

## EPA RAINWORKS

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#### INTRODUCTION

Implementing green infrastructure at Trine University brings environmental, visual, and community benefits. In partnership with university officials, the EES team identified key problem areas and selected sustainable solutions to enhance campus performance and aesthetics.

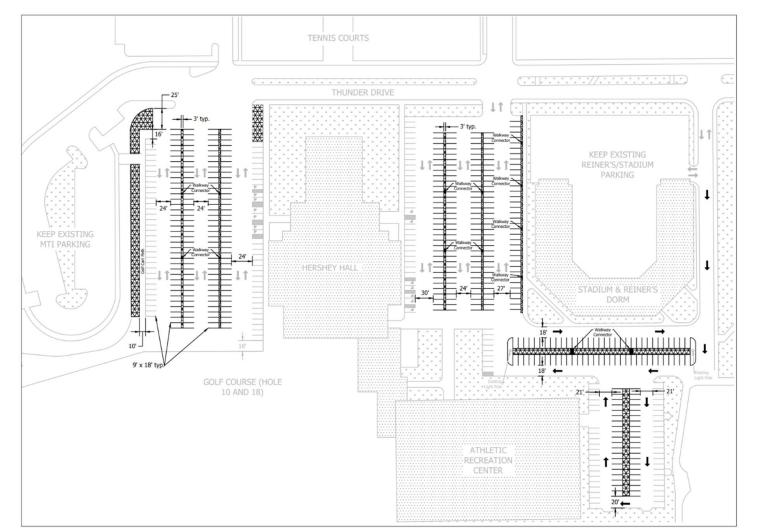
Final BMP designs include infiltration planters, a green roof, and rain gardens. The team conducted a cost analysis and developed a comprehensive design aligned with the EPA RainWorks Challenge guidelines.



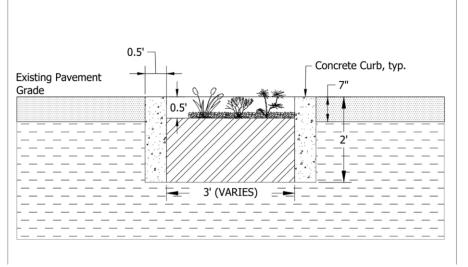


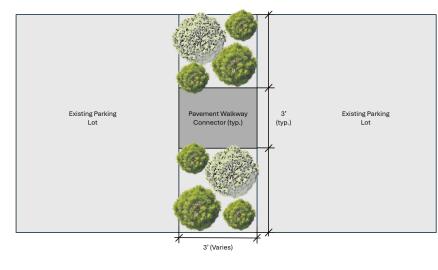
# INFILTRATION PLANTER DESIGN

The design retrofitted infiltration planters into existing parking lots on the east and west sides of Hershey Hall.



- Design follows Angola Municipal Code (aisle width & ADA standards)
- •570 total stalls maintained, including all required ADA spaces
- •Walkthroughs added: 3-ft pavement paths for easy pedestrian access

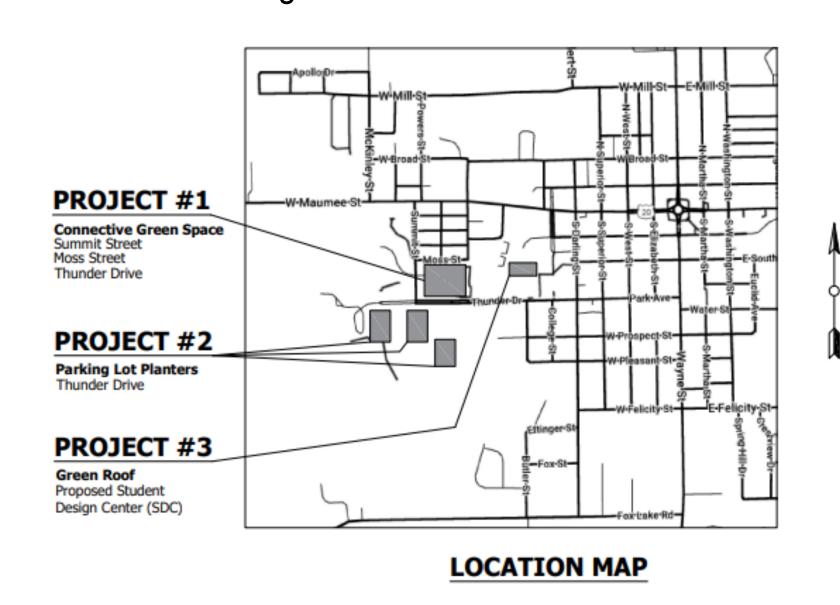




#### SITE SELECTION

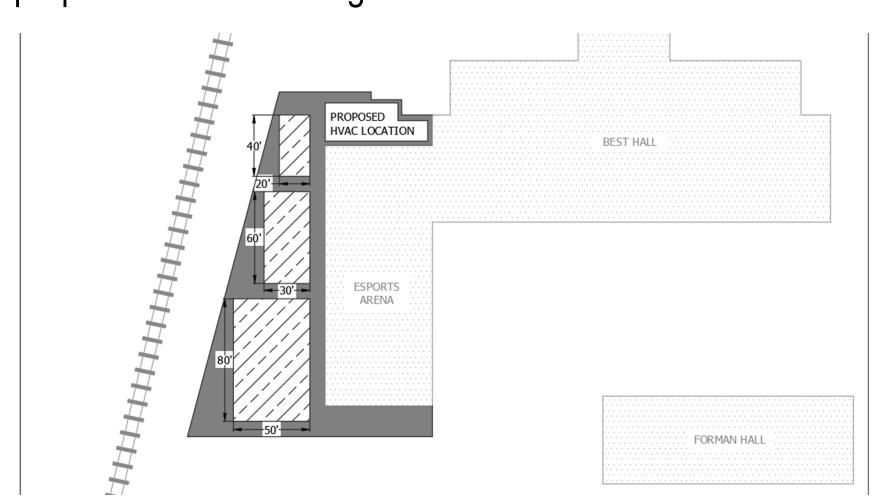
As part of the EPA RainWorks Challenge, our team identified key locations on Trine University's campus for green infrastructure. In coordination with university officials, three primary sites were selected:

- the green space between new dormitories
- existing parking lots next to Hershy Hall
- new student design center on Best Hall



#### GREEN ROOF DESIGN

We designed an extensive green roof on the newly proposed Student Design Center.



### Student Design Center Runoff Volume Totals

With no implemented green roof	35,786 gallons	
With green roof implemented as designed	28,345 gallons	

#### DATA COLLECTION

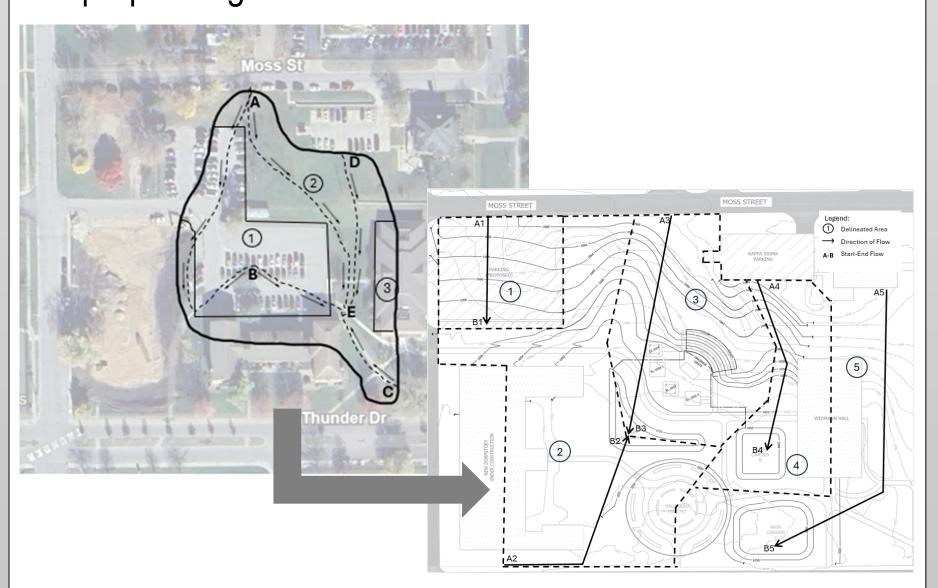
We collected soil samples from a site between Moss St. and Woodward St. at 1, 2, and 3 feet deep. Lab tests confirmed the soil as Miami loam with moderate permeability, ideal for supporting vegetation and managing drainage. A sieve analysis showed well-graded soils with low plasticity, suitable for green infrastructure.



	ssification	Soil Clas											
	Group Name <sup>B</sup>	Group Symbol	Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>4</sup>										
	Well-graded gravel <sup>E</sup>	GW Wel	$Cu \ge 4$ and $1 \le Cc \le 3^D$	Clean Gravels (Less than 5% fines <sup>C</sup> )	COARSE-GRAINED Gravels SOILS (more than 50%	Cummulative Percent Finer		Sieve Number					
	Poorly graded gravel <sup>E</sup>	GP	$Cu \le 4$ and/or $[Cc \le 1$ or $Cc \ge 3]^D$	(DOST MAIL OF MAIL OF	of coarse fraction retained on	3023	30123	Sample 3: 3ft	Sample 2: 2ft	Sample 1: 1 ft			
	Silty gravel <sup>E, F, G</sup>	GM	Fines classify as ML or MH	Gravels with Fines (More than 12% fines <sup>C</sup> )	No. 4 sieve)		•	•	•				
	Clayey gravel <sup>E, F, G</sup>	GC	Fines classify as CL or CH			More than 50% retained on No. 200 sieve	99.50	99.55	99.60	4			
	Well-graded sand <sup>I</sup>	SW	$Cu \ge 6$ and $1 \le Ce \le 3^D$	Clean Sands	Sands		98.85	99.29	99.20	10			
	Poorly graded sand	SP	Cu < 6 and/or [Cc < 1 or Cc > 3] <sup>D</sup>	(Less than 5% fines <sup>H</sup> )	(50% or more of coarse fraction passes No. 4 sieve)		96.63	99.29	99.20	10			
] ,	Silty sand <sup>F, G, I</sup>		Fines classify as ML or MH	Sands with Fines (More than 12% fines <sup>H</sup> )	110. 4 sieve)		98.21	98.70	98.52	20			
(	Clayey sand <sup>F, G, I</sup>		Fines classify as CL or CH				95.03	96.12	94.89	40			
S	Lean clay $K, L, M$	CL	PI > 7 and plots on or above "A" line <sup>J</sup>	inorganic	Silts and Clays	FINE-GRAINED SOILS							
	Silt <sup>E,E,M</sup>	(50)	PI < 4 or plots below "A" line."		Liquid limit less than 50	50% or more passes the No. 200 sieve	70.34	69.93	66.10	60			
	Organic clay E. L. M. N Organic silt E. L. M. O	OL	Liquid limit - oven dried/Liquid < 0.75	organic			21.63	23.21	16.73	140			
	Fat clay <sup>E, L, M</sup>		PI plots on or above "A" line	inorganic	Silts and Clays		12.49	15.77	8.53	200			
	Elastic silt <sup>E, L, M</sup>	MH	PI plots below "A" line		Liquid limit 50 or more			13.48	13.77	8.33	200		
	Organic clay E. L. M. P Organic silt E. L. M. Q	ОН	Liquid limit – oven dried/Liquid < 0.75	organic			4.95	8.94	0.00	pan			
	Peat	PT	d avannia adas	organic matter, dark in color, an	Doincarile	HIGHLY ORGANIC SOILS				F			

#### STORMWATER ANALYSIS

We delineated drainage areas pre- and post-construction to quantify peak flow rates and storage volume requirements for proposed green infrastructure.

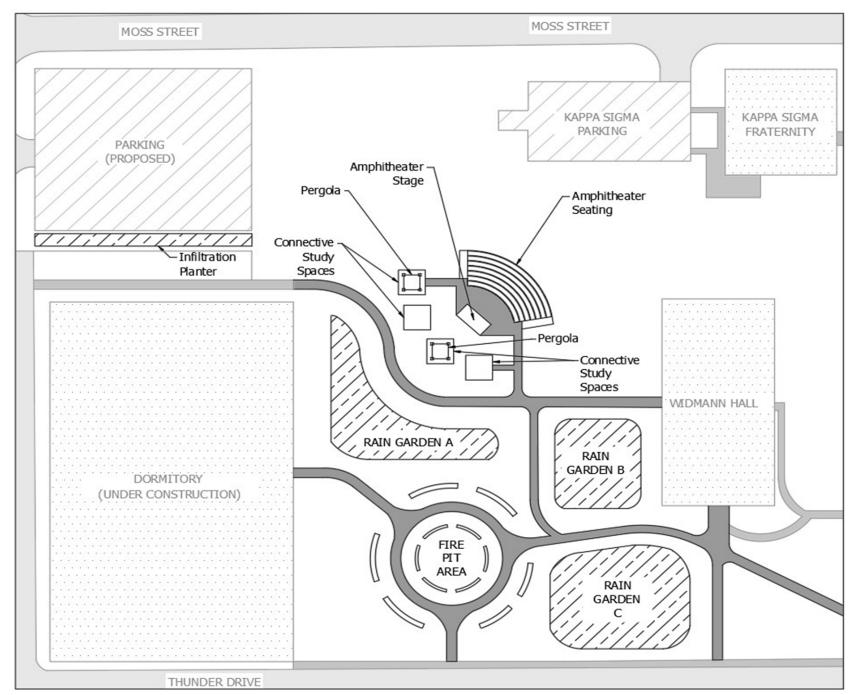


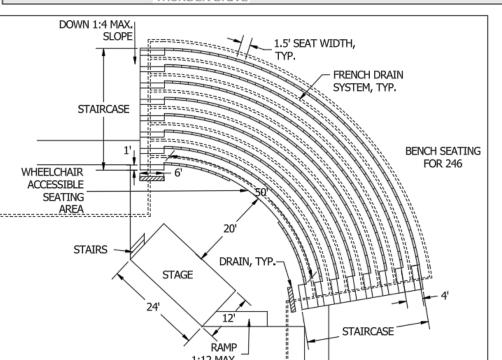
#### Green Space Runoff Coefficient Reduction

Land Condition	Runoff Coefficient	Peak Flow	
Pre Development	.369	4.33	
Post Development	.257	1.95	

#### GREEN SPACE DESIGN

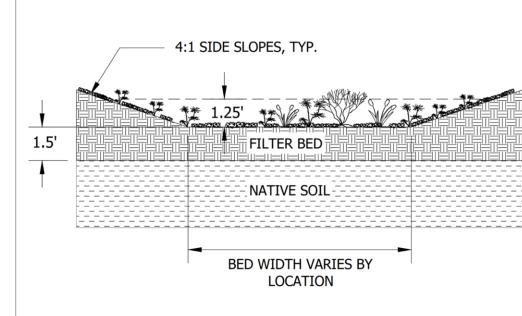
The proposed green space will feature various student gathering places, including pergolas, a fire pit, and an amphitheater. The proposed rain gardens and infiltration planter will capture stormwater runoff.





The proposed amphitheater is ADA compliant and seats almost 250 students.

Rain gardens are designed at a 4:1 slope and can store around 37,000 cubic feet of runoff.



#### COST ESTIMATE

Item	Cost
Infiltration planters	\$178,240.00
Green roof	\$264,000.00
Green Space	\$211,840.00
Total cost	\$654,080.00