Runoff Reduction Recommendations for the Town of Bolton Fall 2020

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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 Town of Bolton, 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, 117,242 sq ft of impervious cover will be disconnected from the stormwater drainage system. This means that 3,086,944 gallons of untreated stormwater, 32.00 pounds of nitrogen, and 4.00 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

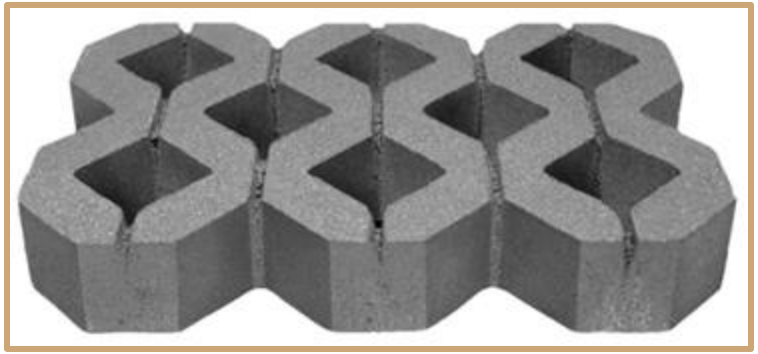
Rain Garden: A rain garden is a green infrastructure practice designed to capture precipitation runoff from an impervious surface. By doing so, water is allowed to percolate into the ground rather than directly entering stormwater management systems. They are usually built adjacent to the impervious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

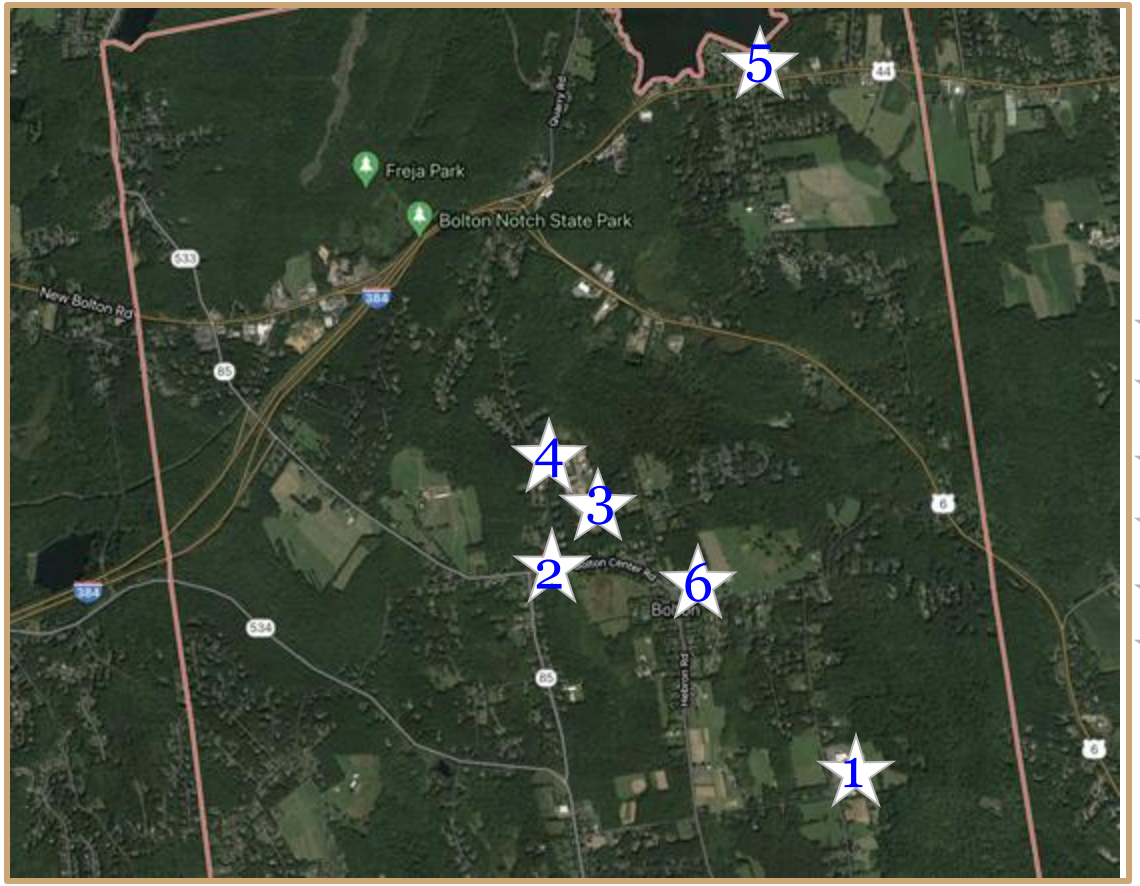
Turfstone pavers stabilize soil erosion by allowing rainwater to gradually filter back into soil. Its eco-friendly design reduces run-off while allowing greenery to grow through it, creating a unique natural look.

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

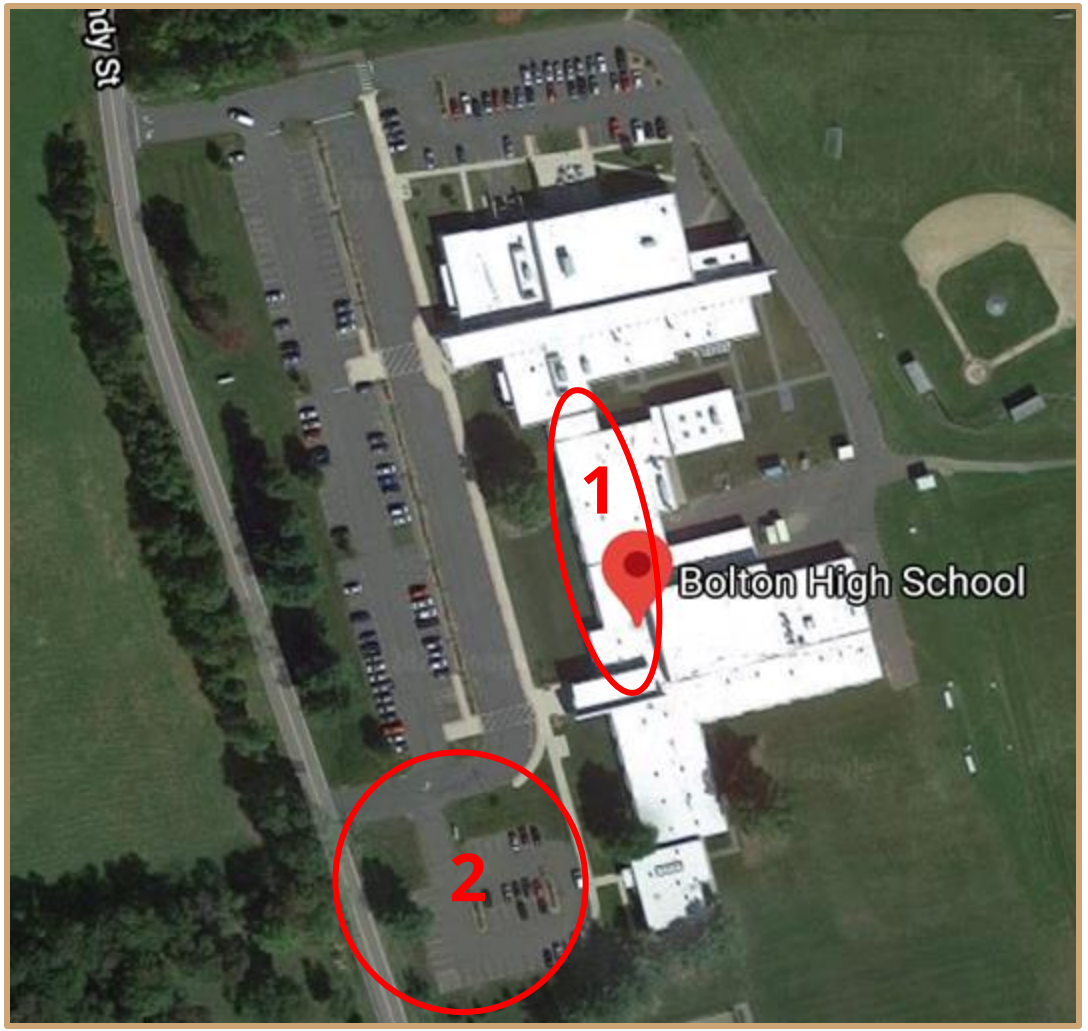
Project Location Map



1. Bolton High School
2. Bolton Fire Department
3. Bolton Center School
4. Bolton Town Senior Services
5. Lower Bolton Lake Boat Launch
6. Bolton Town Hall

Location 1:
Bolton High School

72 Brandy St, Bolton, CT 06043



1 = Rain Garden
2= Grass Swale

Bolton High School: Rain Garden

Bolton High School: Rain Garden

- At this location, downspouts from the roof are piped directly into the ground.

- A rain garden would be a very easy stormwater disconnection to implement here.

- We are recommending the rain garden be a long strip along the side of the building with the downspouts piping into the garden. This will allow for easy maintenance when the grass needs to be mowed.

- Because this location is in the front of the school, this would be a great opportunity for educational signs to be placed.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

Example of Practice

Bolton High School: Rain Garden

- Pros
  - Easy disconnections from existing downspouts.
  - Long rain garden strip would allow for easier maintenance when mowing the lawn around the practice.
  - Location will add landscaping aesthetic and highlight the practice.
  - Educational opportunity if signage were posted.

- Cons
  - Only half of the roof would be able to be captured.
  - Like all landscaped areas, weeding maintenance be needed to prevent the practice from getting overgrown.

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)
8,873.10	Rain Garden	233,625	2.43	0.31	1,472.93

Bolton High School: Grass Swale

Bolton High School: Grass Swale

- At this location there is already a swale in the grass. If curb cuts and shallow channels were dug in the grass leading to the already existing swale, the stormwater would be allowed to infiltrate in the swale.

- There is already an existing pipe at the end of the swale that drains across the street, if a small concrete block were placed slightly in front of that pipe, it would slow down the water draining out of the swale and allow it to infiltrate on site.

- Note: The area of road across from the swale is part of the drainage area but can not be counted towards DCIA because it is not connected to the storm system.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

Example of Practice

Bolton High School: Grass Swale

- Pros
  - Swale already exist, minimal modifications would be needed to capture the highlighted drainage area - low cost.
  - Maintenance would be similar to existing maintenance.
  - Large drainage area would be captured.

- Cons
  - Portion of water draining into the swale from the street cannot be counted as DCIA in regards to the MS4 permit.

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)
20,573.13	Swale	541,682	5.63	0.71	3,415.14

Location 2: Bolton Fire Department

168 Bolton Center Rd, Bolton, CT 06043

Bolton Fire Department: Rain Garden

Bolton Fire Department: Rain Garden

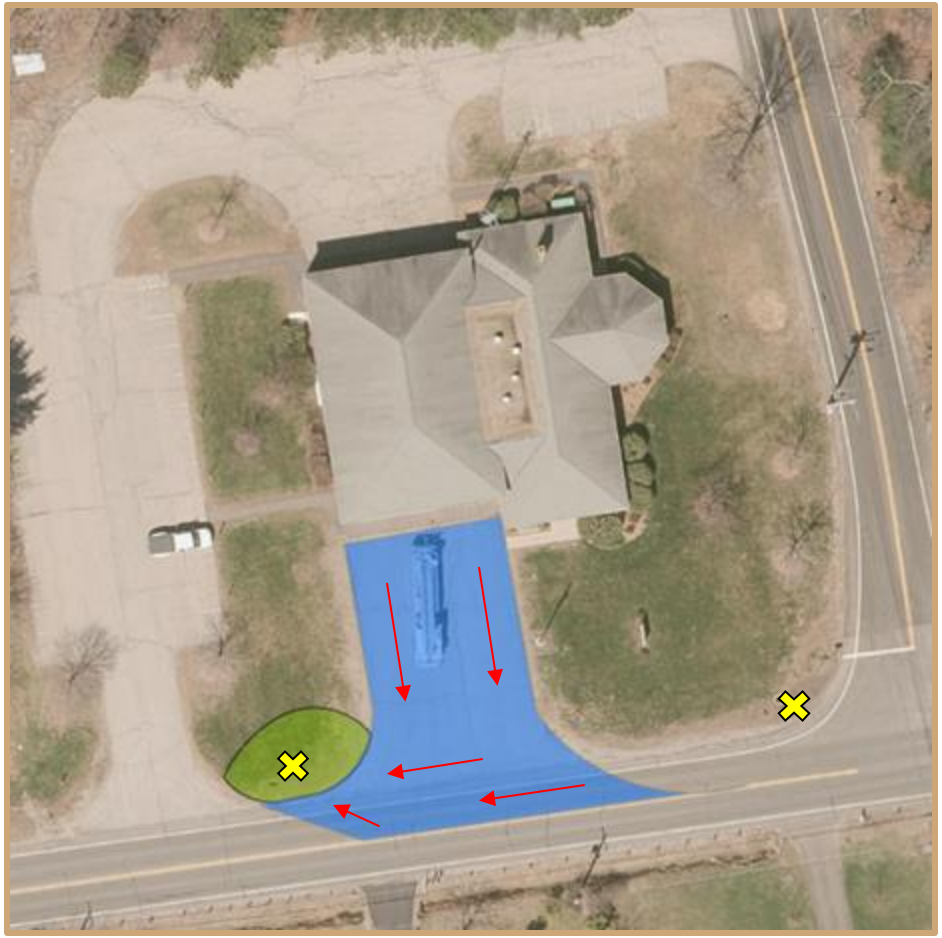
- While most of the Bolton Fire Department is already disconnected from the stormwater system, there is a an area of connected impervious cover.

- A rain garden would be perfect here, as there is already a depression in the landscape to capture water and a storm drain is already in place that could be used as an overflow to prevent ponding in a large rain event.

- We did notice sediment build up along the edge of the road near the storm drain so a sediment trap would be recommended to help keep the GSI practice clean.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

Example of Practice

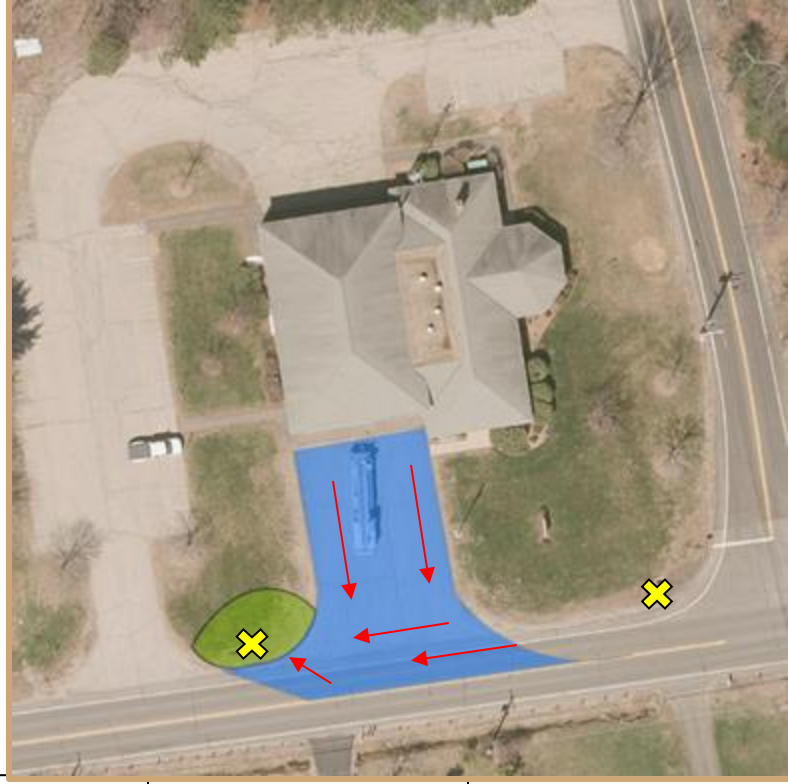


Bolton Fire Department: Rain Garden

- Pros
  - Low cost
  - Depression in the landscape already exists
  - Stormwater infrastructure already exists for easy conversion to an overflow drain.

- Cons
  - Sediment trap would be needed due to steep slow of surrounding pavement.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction



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)
6,568.26	Rain Garden	172,940	1.80	0.23	1,090.33

Location 3:
Bolton Center school

108 Notch Rd, Bolton, CT 06043

1 = Upper Lot
2= Main Parking Lot

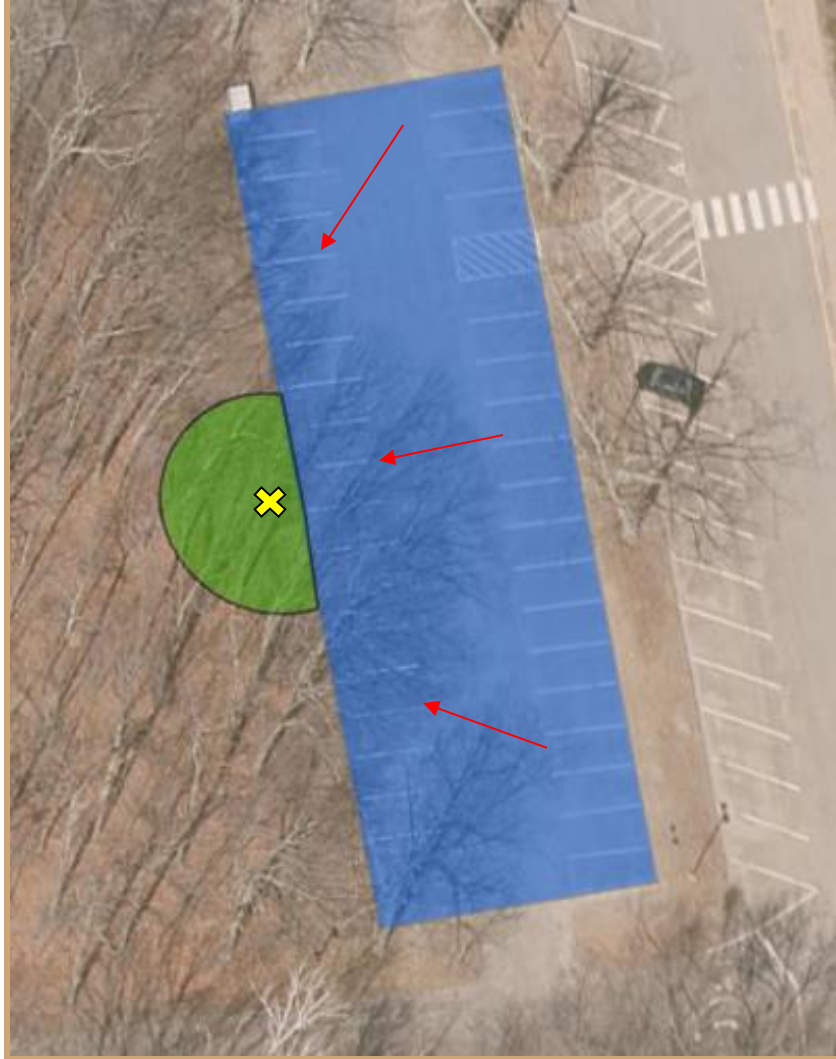
Bolton Center School: Upper Lot Bioretention

Bolton Center School: Upper Lot Bioretention

- This location would be the perfect spot for a bioretention unit.
- The entire parking lot is sloped towards an existing storm drain that is located in the grass along the edge of the parking lot.
- The bioretention could be built around the existing storm drain and the drain could be converted to a standpipe that could then be used as an overflow. This overflow drain would prevent ponding in the bioretention unit.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

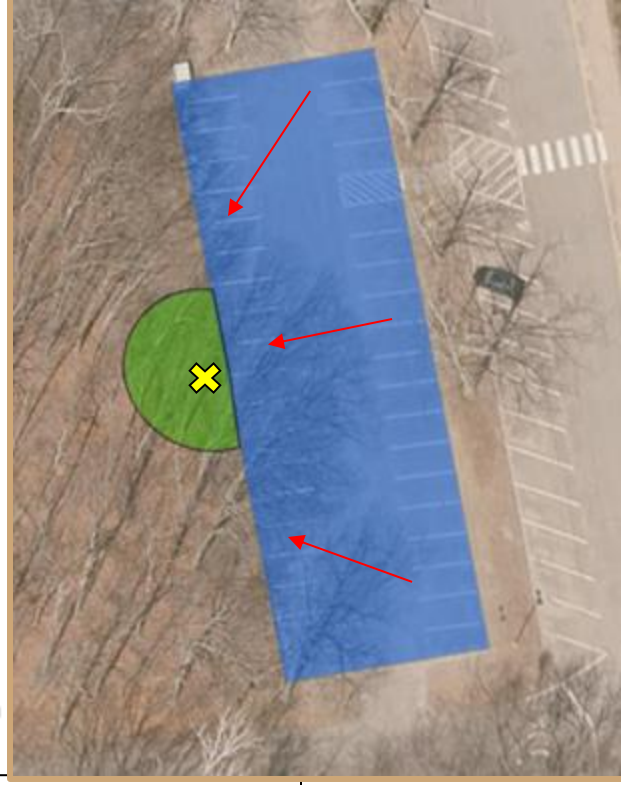
Example of Practice



Bolton Center School: Upper Lot Bioretention

- Pros
  - Little construction needed, just installation of the practice itself.
  - Existing stormwater infrastructure could be converted to an overflow.
  - Large drainage area drains to one common point.

- Cons
  - Sediment trap and maintenance would be needed to prevent clogging and allow for proper infiltration.
  - Not in a high visibility area, which would not be ideal for highlighting 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 [9 Inch Depth] (sq ft)
10,804.93	Bioretention	284,490	2.96	0.37	1,195.75

Bolton Center School: Main Parking Lot

- At this site we came up with multiple options due to the large drainage area of this parking lot.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

Bolton Center School: Main Parking Lot - Tree Box Option

Bolton Center School: Main Parking Lot - Tree Box Option

- With this option, tree box filters could be installed with inlets on both side to capture water from both sides.

- While one tree box filter would not be able to handle the entire volume of water for the lot, multiple boxes would be able to. A tree box filter would be less expensive to install and would not require as much maintenance as a bioretention unit would.

- One tree box filters can treat up to ¼ acre or 10,890 sq ft of impervious cover. This means that 4 tree box filters would be needed to treat this entire parking lot.

= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

Example of Practice

Bolton Center School: Main Parking Lot - Tree Box Option

- Pros
  - Lower cost option.
  - Not much added construction would be needed, other than the cost to install the tree box filter itself.
  - Trees would add to the landscaping aesthetic of the school and educational signs could be posted.

- Cons
  - Multiple tree box filters would be needed to treat the entire lot.
  - Regular maintenance would be required to ensure proper drainage .

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)
38,700	Tree Box Filter	1,018,982	10.60	1.34	N/A

Bolton Center School: Main Parking Lot - Bioretention Option

Bolton Center School: Main Parking Lot - Bioretention Option

- Instead of installing multiple tree box filters, one larger bioretention unit could be installed to capture the stormwater from the entire parking lot.

- A parking spot or two on either side of the suggested practice area would need to be sacrificed. Shown here is a bioretention depth of 1.9 feet or 23 inches. Note that the depth of the bioretention unit would depend on number of parking spots given up. More spots given up would mean a shallower bioretention unit and vice versa.

- A bioretention unit near the front of the school would provide landscaping aesthetic as well as an educational opportunity if signage were posted.

- We would also recommend a small fence around the practice to prevent people from entering it.

Example of Fencing

Example of Practice

Bolton Center School: Main Parking Lot - Bioretention Option

- Pros:
  - One practice could treat entire parking lot.
  - Maintenance would only be required on one practice rather than multiple smaller practices.
  - A larger practice would draw more attention and better highlight the towns green efforts.
  - Existing stormwater infrastructure exists for easy conversion to an overflow.

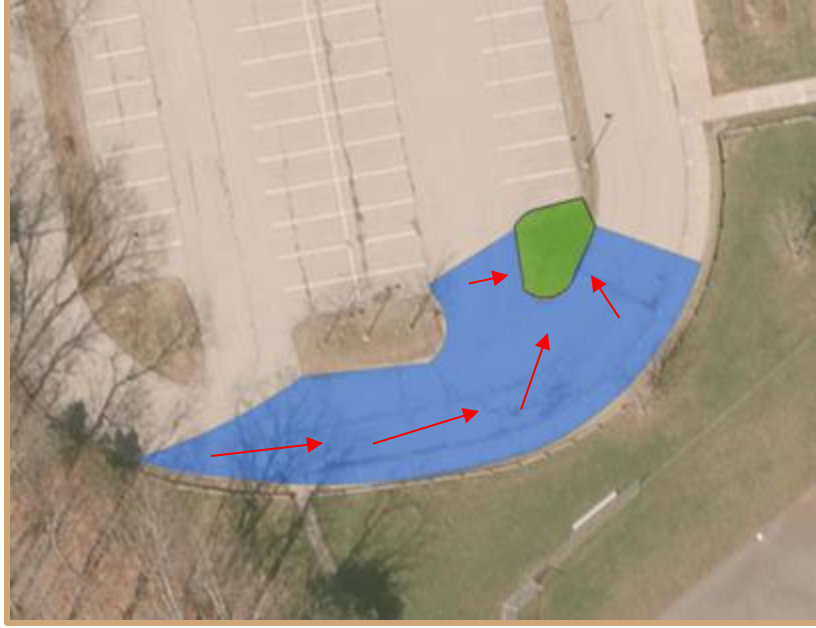
- Cons:
  - Parking spaces would need to be sacrificed.
  - Construction cost would be higher.
  - Regular maintenance would be required.

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 [23 inch depth] (sq ft)
38,032	Bioretention	1,001,367	10.42	1.32	1,637.80

Bolton Center School: Main Parking Lot - Rain Garden Option

Bolton Center School: Main Parking Lot - Rain Garden Option

- At this location we are recommending a rain garden.
- The grass peninsula would be a good spot to capture a large amount of stormwater.
- If curb cuts were made on either side of the peninsula, stormwater would be able to flow into the practice.
- Due to the limited size of the vegetated area, the bioretention would need to be 1 foot in depth.
- A small fence could be put in place around the practice to prevent people from walking in the rain garden.



= Drainage Area
= GSI Practice Area
= Existing Catch Basin
= Flow Direction

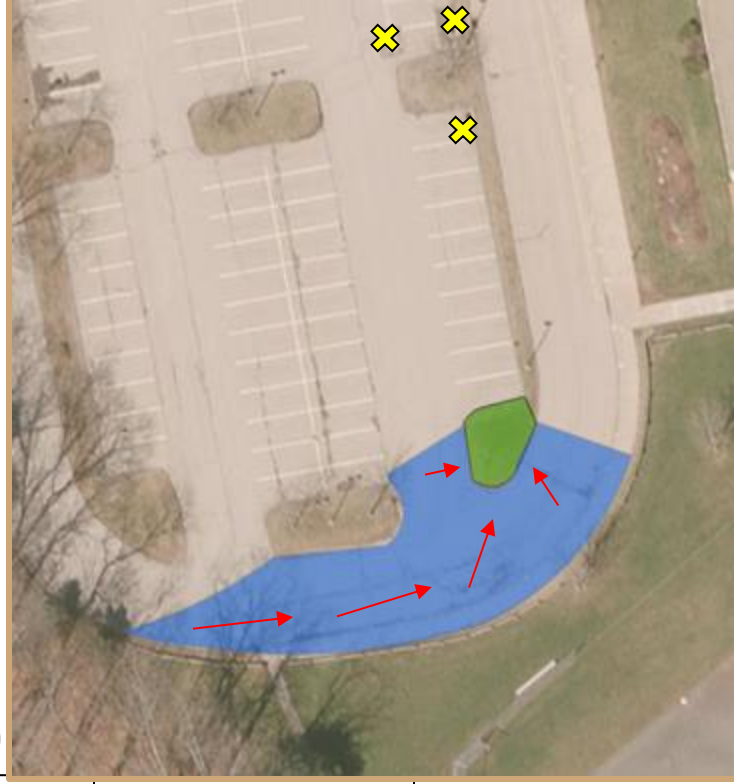
Example of Fencing

Example of Practice

Bolton Center School: Main Parking Lot - Rain Garden Option

- Pros
  - Not much added construction would be needed to construct this practice.
  - Large drainage area could be directed to the bioretention unit by adding curb cuts around the practice.
  - Good location for education on the practice.

- Cons
  - Sediment trap might be needed.
  - No existing stormwater infrastructure to be converted to an overflow.
  - Overflow to parking lot could be implemented to prevent ponding.



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 [12 Inch Depth] (sq ft)
4,872	Bioretention	128,277	1.33	0.17	407.25

Bolton Town Senior Services

104 Notch Rd, Bolton, CT 06043

Bolton Town Senior Services

104 Notch Rd, Bolton, CT 06043

Bolton Town Senior Services

- The building across the street the "Community Voice Channel" has downspouts dropping rain fall from the roof directly onto the pavement draining across the street to the Senior Services Property.

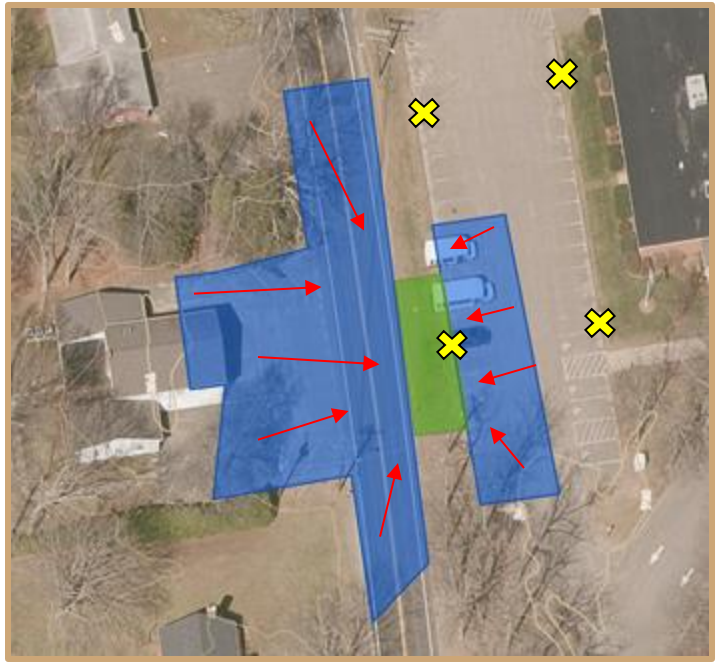
- Evaluation of the site has determined that installation of a bioretention area is best.

- To maintain integrity of the area as it is along a busy road that does not have curb, a stone strip should be installed within the bioretention area abutting the road.

- Salt tolerant plants are recommended due winter road treatment and lack of curbing.

- To gather runoff from Senior Services parking lot, curb cuts would be required by lower left catch basin.

- Installation of a small fence around the practice would ensure the safety of public, preventing potential fall hazard.



Example of Fencing

Example of Practice

Bolton Town Senior Services

Pros:

- Disconnect of DCIA
- No curb on the edge of the road.
- Educational tool for Senior Services as well as neighboring Center School.

Cons:

- Sanding on road may be a concern of sediment build up over time.

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 [12 inch depth] (sq ft)
14,437.7	Bioretention	380,138	3.95	0.50	1,332.7

Lower Bolton Lake Boat Launch

17 Keeney Dr, Bolton, CT 06043

Lower Bolton Lake Boat Launch

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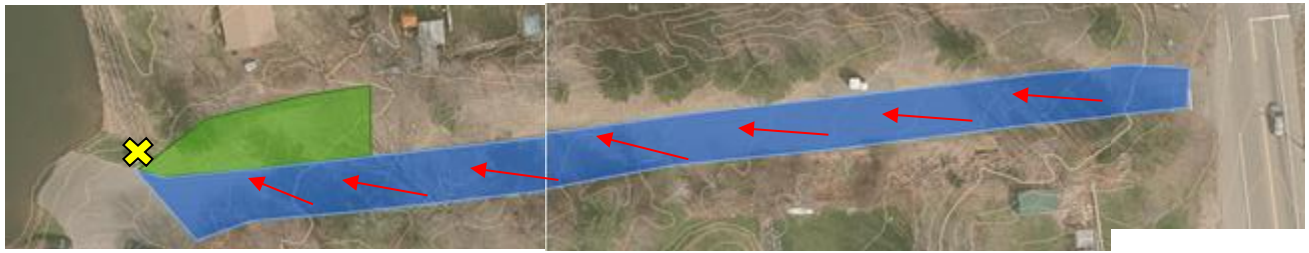
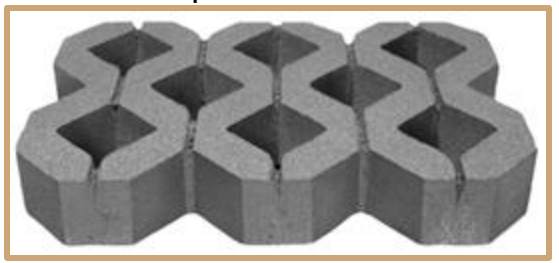
Lower Bolton Lake Boat Launch



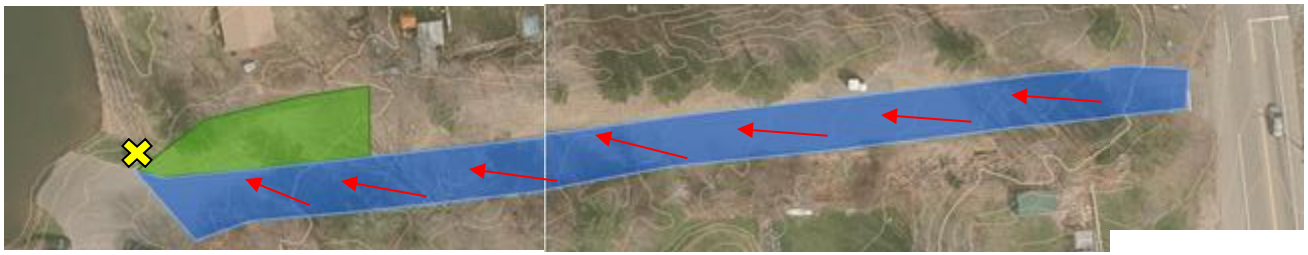
= Drainage Area
= GSI Practice Area
= Drain Pipe
= Flow Direction

- GSI practice recommend is turfstone pavers.
  - The turfstone pavers will slow down and capture a portion of the runoff from the large 17,284 square feet of drainage area flowing directly into the Lower Bolton Lake.
- During field visit, an existing drain pipe appears to catch precipitation flowing from the parking lot and sends it directly into the lake meaning this is directly connected.
- Advise this area to only be salted, no sanding during winter months to avoid build up within the pavers.

Example of Practice



Lower Bolton Lake Boat Launch



Pros:

- Disconnect of DCIA
- Decrease of annual nitrogen & phosphorus loads into the lake
- Provides public education

Cons:

- Winter months management requires salting only

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)
17,284.5	Turfstone Pavers	455,094	4.73	0.60	3,434.3

Bolton Town Hall

- We did not recommend any GSI disconnections for the Bolton Town Hall because this property was already disconnected from the stormwater system.

- There were no catch basins on site and the water from the roof of the town hall is piped to the field behind the property.

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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UConn Environment Corps

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