WETHERSFIELD STORMWATER RUNOFF REDUCTION PLAN FALL 2021

UNIVERSITY OF CONNECTICUT STORMWATER CORPS | OCTOBER 2021

Alex Joslin
(Environmental Science, 2022)

Amealia Maynard
(Applied and Resource Economics, 2022)

Lexi Cyr
(Environmental Science, 2022)

UCONN

SUMMARY:

During the fall of 2021, a team of UCONN students as well as Extension faculty performed an evaluation of potential stormwater infrastructure opportunities in the town of Wethersfield, CT. The process involved a desktop analysis as well as field visits to determine where potential green stormwater infrastructure(GSI) installation opportunities exist on publicly owned land. 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, **82,832** sq.ft. of Impervious Cover(IC) will be disconnected from the current stormwater drainage system. This also means that **2,217,091** gallons of stormwater, **22.66** pounds of Nitrogen, as well as **2.87** pounds of Phosphorus will have been removed from entering the storm system as well as polluting local water bodies annually.

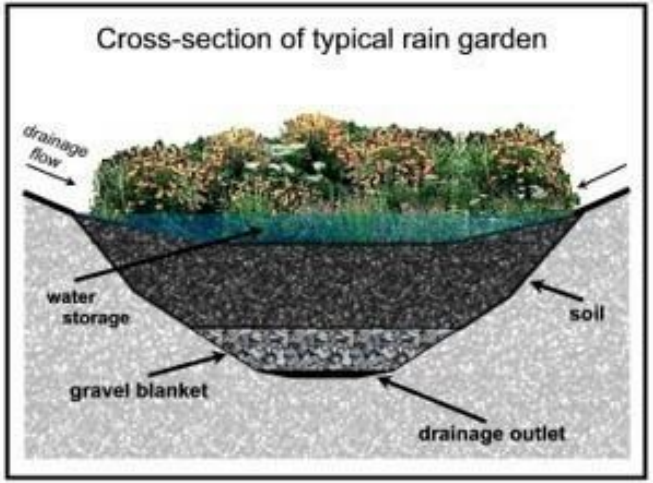
IMPERVIOUS SURFACES/RUNOFF

Impervious surfaces include roads, parking lots, as well as other developments that do not allow water to penetrate through to the ground. Natural surfaces such as grass, leaf litter, vegetated areas, and even dirt areas, absorb significant amounts of precipitation and runoff. Once the water enters the ground, it flows through the groundwater and into the water bodies or recharges groundwater aquifers. When natural surfaces get replaced with impervious cover, the cycle is disrupted. Soil infiltration decreases, while surface runoff significantly increases. This often results in adding to the stormwater management systems and discharged into local water bodies to attempt to prevent flooding in developed areas.

Runoff over impervious cover often collects pollutants, such as nitrogen and phosphorus as well as other sediments, which can cause a plethora of issues, including flooding, erosion, poor water quality, even impact local wildlife. To mitigate these issues, more specifically in water quality, runoff can be disconnected from the stormwater management system by implementing green infrastructure practices that reduce impervious surface impact. For example, disconnecting the downspouts on buildings and directing them into a rain garden or bioretention can help significantly reduce many of these water issues as well as add to the scenery. Previously impervious surfaces mentioned, can be disconnected using these previous alternatives to traditional practices.

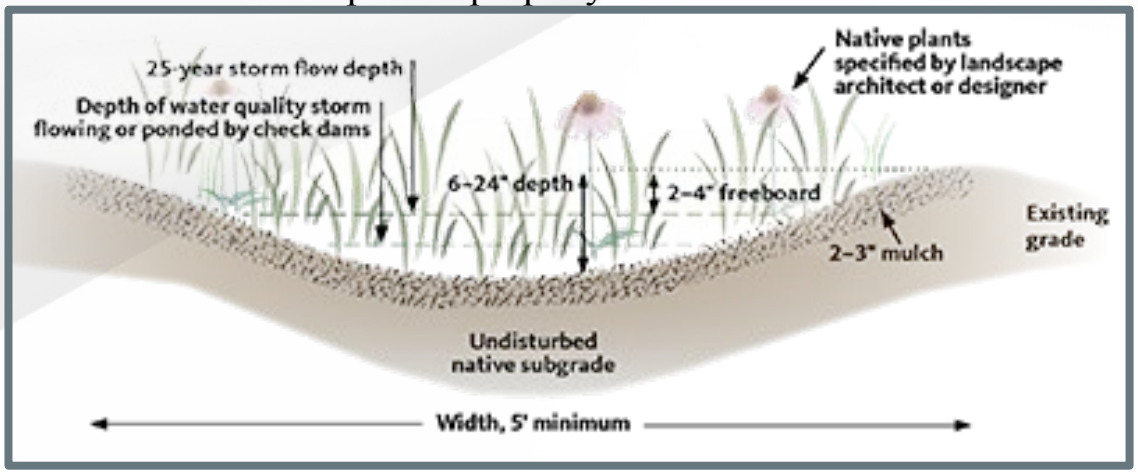
COMMON GSI PRACTICES

Rain gardens: A rain garden is a man-made depression in the ground that collects rainwater that typically comes from an impervious structure or from an area where stormwater runoff has been disconnected from running directly into a sewage system. This form of bioretention is a much more residential kind of GSI practice, with no special soil media or underdrain/overflow structures. They are usually 6”-12” to allow for some ponding, but for the stormwater to be absorbed by the media within 3-4 hours. The soil condition is also very important for stormwater infiltration, and they should be sized to withstand 1 inch of runoff from 100% impervious watersheds. They often add an aesthetically pleasing element to the buildings or land they are added to. In some cases, extra amenities such as curb cuts and special media may be used to account for overflow.



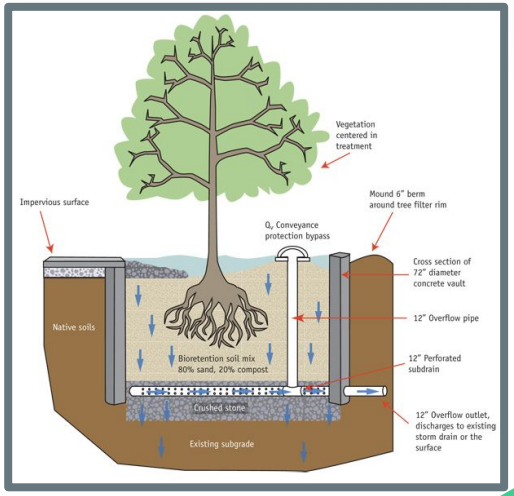
COMMON GSI PRACTICES

Grass swale: a grass swale is a graded landscape which forms a channel, and is used for collecting runoff storm water and allowing it to filtrate into the ground. It aids in reducing flow velocity, and in some cases where the flow of runoff is fast due to the steepness of the swale, extra media such as gravel or wood to create channels to slow flow rate. In the case of intense storms, this GSI practice can direct overflow directly into drainage systems. Maintenance is relatively basic, with mowing the entirety of the area including the swale being unhindered, some replanting if necessary, and removing large objects of debris or accumulated sediment to ensure it operates properly.



COMMON GSI PRACTICES

Treebox filters: A tree box filter can be seen as mini bioretention installations. They are commonly used in urban settings, especially alongside busy roads in cities where space for GSI is limited. The typical design for a tree box filter contains a concrete box which allows for filtration and metal grate at the top to keep the roots of the tree protected, a special bioretention, and with a subdrain underneath the entire structure. Tree box filters act mainly to treat runoff stormwater that flows off of impervious surfaces, and should allow for about 6 inches of ponding. The tree itself should be able to withstand seasonal variations and occasional flooding. Highest maintenance usually requires ensuring the vegetation is established.

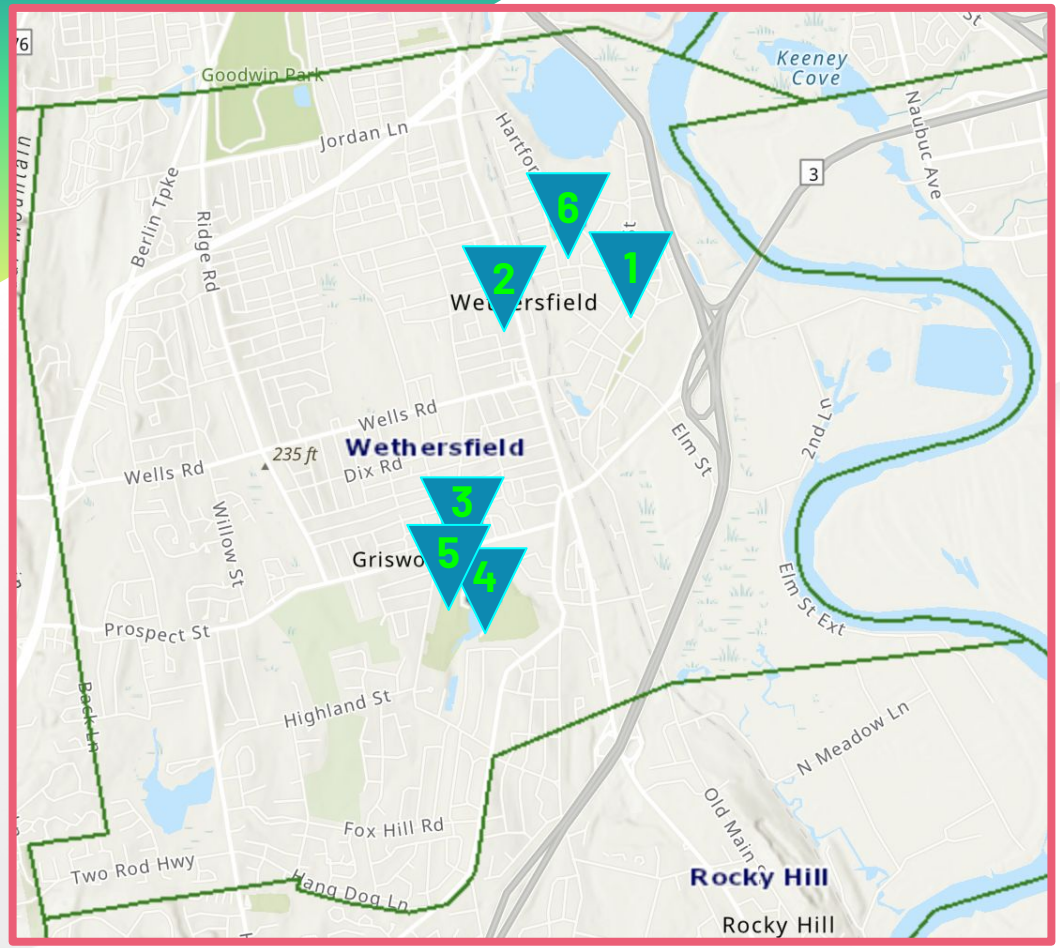


SITE LOCATION OVERVIEW

In accordance with what the town of Wethersfield discussed in our online meeting, a majority of the green stormwater infrastructure, or GSI, that we are recommending are rain gardens. We wanted to offer a variety of LID practices, however, and chose locations where GSI such as treebox filters and grass swales could be implemented. Before coming to any conclusion about what retrofit to suggest, our team conducted research and site visits to determine what sites would be the best options for us to offer multiple practices to implement. Once observing the sites in person and looking at the advantages and disadvantages of each, the practices presented in this presentation were decided based on their suitability to the site.

The sites we ultimately decided on were Silas Deane Middle School, Eleanor Buck Wolf Nature Center, Mills Wood Park, the Volunteer Ambulance Association, Keeney Memorial Cultural Center, and Hanmer Elementary School. Each of these sites provides multiple opportunities to suggest retrofits that could also offer educational opportunities along with increasing aesthetic appeal.

SITE LOCATION OVERVIEW & CRITERIA FOR CHOOSING



1 - Keeney Memorial Cultural Center
2 - Silas Deane Middle School
3 - Eleanor Buck Wolf Nature Center
4 - Mill Woods Park
5 - Volunteer Ambulance Association
6 - Hanmer Elementary School

Criteria:

- Has a significant enough proportion of connected impervious cover
- Municipally owned property
- Has the potential to have significant portions of impervious surfaces disconnected
- Locations where practices would be seen so they will not be forgotten about.
- Practices could not be pervious asphalts and pavements (per request)

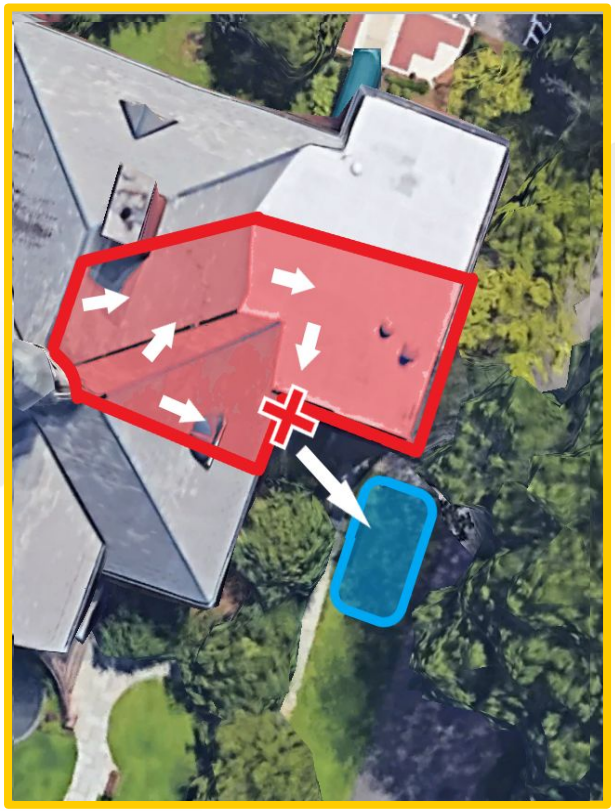
KEENEY MEMORIAL CULTURAL CENTER

200 Main St.

Aerial view of Keeney Memorial

Impervious cover and topography map of Keeney Memorial

PRACTICE RECOMMEND (1): RAIN GARDEN ON LEFT HAND SIDE OF BUILDING



Key:

Blue = practice

Red = drainage area

White arrows = water flow

Red “X” = drainage basin

ABOUT THE PRACTICE:

- Stormwater being redirected already from basement
- Install new piping under sidewalk and run it directly into rain garden
- Curb cuts for overflow

Pros

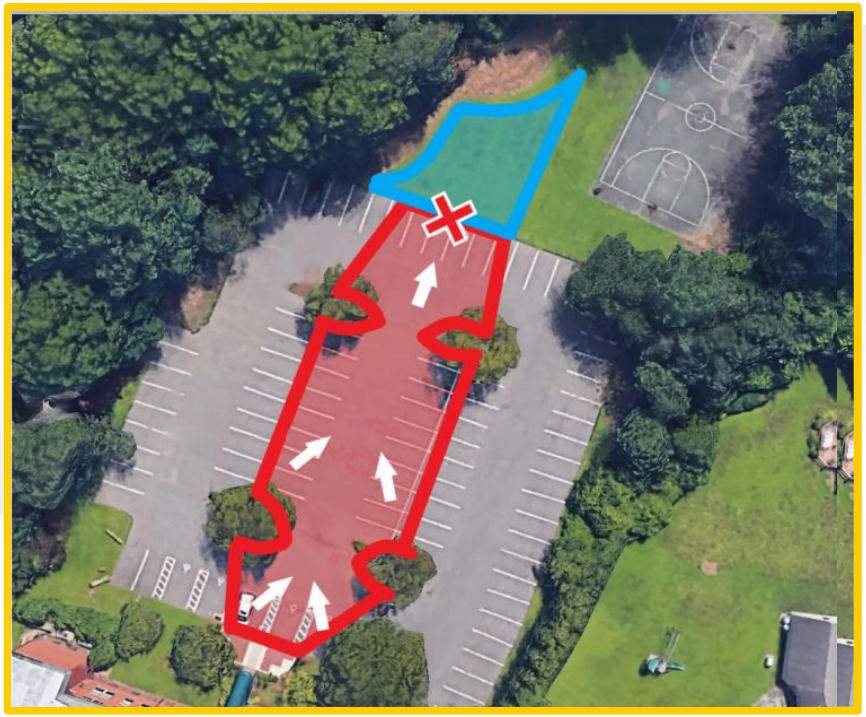
- Smaller size means smaller price tag
- Rain gardens = easiest practice to implement
- In plain site of people driving from the road and those parking
- Easy maintenance

Cons

- Small size means not as much stormwater treated
- Cost to curb cut and add new drainage
- Foot traffic
- Upkeep of maintenance

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
2100	Rain Garden 6” deep	55,300	0.57	0.07	348.6

PRACTICE RECOMMENDATION (2): RAIN GARDEN BEHIND BACK PARKING LOT



Key:

Blue = practice

Red = drainage area

White arrows = water flow

Red "X" = drainage basin

ABOUT THE PRACTICE:

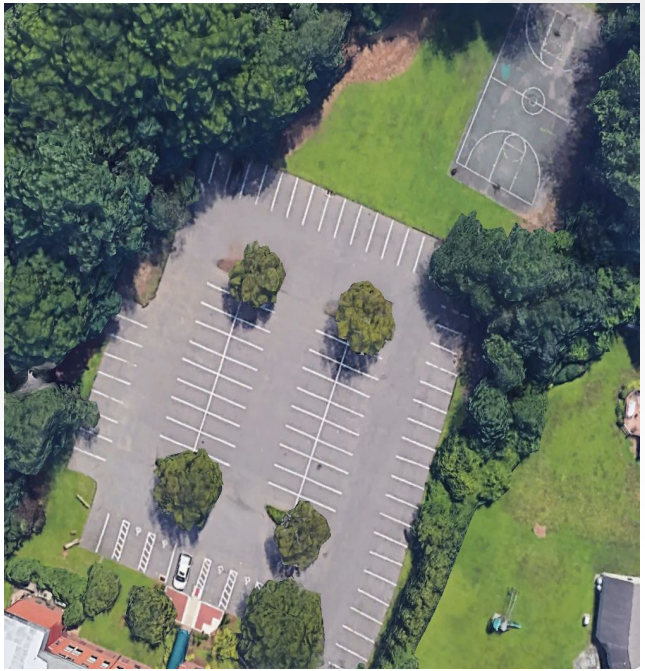
- Located near a basketball court
- Takes water from ⅓ of the parking lot
- Potential educational opportunities

Pros

- Larger area means more treatment
- Less foot traffic, pushed away from back basketball court
- Education opportunity
- Same benefits as rain garden in option 1(maintenance, implementation)

Cons:

- More expensive to install
- Curb cut expense
- Size may require more maintenance
- Runoff during the winter months



Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
9340	Rain Garden 6” deep	245,951	2.55	0.32	1550.5

SILAS DEANE MIDDLE SCHOOL

551 Silas Deane Hwy

SILAS DEANE MIDDLE SCHOOL

Impervious Cover map

- Not Impervious
- Buildings
- Roads
- Other Impervious

SILAS DEANE MIDDLE SCHOOL

Location of the 2 Suggested Practices

SILAS DEANE MIDDLE SCHOOL

Retrofit Location Images

SILAS DEANE MIDDLE SCHOOL: OPTION 1 - RAIN GARDEN

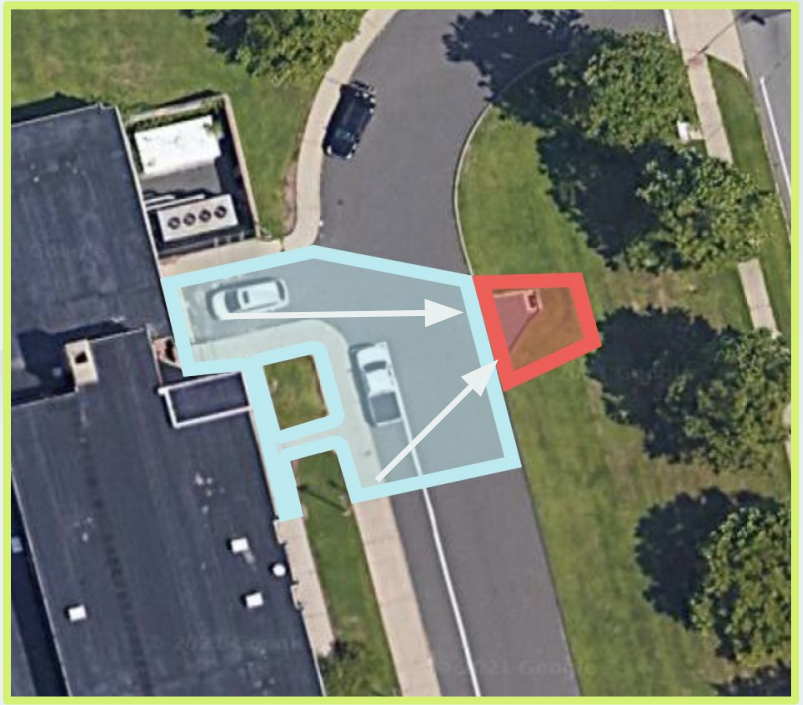
- This location is the smaller of the two options.
- Can either rip out pavement or build around
- Can add symmetry with both options

Pros:

- Small Area = Less Expensive to Build
- ↑ traffic area at school, ↑ visibility, learning opportunity for students
- Increases school's aesthetic
- Easy maintenance

Cons:

- ↓ practice = ↓ disconnected IC
- May have to burm up back due to hill slope to the road



Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
3136	Rain Garden 6" deep	93839	0.86	0.11	523

SILAS DEANE MIDDLE SCHOOL: OPTION 2 - RAIN GARDEN

- Larger of the two options
- Can also get rid of pavement surrounding the catch basin and raise it as an overflow, or you can build around it.
- This has all the same benefits as option 1 but at a ↑ scale!

Pros:

- ↑ practice = ↑ IC disconnected
- ↑ traffic area in front of school & road
- Educational benefits
- ↑ Aesthetic Value
- ↑ options when designing the practice since it is larger

Cons:

- ↑ practice = ↑ cost
- Must be maintained as it is seen by everyone
- ↑ traffic and ↑ drainage area = may need maintenance more
- May have to burm up the back as hill slopes down to the road

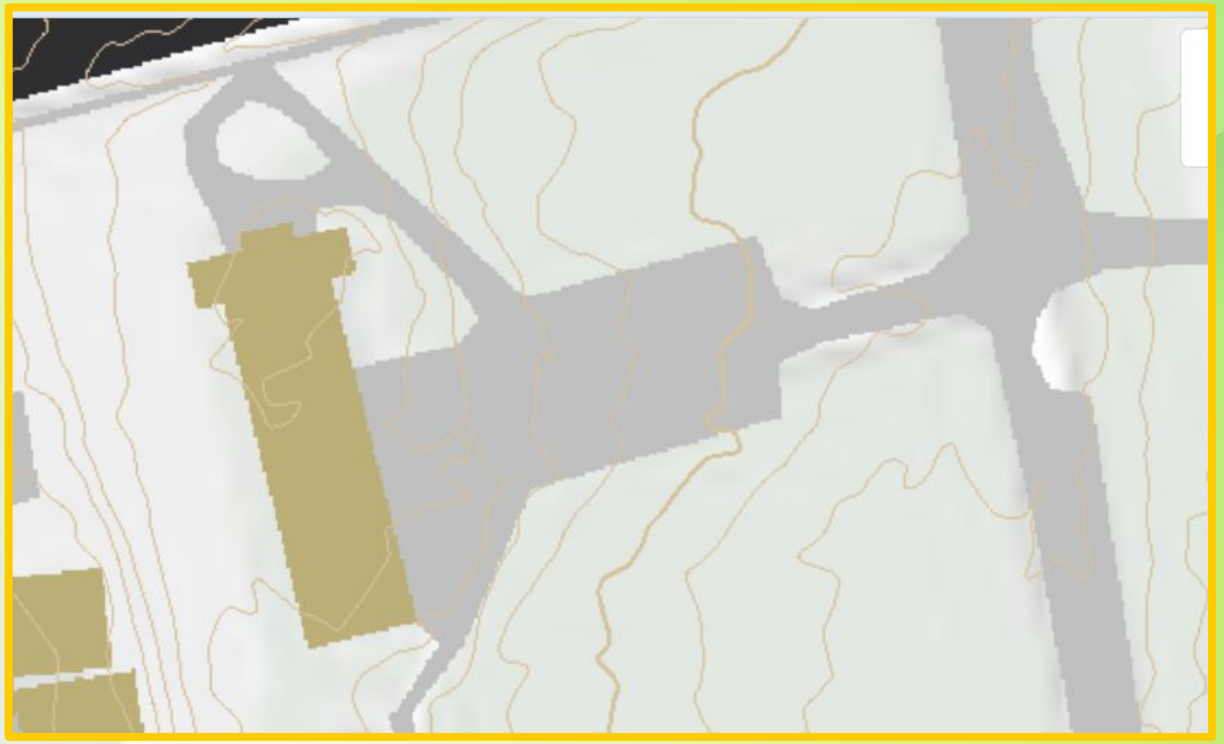
Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
6926	Rain Garden 6" deep	207227	1.89	0.24	1154

ELEANOR BUCK WOLF NATURE CENTER

156 Prospect St.

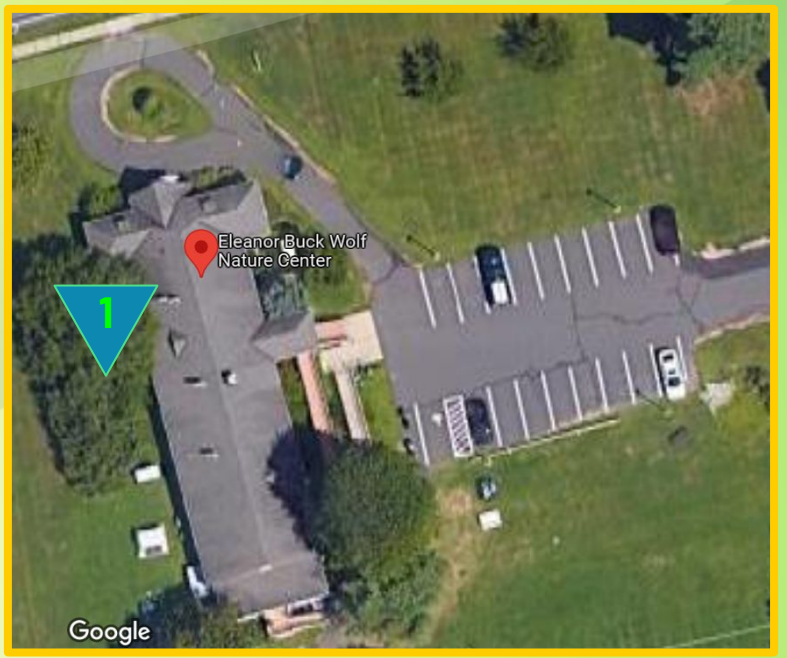
ELEANOR BUCK WOLF NATURE CENTER

Impervious Cover Map:



ELEANOR BUCK WOLF NATURE CENTER

Suggested Practice Location:



ELEANOR BUCK WOLF NATURE CENTER

Site Images:

PRACTICE RECOMMENDATION: GRASS SWALE

✘ = Downspouts

Red shaded area = the grass swale

Blue shaded area = the drainage area

Arrow = direction of the stormwater runoff.

ABOUT THE PRACTICE:

Pros:

- Easy to maintain
- A good example of how to disconnect downspouts.

Cons:

- Not centrally located.
- Trees and proximity to the basement may cause mechanical problems.

Other things to consider:

- The trees in the back could treat water from the third downspout.
- More information is needed on the areas water filtration capacity to proceed.
- The swale should be up against the trees to make mowing easier.

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
1,117	Grass Swale 6” deep, graded	29,410	.31	.04	187

MILL WOODS PARK

154 Prospect St.

MILL WOODS PARK

Impervious Cover Map

- Not Impervious
- Buildings
- Roads
- Other Impervious

MILLS WOOD PARK

Suggested Site Location and image:

PRACTICE RECOMMENDATION: RAIN GARDEN

✖ = Overflow for rain garden

Red shaded area = the rain garden

Blue shaded area = the drainage area

Arrow = direction of the stormwater runoff.

ABOUT THE PRACTICE:

Pros:

- Treats a large portion of the parking lot.
- The rain garden is centrally located.
- Not in the way of any walking paths
- Has a place for an overflow.

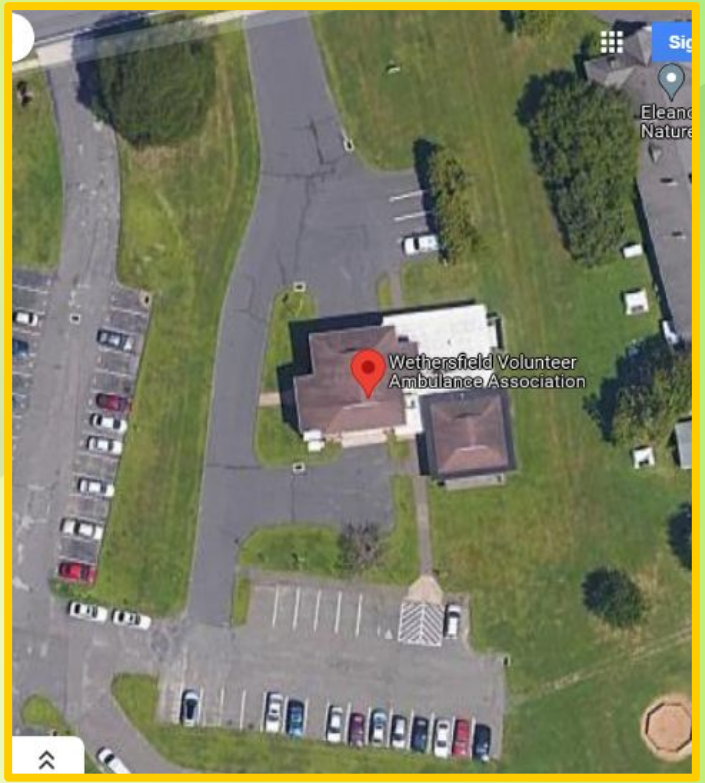
Cons:

- Size of the drainage area means a greater depth of the garden.
- Trees in the parking area could be in the way.

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
20,164	Rain Garden 1 ft. deep	530910	5.52	0.70	1680

VOLUNTEER AMBULANCE ASSOCIATION

206 Prospect ST



VOLUNTEER AMBULANCE ASSOCIATION

Impervious cover map:

VOLUNTEER AMBULANCE ASSOCIATION

Site location map:

VOLUNTEER AMBULANCE ASSOCIATION

Images of the sites:

Option #1

Option #2

PRACTICE RECOMMENDATION: OPTION 1 - RAIN GARDEN

✖ = Overflow for rain garden

Red shaded area = the rain garden

Blue shaded area = the drainage area

Arrow = direction of the stormwater runoff.

ABOUT OPTION #1:

Pros:

- High traffic area.
- Will add the same visual appeal as a garden with the added benefits listed below.
- Could drawn attention to the association due to their proximity to the nature center.

Cons:

- Maintenance requirements.

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
3,937	Rain Garden 6” deep	103,660	1.08	.14	656

PRACTICE RECOMMENDATION: OPTION #2 - RAIN GARDEN

Key:

- Drainage area
- Practice area
- Direction of Water Flow
- Catch Basins

ABOUT PRACTICE #2:

Pros:

- Right next to nature center = high view area
- Big practice = more disconnection
- Can draw more attention to the nature center as well

Cons:

- Larger practice = high cost
- Near ambulance center so it might draw extra people there
- Likely have to redo entire parking lot as it's in need of it.
- Will need to add curbs to get water flowing into garden perfectly

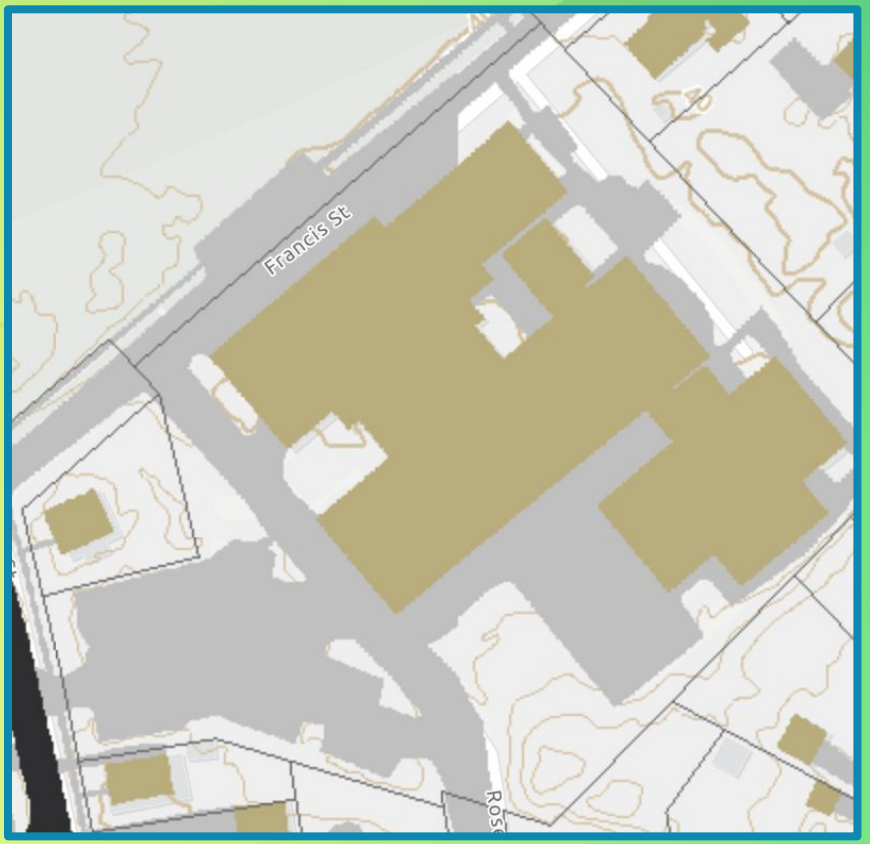
Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual Nitrogen Reduction [lb N/yr]	Annual Phosphorus Reduction [lb P/yr]	Suggested Practice Size [sq ft]
14550	Rain Garden 6" deep	383,070	3.98	0.5	2415

HANMER ELEMENTARY SCHOOL

50 Francis St.

HANMER ELEMENTARY SCHOOL

Impervious Cover Map



- Not Impervious
- Buildings
- Roads
- Other Impervious

HANMER ELEMENTARY SCHOOL

Locations of the 3 Suggested Practices

HANMER ELEMENTARY SCHOOL

Retrofit Location Images

HANMER ELEMENTARY SCHOOL: OPTION 1 - TREE BOX FILTER

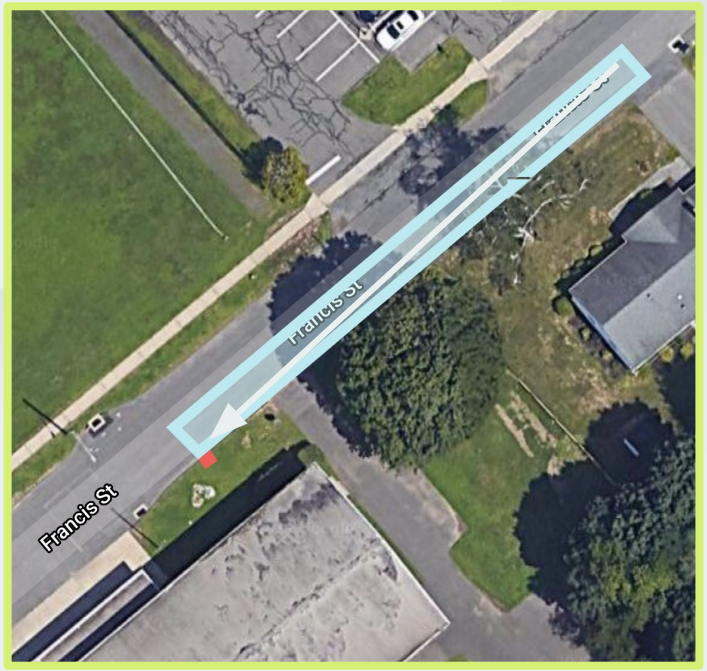
- Tree box filter (filtera) in the front as it can add variety to retrofits added.
- Each tree box can take ¼ of an acre of water
- If repaving: Can grade the road to run more water into the box and make it increasingly effective.

Pros:

- Compact
- Easy to maintain
- Educational value as it is to the right of the school entry
- ↑ Aesthetic value

Cons:

- ↑ cost compared to rain gardens
- Trees can grow large, choosing a suitable tree is mandatory
  - I.e. Easy maintenance, can stand very saturated soil, etc
- Must be maintained as it is in a very public space



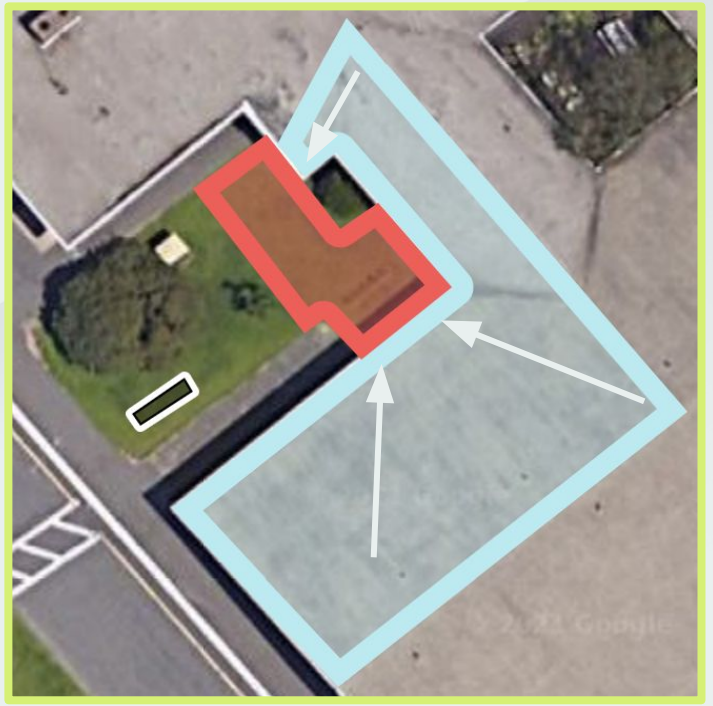
Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual N Reduction [lb N/yr]	Annual P Reduction [lb P/yr]	Suggested Practice Size [sq ft]
2,483	Tree Box Filter	65,374	0.68	0.09	412

HANMER ELEMENTARY SCHOOL: OPTION 2 - GRASS SWALE

- A grass swale functions similarly to a rain garden, but without all the plants.
- Effective for being able to have the grass mowed over without being flashy.

Pros:

- Disconnects a significant portion of the rooftop
- Simple and easy to maintain design makes this effective
- Grading it makes it safe for children so they don't fall if they were to walk through.
- Small educational benefit



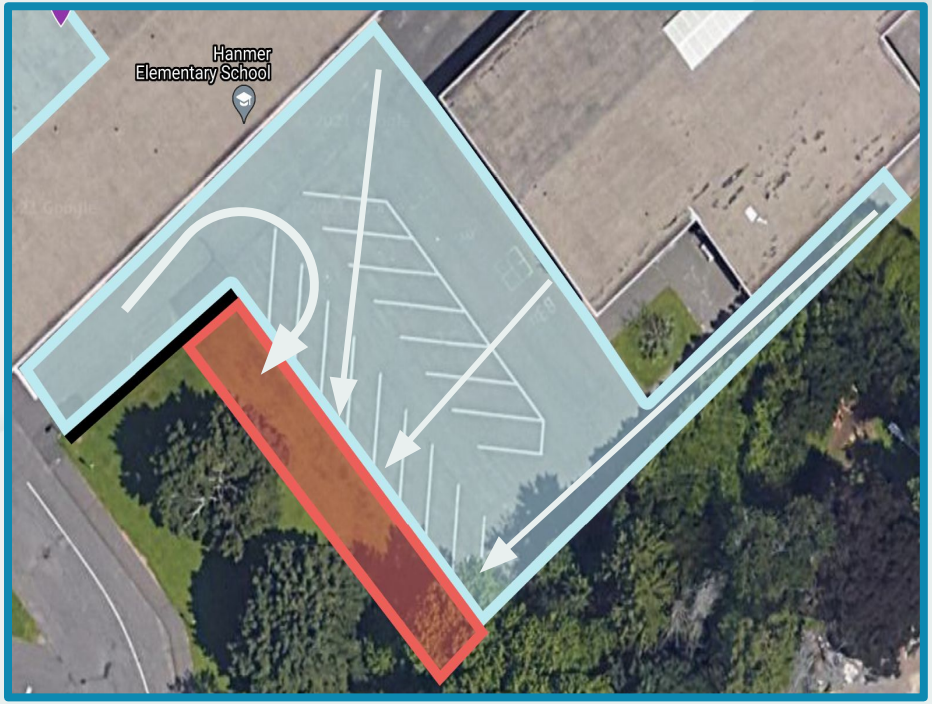
Cons:

- Likely will have to make larger due to have a graded ground level
- Will have to move the bike rack to another grass patch in order to not have it in the middle of the retrofit and having traffic compact it as much
- Can't disconnect the entire portion of roof without making deeper
  - Deeper = ↓ safety = fencing off and making bioretention instead

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual N Reduction [lb N/yr]	Annual P Reduction [lb P/yr]	Suggested Practice Size [sq ft]
4312	Grass Swale (6" deep)	113545	1.18	0.15	716

HANMER ELEMENTARY SCHOOL: OPTION 3 - RAIN GARDEN

- This rain garden is right near the parking area for teachers
- Takes up a huge amount of water in comparison to other retrofits
- Installation of a curb on that strip of road [black bar on image] would be necessary



Pros:

- ↑ drainage area = ↑ IC disconnection
- Many designing options
- ↓ in lawn area = ↑ time saved mowing
- Erosion prevention, an issue with this site
- Less $ to build than many other options such as paving

Cons:

- ↑ retrofit = ↑$$ investment
- Curb added = ↑$ added to cost
- If not maintained, stormwater issues ↑ further than before

Drainage Area [sq ft]	Suggested Practice	Annual Gallons Treated	Annual N Reduction [lb N/yr]	Annual P Reduction [lb P/yr]	Suggested Practice Size [sq ft]
14,767	Rain Garden (6” deep)	388,805	4.04	0.51	2,451

GRAND TOTALS OF ALL RETROFITS:

Practice Location	Practice Type	Drainage Area [sq ft]	Price Low	Price High
Silas Deane Middle School	Rain Garden	3,136	$2,092.00	$8,368.00
Silas Deane Middle School	Rain Garden	6,926	$4,616.00	$18,464.00
Eleanor buck Wolf Nature Center	Grass Swale	1,117	$841.50	$3,740.00
Mill Woods Park	Rain Garden	20,164	$3,360.00	$13,440.00
Volunteer Ambulance Association	Rain Garden	3,937	$2,624.00	$10,496.00
Volunteer Ambulance Association	Rain Garden	14,550	$10,867.50	$48,300.00
Keeney Memorial Cultural Center	Rain Garden	2,100	$1,392.00	$5,568.00
Keeney Memorial Cultural Center	Rain Garden	9,340	$6,200.00	$24,800.00
Hanmer Elementary School	Tree Box Filter	2,483	$3,000.00	$18,000.00
Hanmer Elementary School	Grass Swale	4,312	$3,222.00	$14,320.00
Hanmer Elementary School	Rain Garden	14,767	$9,804.00	$39,216.00
Totals:		82,832	$48,019.00	$204,712.00

*** These prices are informal estimates prepared by Joshua Snarski, University of Connecticut. They provide context for the scope of our practice recommendations.

HONORABLE MENTIONS

& Reasons for not Selecting them

Wethersfield Town Hall/Library:

- Not many opportunities other than PICP's in the front driveway
- Back parking could have pervious pavement installed but that's pretty much it

Fire Station 1/Community Gardens:

- Too many uncertainties with how building is connected, main opportunities is pervious pavements since basins are in the middle of the parking lot

Silas Deane Middle School:

- Options for pervious pavements in some places
- Side Road that the Catholic School shares has opportunities for Tree box filters [uncertain whether it was on town property so this was not suggested]

Ambulance Station/Hanmer Elementary/Keeney Memorial:

- Instead of the rain garden next to parking lot, there is an option for repaving with pervious asphalt as a lot of these looked close to needing repaving anyways.

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

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

CLEAR
Center for Land Use Education & Research