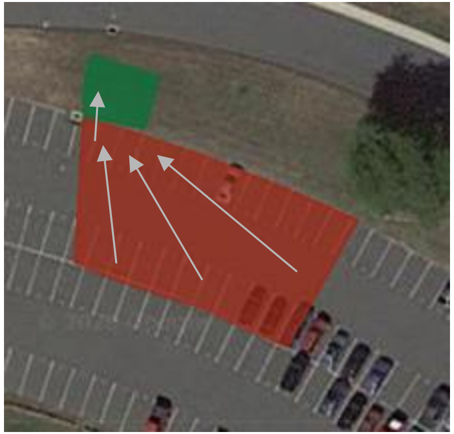
Brown - Drainage Area 4: Side Parking Area
6,708 Square Feet

Green - Rain Gardens



Option 1: Student Lot

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 (cubic ft.)
6,206	Rain Garden 1	185,592	1.7	0.23	1,030



The red area of the entrance parking lot runs to a catch basin along the curb, where we suggest making curb cuts along each side allowing the water to run into a rain garden in the area indicated. This area is away from trees and other potentially barriers that would prevent making a depression in the ground.

Pros:

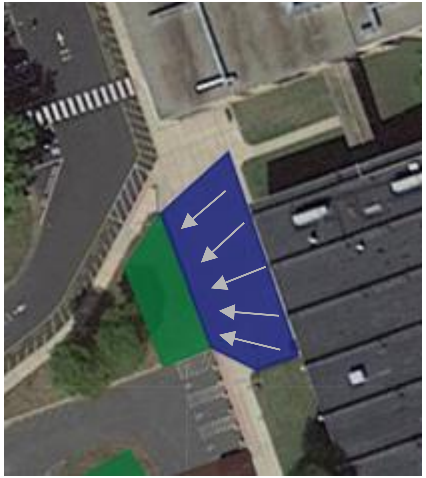
- Aesthetically appealing
- Easy to install
- Educational element
- Not a space that people would typically walk through

Cons:

- Maintenance required
  - Weeding, plant care, etc.
- Would require plants that could withstand plowing - if snow was placed here

Option 2: Front Sidewalk

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 (cubic ft.)
3,267	Rain Garden 2	97,748	0.9	0.11	542



The sidewalk highlighted in blue runs off to the parking lot but is starting to erode the corner of the grass island on its way there. We would like to put a rain garden there to catch this runoff reducing erosion and disconnecting this area before it becomes a bigger problem.

Pros:

- Aesthetically appealing
- Easy to install
- Educational element
- Would stop the erosion problem

Cons:

- Maintenance required
- Would require plants that could withstand plowing - if snow was placed here

Option 3: Senior Rock

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 (cubic ft.)
5,532	Rain Garden	165,521	1.5	0.19	918

The yellow area on the map is a drainage area that flows towards a grassy area with a large rock that looked as though it was dedicated to the seniors each year. In order to avoid water pooling in this area and prevent runoff, a curb cut would be made and a rain garden placed around the rock. This would make the area even more special for the seniors.

Pros:

- Aesthetically appealing
- Easy to install
- Educational element
    - Could be a senior project

Cons:

- Maintenance required
- Would require plants that could withstand plowing - if snow was placed here

Option 4: Side Parking Area

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 (cubic ft.)
6,708	Rain Garden	200,710	1.84	0.23	1,114

The brown drainage area feeds into a catch basin at the corner indicated by the flow arrows. In order to disconnect this from the system, a curb cut would be made and the water could then flow into the garden in the adjacent grassy area. The catch basin could be used as overflow for the garden so that the runoff can infiltrate into the ground rather than being directly connected.

Pros:

- Easy to install
- Aesthetically appealing
- Could have a rock path for students to walk through in order to create a walkway

Cons:

- Maintenance required
- Altered mowing
- Could remove potential walkway for students (if they cut through the grass)

Site 3: North Street School

Location

325 North St, Windsor Locks, CT 06096

Impervious Area

159,564 Square Feet

Total Area Disconnected

14,126 Square Feet

Key

Red - Option 1: Back Parking Lot

9,988

Blue - Option 2: Front Entrance

4,138

Green - Rain Gardens

Option 1: Back Parking Lot

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 (cubic ft.)
9,988	Rain Garden	298,719	2.7	0.35	1,657

A rain garden is recommended to disconnect approximately half of the back parking lot. The red drainage area currently drains to a catch basin in the corner of the lot. It is recommended that curb cuts be made to the side of the catch basin to allow runoff to run a rain garden in the grassy area indicated in green. The catch basin could be used for overflow

Pros:

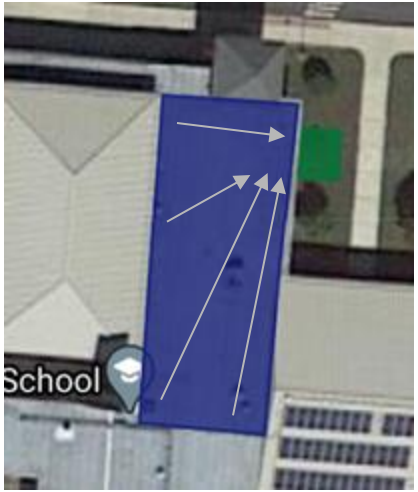
- Aesthetically appealing
- Would provide a project for students
- Educational aspect

Cons:

- Should be designed to avoid students stepping into it

Option 2: Front Entrance

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 (cubic ft.)
4,138	Rain Garden 2	123,814	1.13	0.14	686



At the front of the school there is an area of grass that already contains some plants and small trees. The blue section of roof runs off into the grass and while it is infiltrated, could be better handled by placing a rain garden at the front of the school near the entrance. The current catch basin could be used as overflow for the rain garden by adding raised sides around the edge.

Pros:

- Aesthetically appealing - in the front of the school
- Educational aspects
- Would take in more of the runoff

Cons:

- Would have to work around the already present trees

Catch basin

Site 4: Pesci Park

Location

On Center Street

Impervious Area

24,830 Square Feet

Total Area Disconnected

16,210 Square Feet

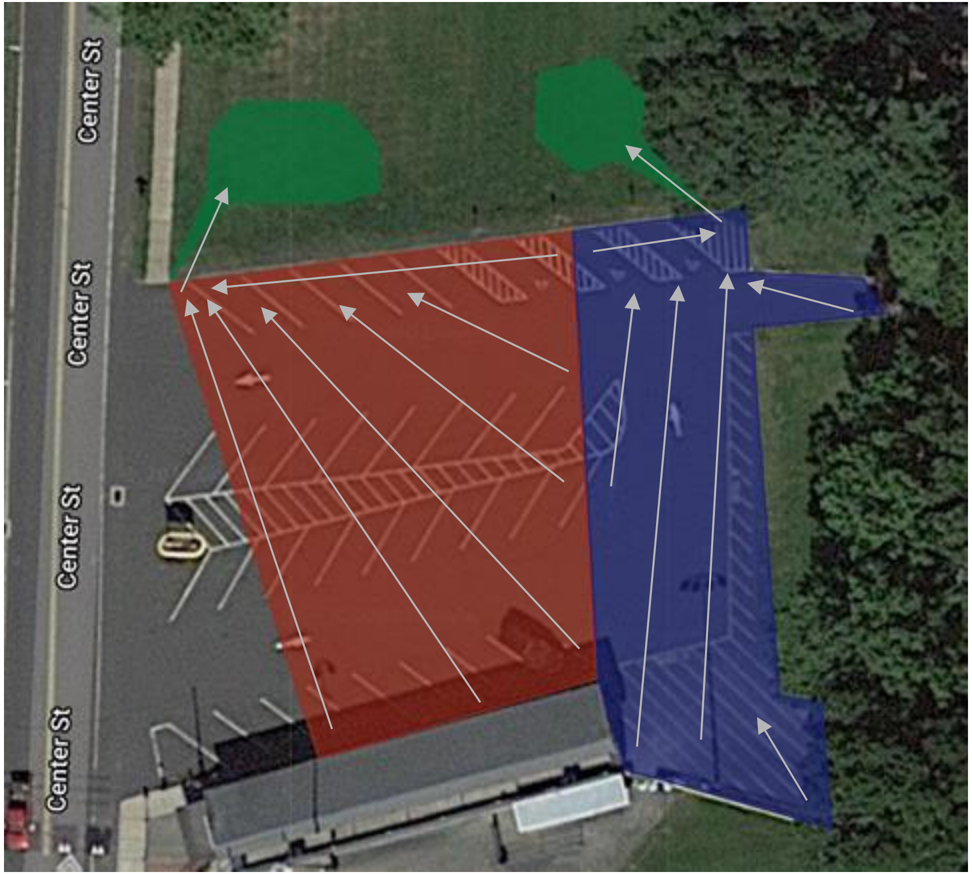
Key

Red - Drainage Area 1

Blue Drainage Area 2

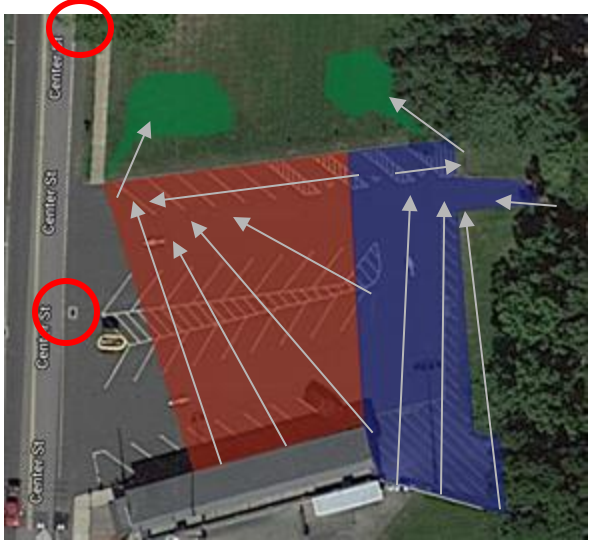
Total: 16,210 Square Feet

Green - Rain Gardens



Pesci Park

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 (cubic ft.)
16,210	Rain Gardens	56,732	4.4	0.55	2,675



There are two watersheds in this parking lot due to the crown in the road; they are shown in red and blue on the map. The runoff from the red section flows down the sidewalk into a catch basin that looks as though it is being overworked. Rain gardens could be installed in the corners of this lot to infiltrate stormwater runoff from the majority of the lot. Curb cuts would need to be made to intercept flow and redirect to the gardens rather than the catch basins.The gardens have been placed lower on the hill to avoid being covered in snow due to plowing.

Pros:

- Would take some stress off the lower catch basin
- Add more aesthetic appeal to the park

Cons:

- Maintenance
- Would alter mowing patterns

Contact and 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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CLEAR
Center for Land Use Education & Research

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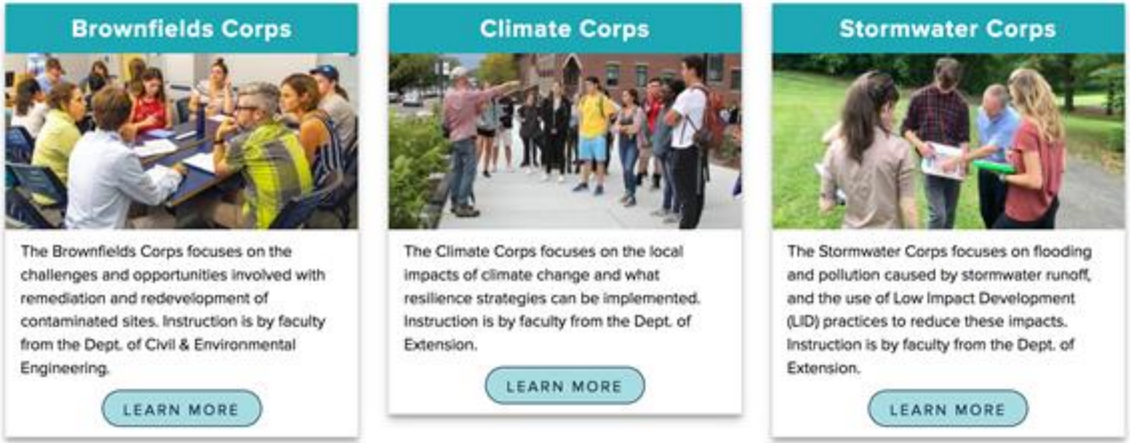

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