

# Hebron Stormwater Runoff Reduction Plan Fall 2021

University of Connecticut Stormwater Corps | November 2021

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# 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 Hebron, 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, **104,774 sq.ft.** of Impervious Cover (IC) will be disconnected from the current stormwater drainage system. This also means that **2,784,659** gallons of stormwater, **28.61** pounds of Nitrogen, as well as pounds **3.62** 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.



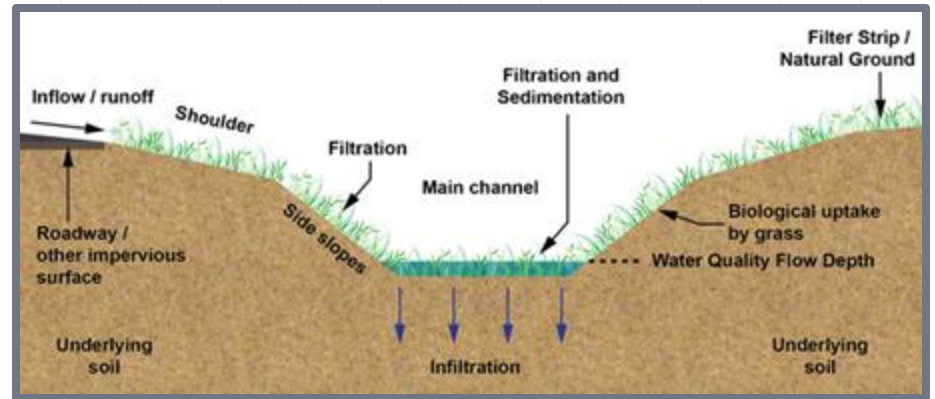
# Common Practices



**Rain gardens:** A rain garden is a man-made depression in the ground which collects rainwater, typically 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-friendly type of GSI practice, with no special soil media or underdrain/overflow structures. They are typically 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 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 Practices

**Permeable Pavements:** Pervious pavements include permeable asphalt and concrete, which replace the typical asphalt/concrete that make up sidewalks and roads. By removing fine aggregates from the mix, these pavements are able to absorb stormwater and runoff at much higher rates than their impervious counterparts. Porous pavements are also a smart infrastructure investment, as they can eliminate the need for other green stormwater infrastructure such as swales, extensive bioretention areas, and more.



This pavement is able to achieve such high rates of absorption because of its structure. The porous pavement is the top layer, which allows stormwater to flow through. The thicker choker course underneath stabilized the pavement. A clean graded coarse aggregate is used as temporary stormwater storage, and the uncompacted subgrade on the bottom maximizes infiltration to the soil. Depending on the type of pavement chosen to implement, special equipment may be needed to put in new permeable concrete or asphalt.

# Site Location Overview

In the meeting with the Town of Hebron, there was a discussion on using a variety of different practices, including but not limited to rain gardens, pervious pavements, as well as green roofs. We wanted to offer as much of a variety as possible when recommending practices, but also tried to keep LID practices practical. Before coming to conclusions about any retrofits that were suggested, our team conducted site visits to determine which sites would be the best option for implementing a variety of LID practices. Once the site visits were complete, as well as looking at advantages and disadvantages of the sites, the practices presented in this presentation were decided based on the suitability of the site.

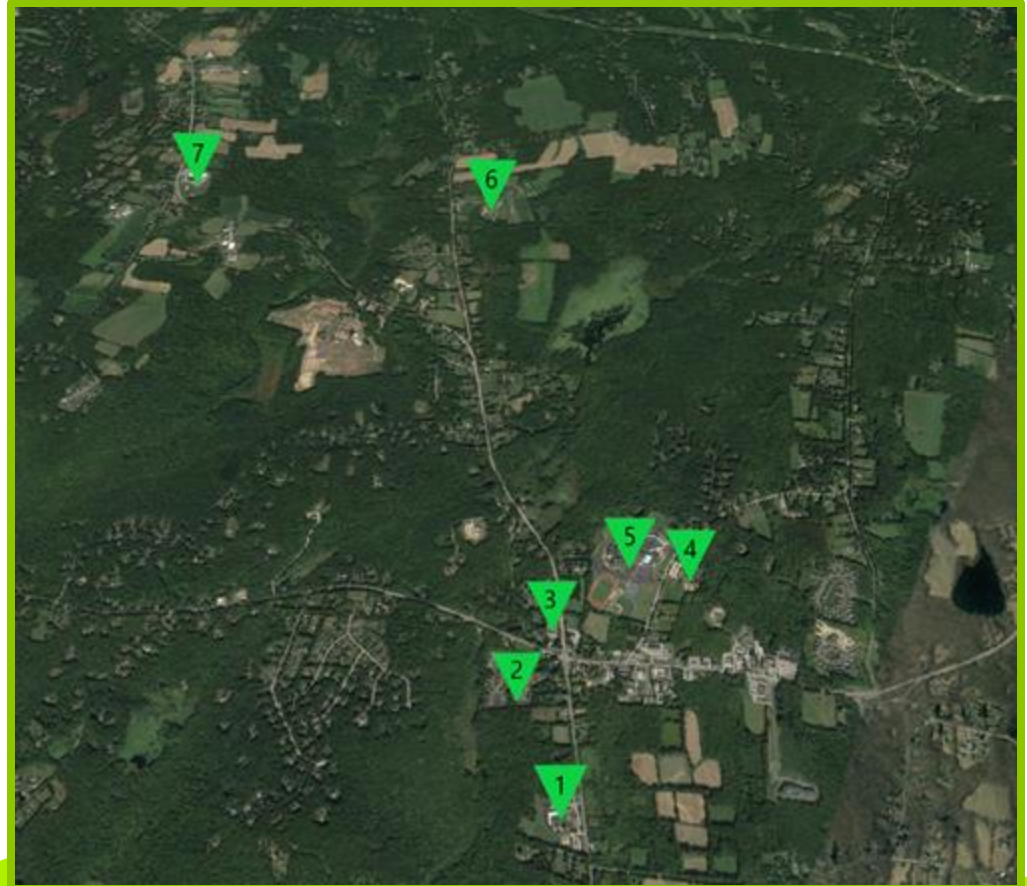
The sites we ultimately decided on were Hebron Elementary School, Russell Mercier Senior Center, Hebron Town Office Building, Veteran's Memorial Park, Rham Middle/High School, Burnt Hill Park, & Gilead Hill School. Each of these sites provided opportunities to suggest retrofits that could also offer educational opportunities along with increasing aesthetic appeal.



# Location Overview & Site Criteria

1. Hebron Elementary School
2. Russell Mercier Senior Center
3. Hebron Town Office Building
4. Veteran's Memorial Park
5. Rham Middle & High School
6. Burnt Hill Park
7. Gilead Hill School

- Has a significant proportion of connected impervious cover
- Municipally owned property
- Has the potential to have significant portions of impervious surfaces disconnected
- Locations where practices would be feasible





# Hebron Elementary School | 92 Church St



# Hebron Elementary School Impervious Cover Map



# Hebron Elementary School | 92 Church St

## Option 1: Rain Garden



Drainage Area
3,504 SF
Annual Gallons Treated
92,258 gal.
Nitrogen Treated
0.96 lb N/yr
Phosphorus Treated
0.12 lb P/yr
Suggested Size
584 SF

# Hebron Elementary School Pros/Cons: Rain Garden (Option 1)

## Pros:

- Will be visually appealing.
- Educational opportunities.

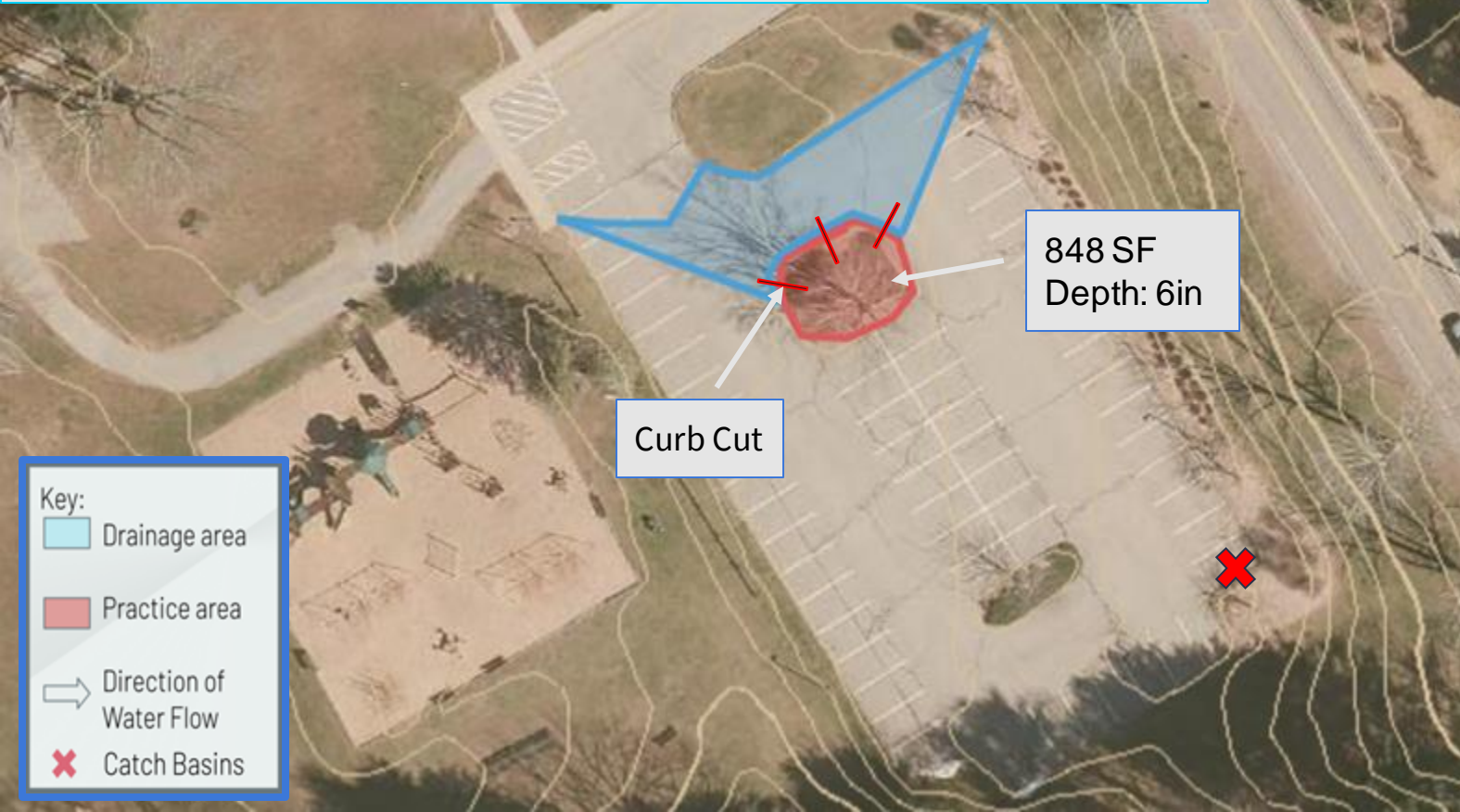
## Cons:

- Will need to modify the garden.
- Could be in the way of recreational activity.

**About the site:** The rain garden will be a long strip extending the garden already there. Someone will be able to mow around the practice, and it will require the same maintenance as the garden already on-site.

# Hebron Elementary School | 92 Church St

## Option 2: Rain Garden



Key:

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

Drainage Area
1,476 SF
Annual Gallons Treated
38,862 gal.
Nitrogen Treated
0.40 lb N/yr
Phosphorus Treated
0.05 lb P/yr
Suggested Size
246 SF Actual: 848 SF

# Hebron Elementary School Pros/Cons: Rain Garden (option 2)

## Pros:

- Can disconnect some of the parking lot and reduce the debris building up and around the catch basin.
- Will make the parking lot look nice.

## Cons:

- Could be hard to dig up and create a garden in such as small area.
- Needs curb cuts.



**About the site:** There is only one catch basin in the back of the parking lot. The other grassy divider behind option 2 could also be made into a rain garden.

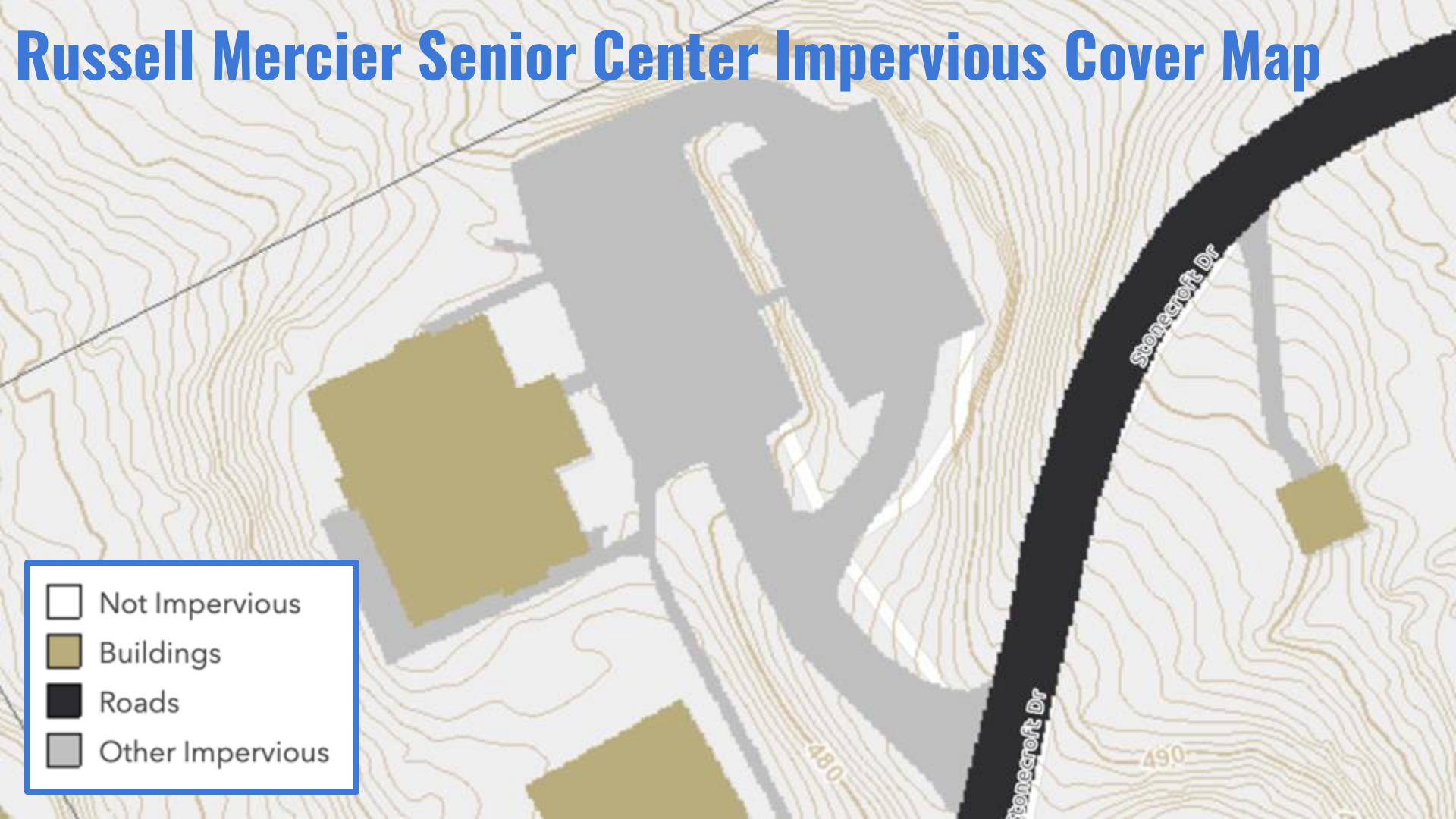


# Russell Mercier Senior Center Location Images



# Russell Mercier Senior Center Impervious Cover Map

	Not Impervious
	Buildings
	Roads
	Other Impervious





# Russell Mercier Senior Center | 14 Stonecroft Drive

## Option 1: Pervious Asphalt



**Key:**

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

Treated Area
17,294 SF
Annual Gallons Treated
517,436 gal.
Nitrogen Treated
4.74 lb N/yr
Phosphorus Treated
0.60 lb P/yr
Suggested Size
6,578 SF

# Russell Mercier Senior Center Pros/Cons

## Pros:

- Huge Drainage Area
- Less need for Salting since water doesn't collect
- Reduced Frost Heaves
- Treats nearly 100% of runoff
- May take up additional runoff from the connecting road
  - depending on how the road is graded
- Will last much longer than regular pavements

## Cons:

- More expensive than regular pavement
- Must vacuum approximately twice a year to avoid more expensive maintenance
- Cannot use sand at this location and attempt to not use it nearby as well if it is being used!

## About This Site:

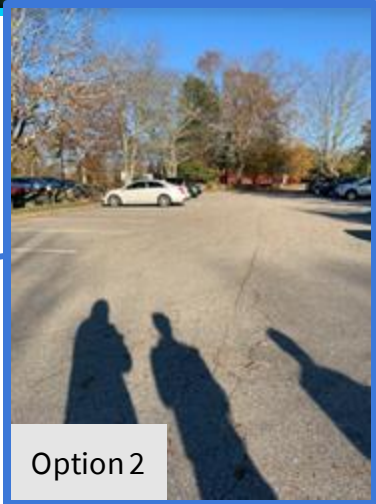
This site is a lot of parking lot surrounded by many nice plants. Since There were so many plants, and the building itself would be difficult to disconnect anything significant from, the parking lot seemed like a great place to look as it is looking in rough shape as it is. This would be perfect for people to easily get around safely, but also make the property look much nicer in general. While not marked, as we were unsure, it may also take up more drainage than we thought of, and be able to be disconnected even more potentially.



# Hebron Town Office Building



Option 1



Option 2

# Hebron Town Office Building Impervious Cover Map







# Hebron Town Office Building | 15 Gilead St

## Option 1: Rain Garden



Key:

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

Curb cuts:  
to the sides  
of the X if  
needed

Drainage Area
4,221 SF
Annual Gallons Treated
111,152 gal.
Nitrogen Treated
1.15 lb N/yr
Phosphorus Treated
0.15 lb P/yr
Suggested Size
704 SF

# Hebron Town Office Building Option 1 Pros/Con

## Pros:

- Larger rain garden means more water is treated
- Plenty of space to adjust the size and shape
- Easy maintenance-ability to mow around the garden

## About the Retrofit:

This retrofit would be placed near the parking lot on the left side. The drainage basin the drainage area pitches to takes a lot of the parking lot, and provides ample space for a rain garden that will be visible from the building.

## Cons:

- Larger practice means more money upfront to build
- Will be big, but not centrally located
- Possible curb cuts may increase price

# Hebron Town Office Building | 15 Gilead St

## Option 2: Rain Garden

Drainage Area

8,759 SF

Annual Gallons Treated

35,036 gal.

Nitrogen Treated

2.40 lb N/yr

Phosphorus Treated

0.30 lb P/yr

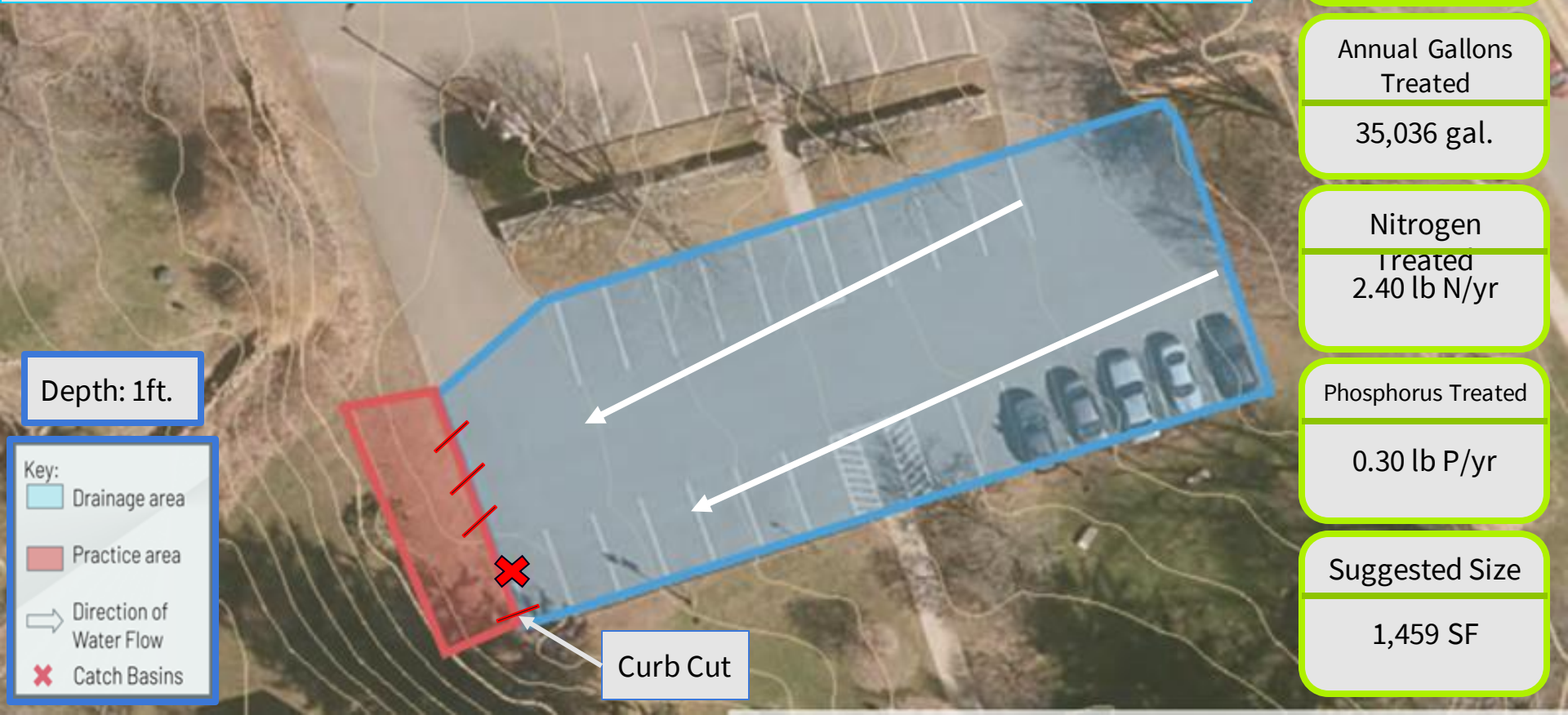
Suggested Size

1,459 SF

Depth: 1ft.

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

Curb Cut



## Hebron Town Office Building: Pros/Cons of Option 2

### Pros:

- Large area to disconnect.
- Rain Garden is visually pleasing for staff, residents, and visitors.
- Catch basin can be used for overflow

### About the site:

Since the parking lot is large, the rain garden needs to be 1 foot deep.  
Right behind the rain garden is a steep downward slope.

### Cons:

- Mechanical problems.
- Maintenance for a larger rain garden will take more time and it may be hard to mow around.





# Veteran's Memorial Park Location Imagery

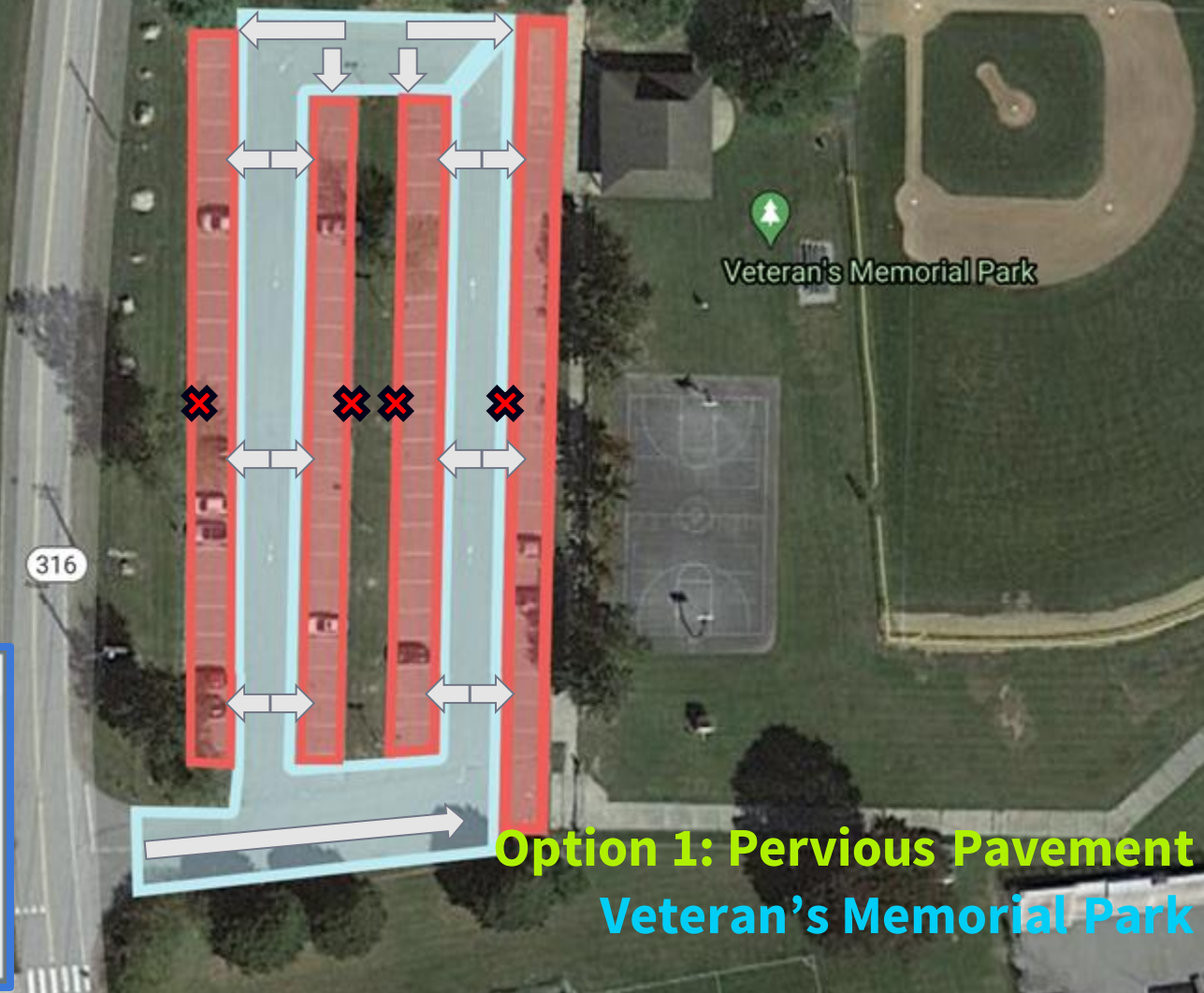


# Veteran's Memorial Park Impervious Cover Map



**Key:**

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



**Option 1: Pervious Pavement  
Veteran's Memorial Park**

Drainage Area
37,025 SF
Annual Gallons Treated
1,097,400 gal
Nitrogen Treated
10.05 lb N/yr
Phosphorus Treated
1.27 lb P/yr
Suggested Size
18,340 SF

# Veterans Memorial Park Pros/Cons

## Pros:

- Very large amount of water treated [nearly 100% of the parking lot]
- May also get some of the sidewalk and roof from the nearby building
- great aesthetic addition to the park
- Can do only part of it if necessary

## Cons:

- Rain Garden not really easy due to the road being pitched in the center, so less water captured
- Pricier than practices, but for the ability to disconnect more of the water
- Must maintain and avoid sand nearby or practice will become clogged

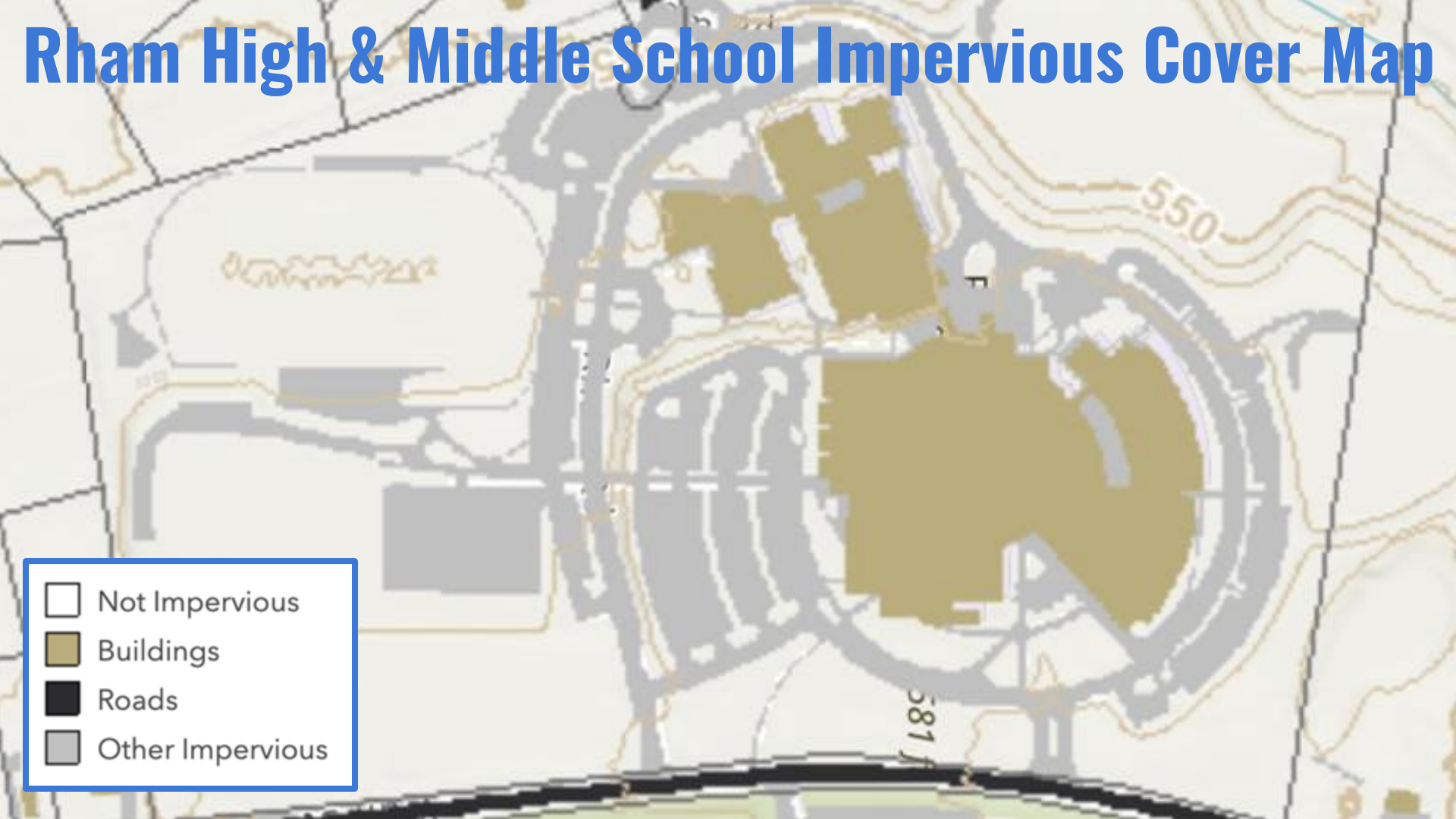
## About this site:

This is right across from Rham Middle/High School, which looked like a relatively active place for parents to bring their kids. While it may not be ready for replacement now, in the next few years, it could definitely have potential to have some green infrastructure installed, even if it's just the parking spots. Overall it will last longer and save money over time, which means there will be less needed to save for it in the future.

# Rham Middle & High School



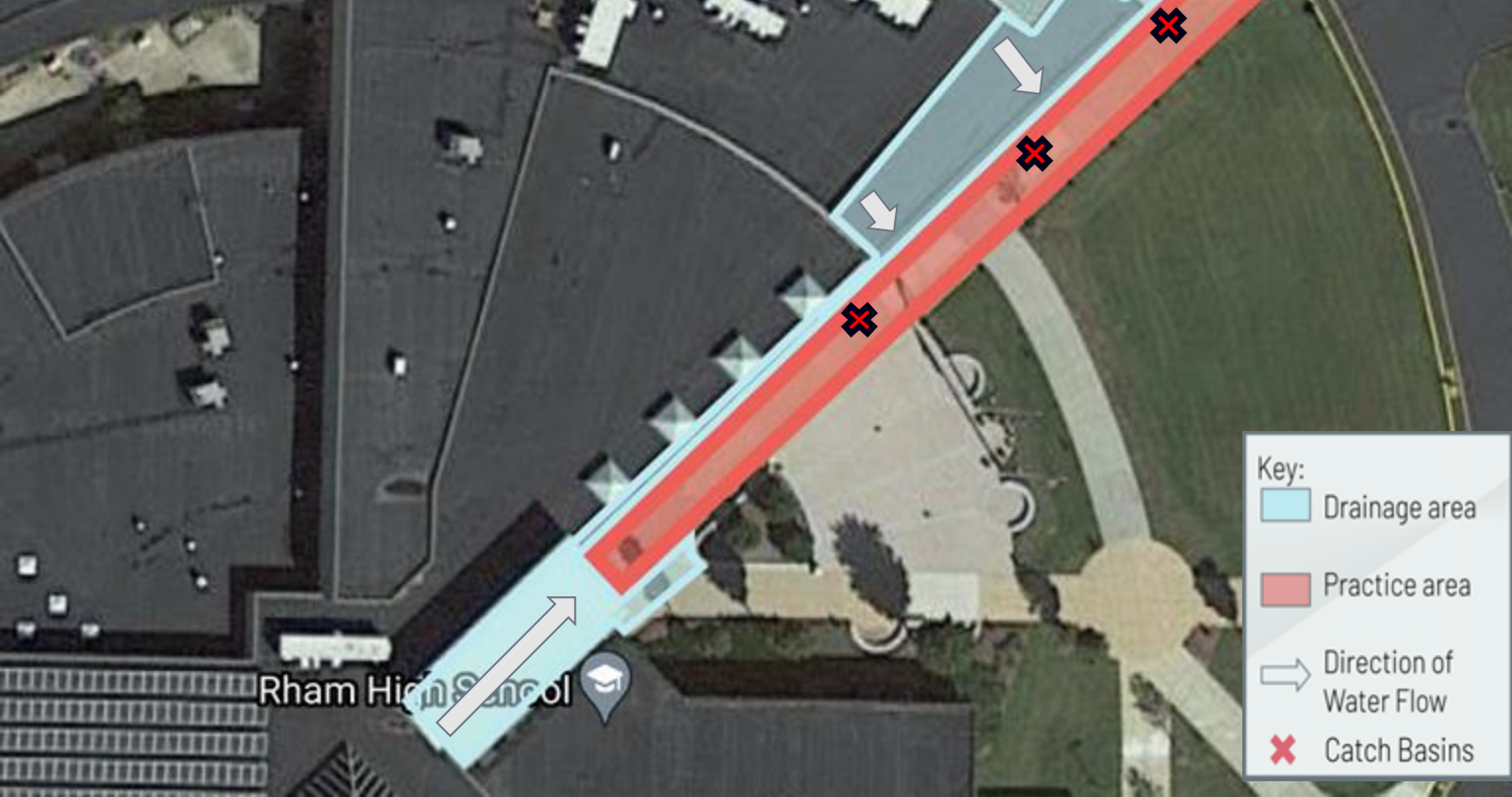
# Rham High & Middle School Impervious Cover Map



# Rham Middle & High School

## 85 Wall St/25 Rham Rd

### Option 1: Pervious Concrete



Key:

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

Treated Area  
10,280 sq ft

Annual Gallons Treated  
307,575 gal

Nitrogen Treated  
2.82 lb N/yr

Phosphorus Treated  
0.36 lb P/yr

Suggested Size  
4,225 sq ft  
Min size: 2,056 sq ft

# Rham Middle & High School: Pro/Cons for Option 1

## Pros:

- Will take up water from larger storms
- Fixes the issue of needing a pitched walkway
- May take up even more depending on flow of rest of sidewalk as well as if more from roof can be disconnected
- Can make minimize the practice size to be cheaper

## Cons:

- Not many alternatives
- Awkward drainage area
- Amount of water is variable & can change depending on what can be disconnected.
- Drainage basins make having a rain garden instead difficult, but a possible cheaper alternative if there were modifications to the pathway not being pitched to the center and to the road.

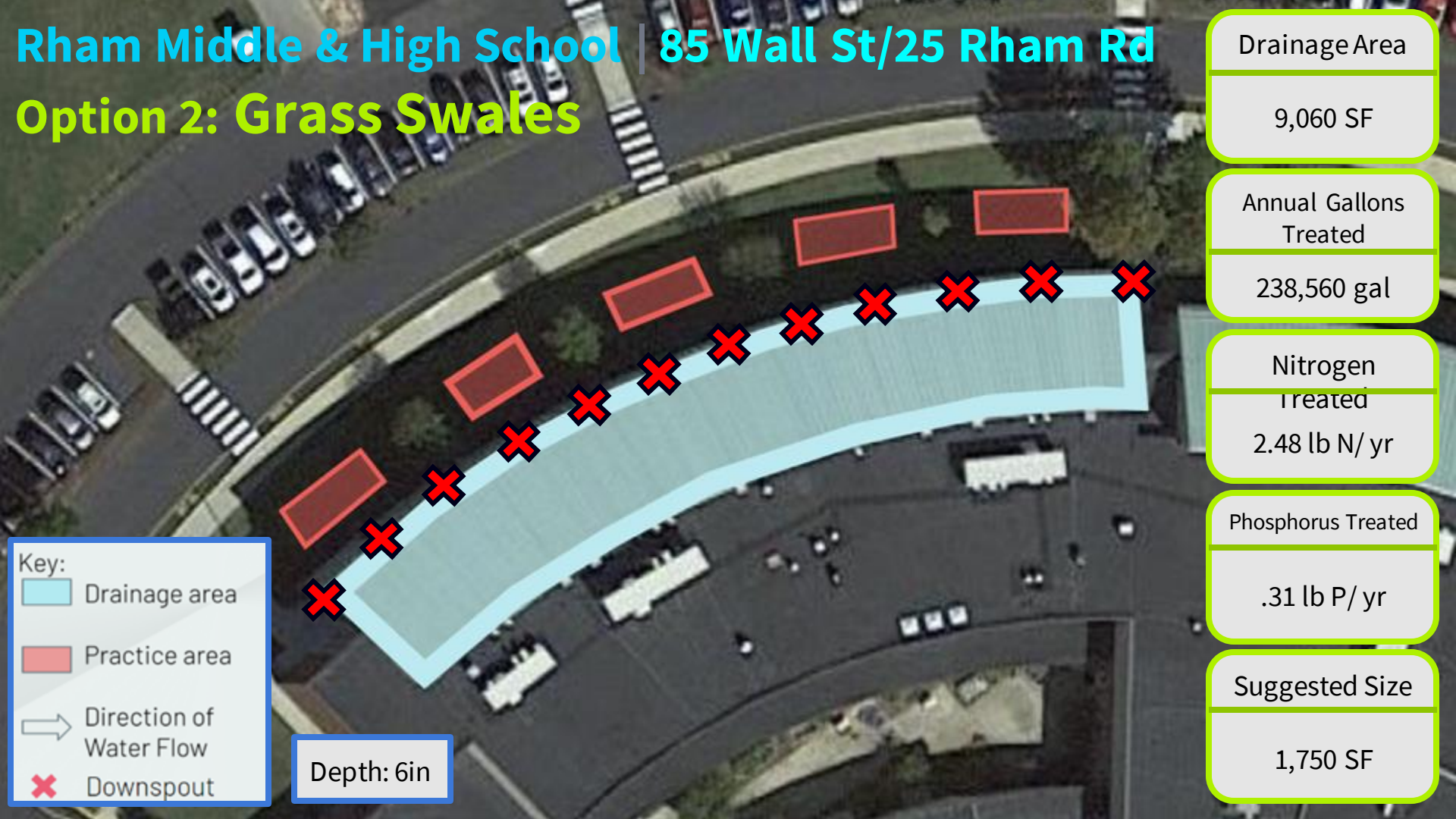
## About the site:

Since this site is right in the front, it would be nice to tie in the look of the area by renovating, would be great for everyone to see and as a learning material. There is a lot of variation as what is going on with the roof, but overall is a good spot to look into with a lot of flexibility. While it's not completely ready to tear up and renovate in this point in time, it will be likely in the next few years as something to consider.



# Rham Middle & High School | 85 Wall St/25 Rham Rd

## Option 2: Grass Swales



Key:

- Drainage area
- Practice area
- Direction of Water Flow
- Downspout

Depth: 6in

Drainage Area
9,060 SF
Annual Gallons Treated
238,560 gal
Nitrogen Treated
2.48 lb N/yr
Phosphorus Treated
.31 lb P/yr
Suggested Size
1,750 SF

# Rham Middle & High School: Pro/Cons for Option 2

## Pros:

- Huge drainage area
- Very simplified and can move the seating area on the other side of the bordering sidewalk
- Cheaper to disconnect a huge area
- Very easy to maintain

## Cons:

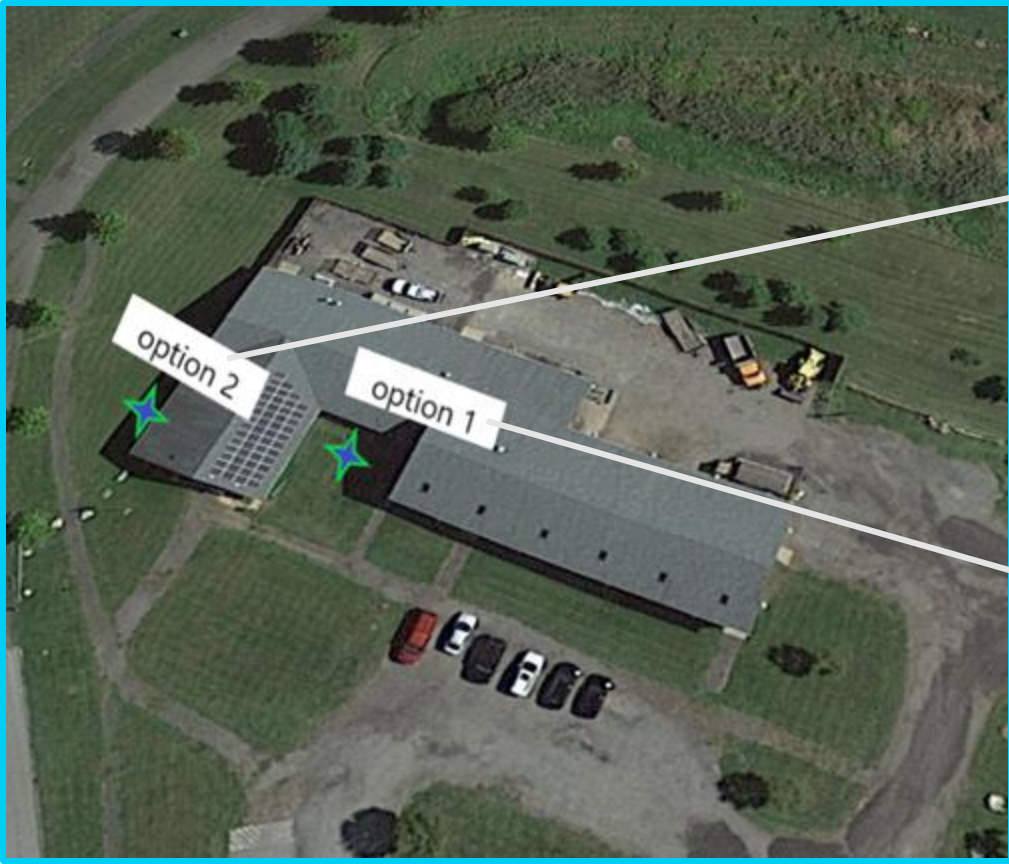
- May not be able to disconnect one or two pipes due to tree roots in the way
- Will have to relocate picnic tables to the right of the walking path or just spread them out along the area more, to add every single swale.

## About the site:

This site is all in the back of the school, where there is a lot of benches to sit around and relax at. Since it doesn't seem like too many people will see it aside from when they sit there or drive by, it can be used not only for educational purposes, but also make it easier to maintain in comparison to a rain garden because it's just grass.



# Burnt Hill Park



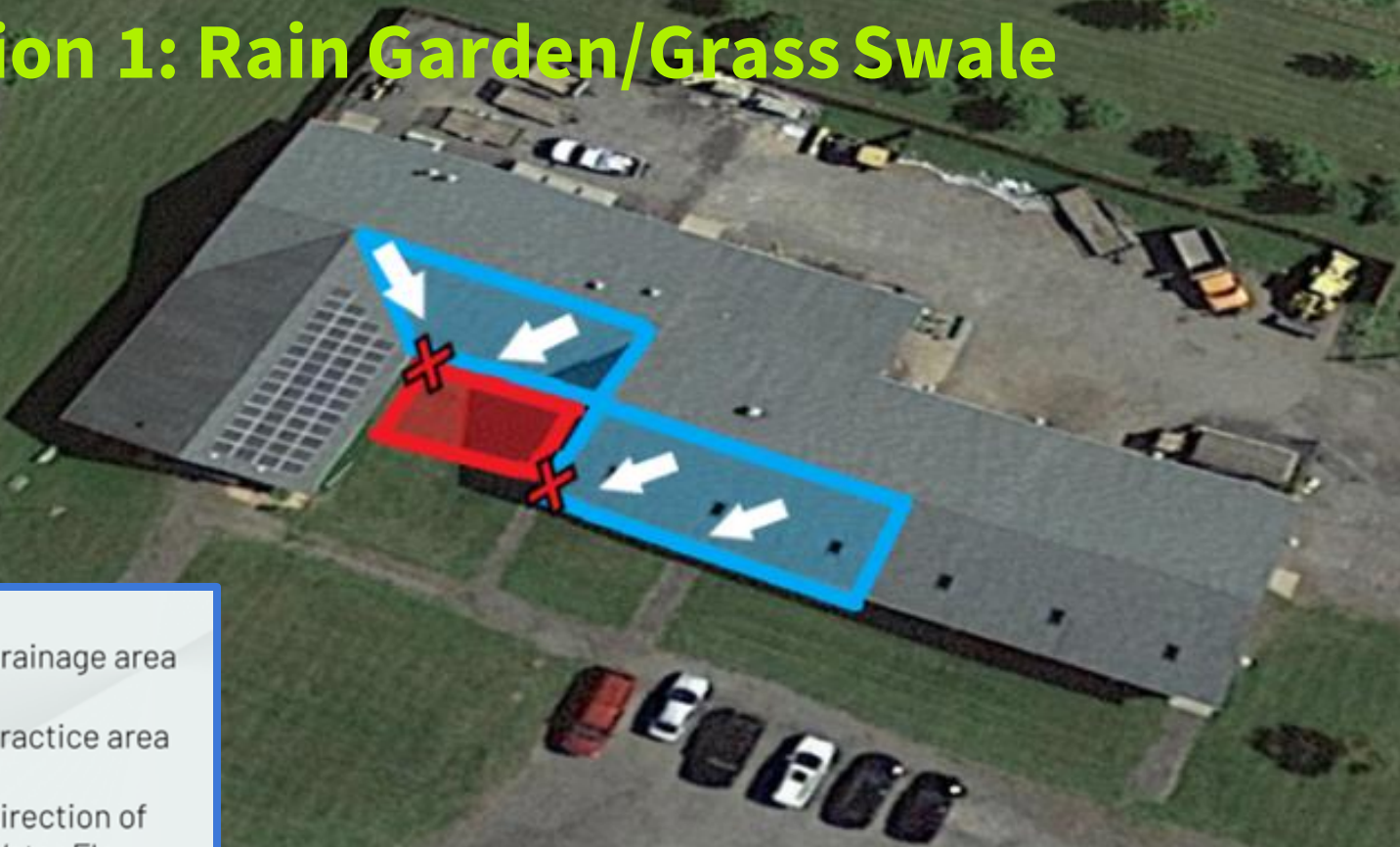
# Burnt Hill Park Impervious Cover Map







- Not Impervious
- Buildings
- Roads
- Other Impervious

# Burnt Hill Park

## Option 1: Rain Garden/Grass Swale



Key:

-  Drainage area
-  Practice area
-  Direction of Water Flow
-  Downspout

Drainage Area
2520 SF
Annual G Treated
66359 G
N Treated
0.69 lb/yr
P Treated
0.09 lb/yr
Suggested Size
420 SF
Depth
0.6 in

# Burnt Hill Park Option 2 Pros/Cons

## Pros:

- Easy maintenance; mowing around the edge and weeding
- Educational opportunity; signage
- Smaller price tag
- Along the side of the building, aesthetic
- Could be placed further away from building if there is a basement

## About the site:

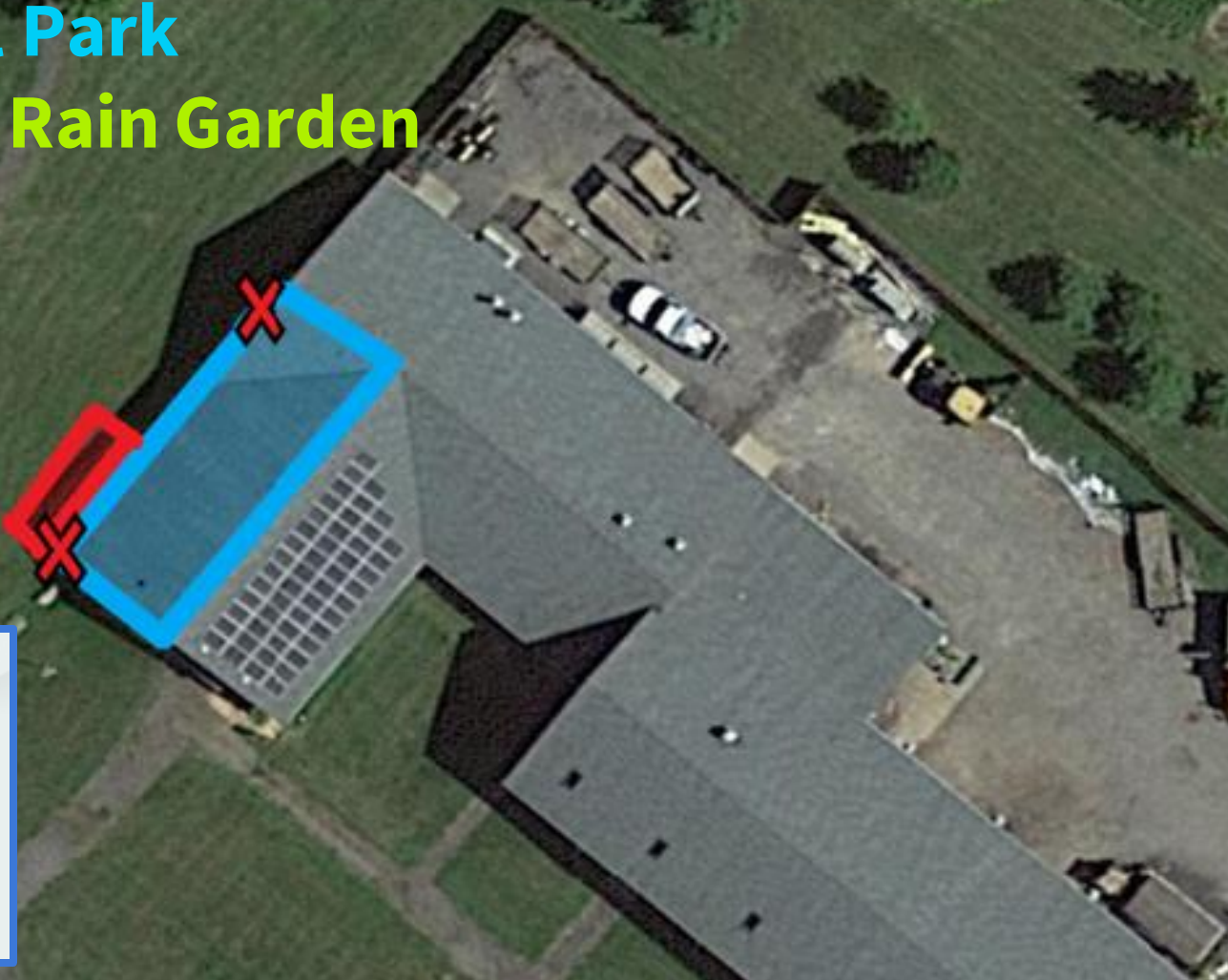
Located along the side of the building, there is already a small garden to slow the water exiting the storm drains. It would be an easy installation, as the garden would essentially just need to be made deeper and possibly add a drain.

## Cons:





- Located near door-foot traffic may cause issue
- Extra drainage/gravel may be needed because of pitching
- Smaller drainage area means less treated

# Burnt Hill Park

## Option 2: Rain Garden



Key:

-  Drainage area
-  Practice area
-  Direction of Water Flow
-  Downspout

Drainage Area  
1670 SF

Annual G Treated  
43,976 gal

N Treated  
0.46 lb/yr

P Treated  
0.06 lb P/yr

Suggested Size  
278 SF

Depth  
6 in

# Burnt Hill Park Option 1 Pros/Cons

## Pros

- Smaller garden means smaller price tag
- Similar to all other rain gardens; easier maintenance, educational opportunity, aesthetic appeal

## About the site

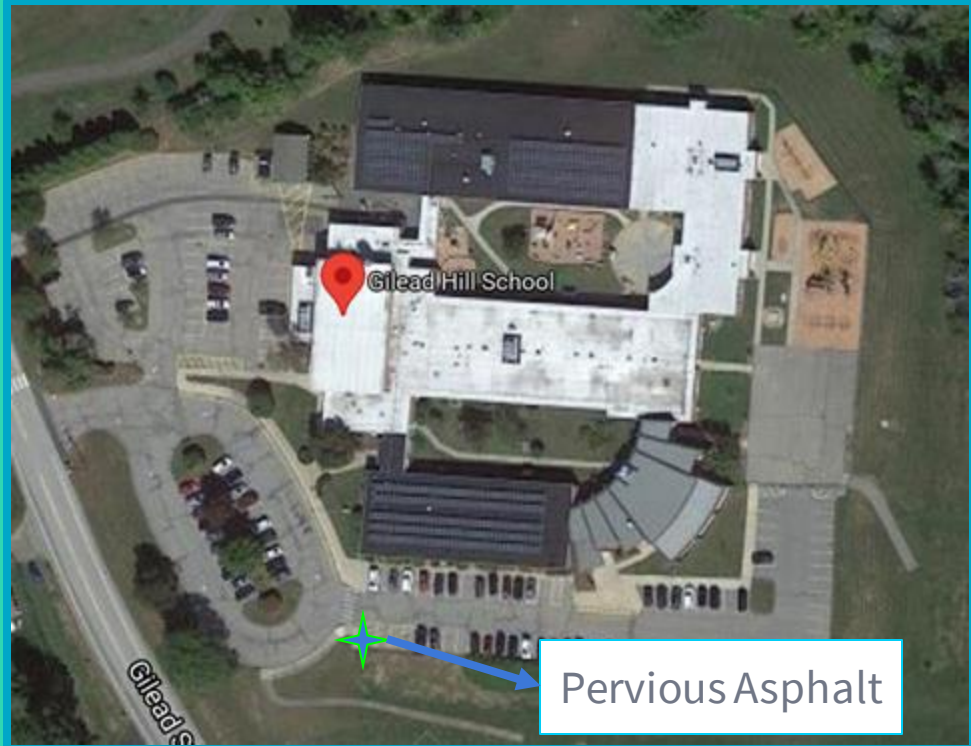
This location has the Parks and Recreation building on site, which is where the retrofits would be put in. There are a number of downspouts which would be disconnected, and the land is already sloping toward the area where we want to put in a small rain garden.

## Cons

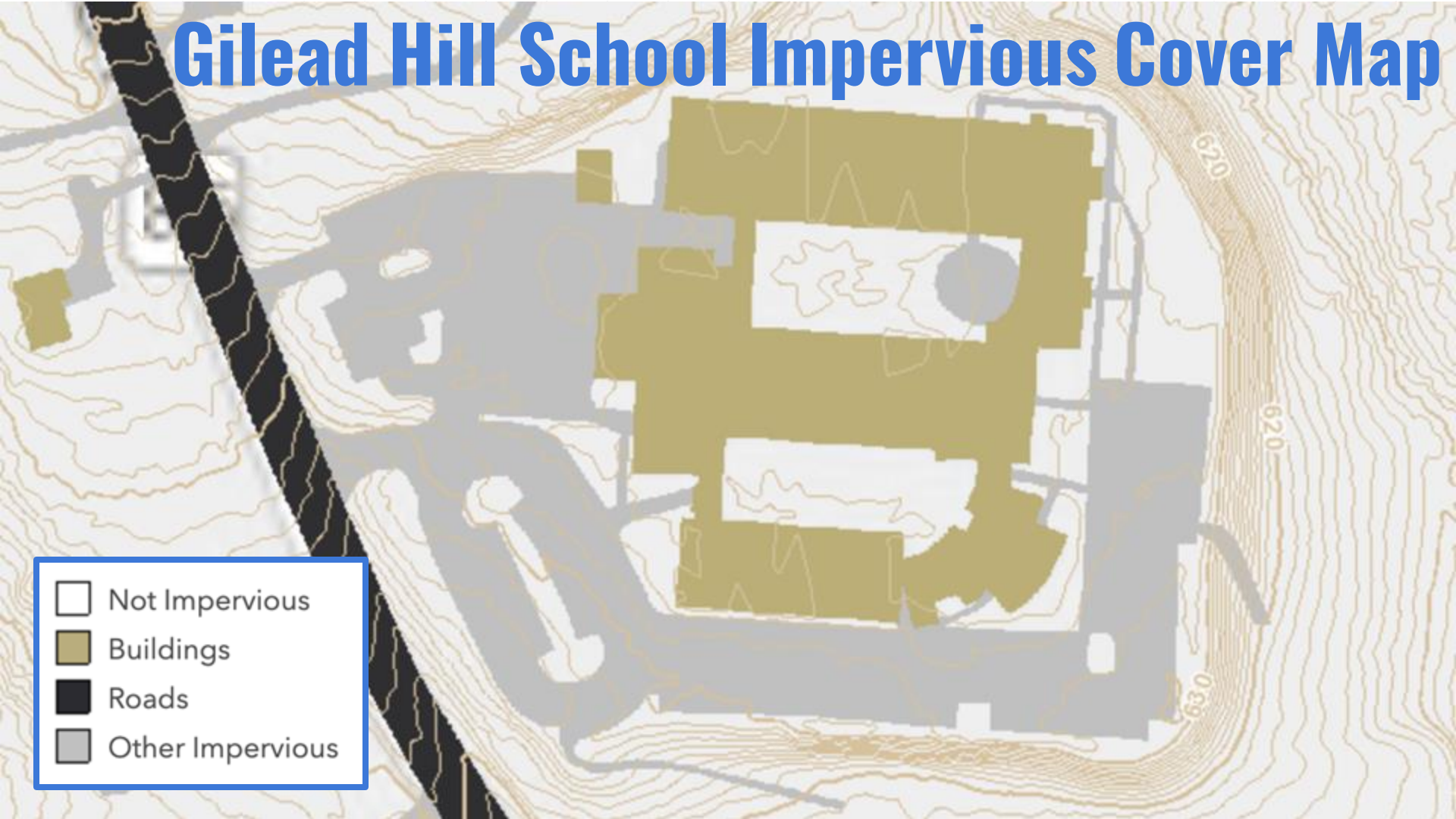
- Small
- Only a few downspouts can be disconnected
- Hard to see from a distance; not the greatest visibility



# Gilead Hill School



# Gilead Hill School Impervious Cover Map







# Gilead Hill School | 580 Gilead St

## Pervious Asphalt



Key:

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

Drainage Area
8,965 SF
Annual Gallons Treated
236,045 gal
Nitrogen Treated
2.46 lb N/yr
Phosphorus Treated
0.31 lb P/yr
Suggested Size
1,494 SF

# Pros/Cons for Pervious Concrete at Gilead Hill School

## Pros:

- Large area to disconnect
- Educational opportunity
- Good choice if planning on repaving the parking lot.

## Cons:

- High installation costs.
- Maintenance can be expensive.

**About the site:** This site captures a good portion of the parking lot and by only doing a portion with pervious pavement it cuts down on the cost. We did not consider a rain garden here due to the proximity to the sidewalk.

## Grand totals of all retrofits:

Practice Location	Practice Type	Drainage Area [sq ft]	Price Low	Price High
Hebron Elementary School (option 1)	Rain Garden	3,504	\$2,336	\$9,344
Hebron Elementary School (option 2)	Rain Garden	1,476	\$3,392	\$13,568
Hebron Town Buildings (option 1)	Rain Garden	4,221	\$2,816	\$11,264
Hebron Town Buildings (option 2)	Rain Garden	8,759	\$5,836	\$23,344
Gilead Hill School	Pervious Asphalt	8,965	\$11,952	\$25,398
Russell Mercier Senior Center	Pervious Asphalt	17,294	\$23,020	\$52,620
Veteran's Memorial Park	Pervious Asphalt	37,025	\$64,190	\$146,710
Rham High School (option 1)	Pervious Concrete	10,280	\$21,125	\$57,040
Rham High School (option 2)	Grass Swales	9,060	\$7,875	\$35,000
Burnt Hill Park (option 1)	Rain Garden	1,670	\$1,112	\$4,448
Burnt Hill Park (option 2)	Rain Garden	2,520	\$10,080	\$40,320
<b>Totals:</b>		104,774	\$153,734	\$419,056

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

# 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:

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