Youngstown State University Campus Green Infrastructure Plan

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Abstract

Our research group outlined a green infrastructure plan for priority areas throughout the Youngstown State University campus. Overland flow calculations were performed to evaluate the site in its current state and the site after it would be remodeled to improve rainwater flow. Environmental sustainability was kept in mind, through incorporating permeable pavement, rain gardens, and bioswales. The final priority of the project was to make the area more appealing to the campus community. Furthering this, by selecting priority areas campus-wide, an action plan was also completed to summarize the actions we would like to see done in each of the study areas.

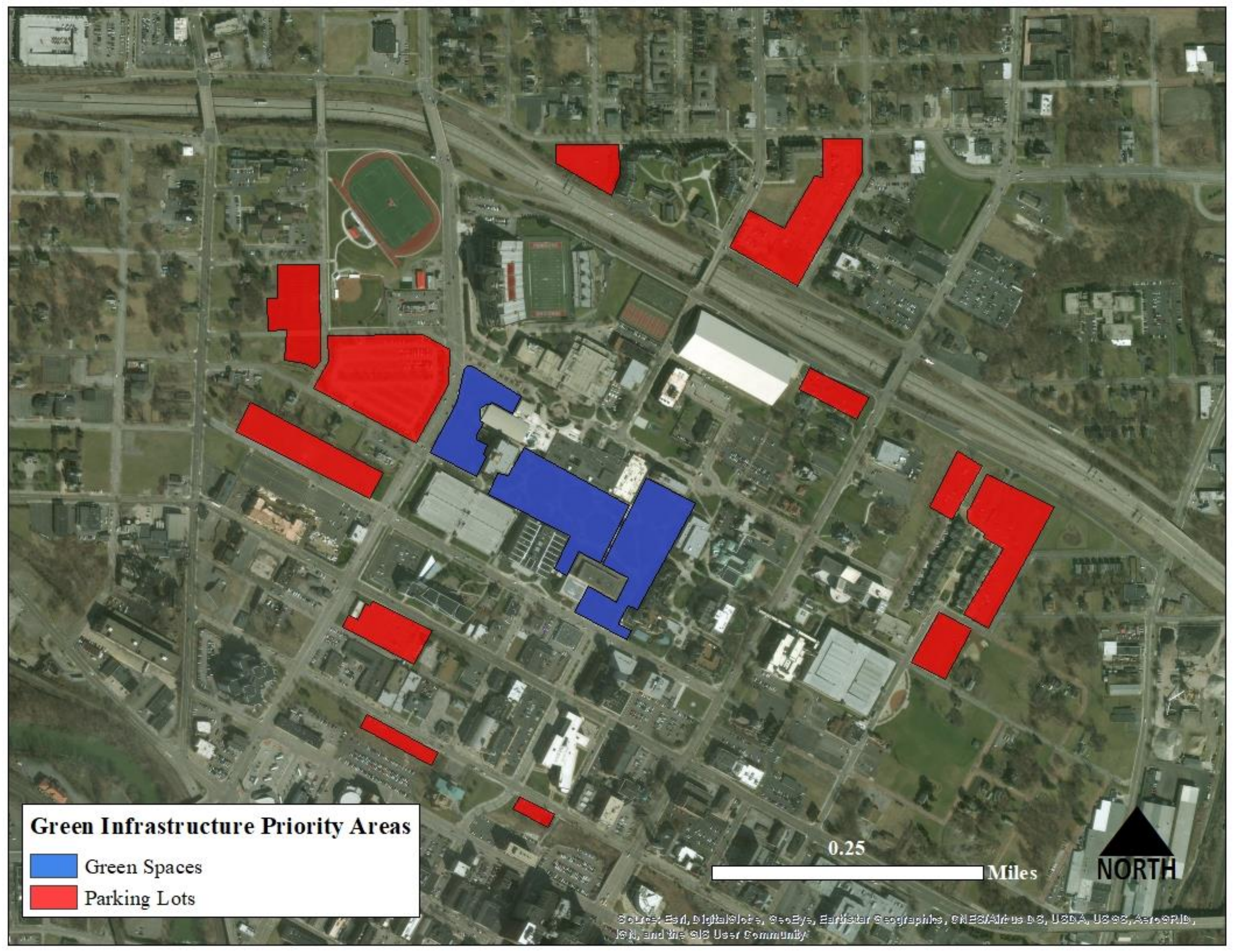
Purpose

- To reduce the environmental impact that the campus has on the local environment.
- To expand upon our research completed last year by replicating our processes and calculations on more locations
- To improve the aesthetics of campus to make a more appealing student environment.
- To gain a better understanding of stormwater runoff and how to effectively manage it.

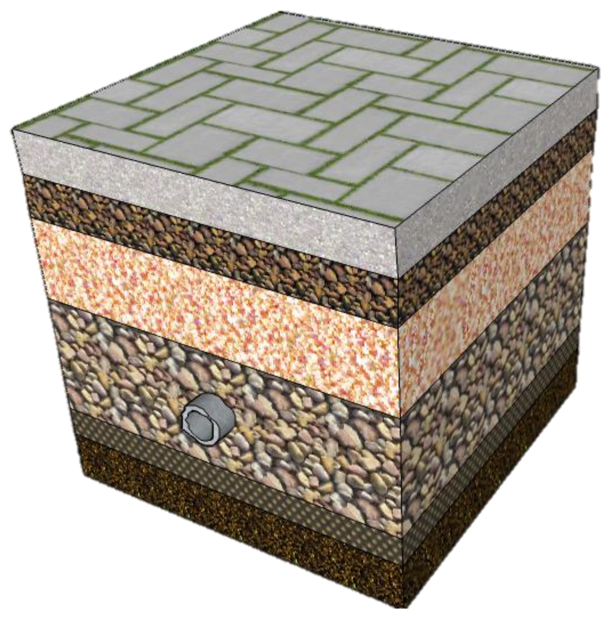
Introduction

Our research group addressed the issue of Green Infrastructure on the Youngstown State University Campus. Green Infrastructure is becoming increasingly important to urban landscapes across the country, especially in Youngstown. The City of Youngstown, Mill Creek Metroparks, and The Colony are just several stakeholders who are implementing green infrastructure practices around the city. We took green infrastructure practices and calculated the impact that they would create on the rainwater management of our most impermeable surfaces: parking lots. Our plan, if put into action, would improve rainwater management on campus, as well as create a greener campus scape at Youngstown State University.

Proposed Areas

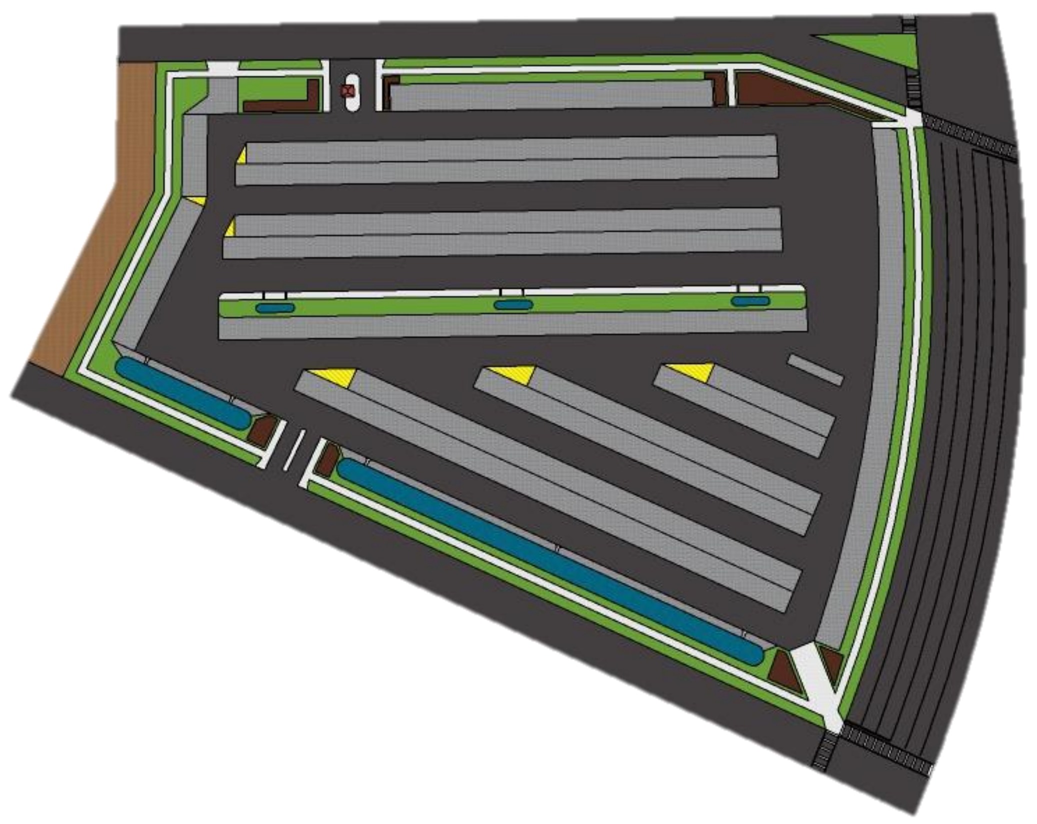


Permeable Paver Parking Lot



Bioswale

Sample Area: Area 1



Flow Calculations

I Values (@30mins)		Q Values (Cfs)		
Year Storm	I (in/hr)	Year	Q_{pre}	Q_{post}
10	2.72	10	254.2403	205.6145
25	3.17	25	635.6008	514.0363
50	3.5	50	1271.202	1028.073
100	3.84	100	2542.403	2056.145
C_{pre} Calculations				
$C1_{pre}$	Type	Area	% Area	C
	Pavement	4.8	0.9	0.95
	Park	0.53	0.1	0.25
	Total	5.33	1	0.88
C_{post} Calculations				
$C1_{post}$	Type	Area	% Area	C
	Pavement	4.8	0.9	0.75
	Park	0.53	0.1	0.25
	Total	5.33	1	0.7
C Values				
	Area(Acres)	% Area	C_{pre}	C_{post}
A1	5.33	0.158537	0.88	0.7
A2	2.41	0.071684	0.88	0.7
A3	1.4	0.041642	0.32	0.3
A4	4.29	0.127603	0.46	0.4
....	....	....	...	...
Total	33.62	1	0.756217	0.611584
Equations				
$C_{pre} = (Area_{\%}1 * C_{pre}1) + (Area_{\%}2 * C_{pre}2) + (Area_{\%}3 * C_{pre}3)$				
$C_{post} = (Area_{\%}1 * C_{post}1) + (Area_{\%}2 * C_{post}2) + (Area_{\%}3 * C_{post}3)$				
$Area_{\%} = Area/Area_{total}$				
$Q = (C_{total}) * (I) * (Area_{total})$				

Conclusion

Campus would become more aesthetically pleasing from the added plant life through the implementation of rain gardens and bioswales. Permeable pavers and asphalt will keep the integrity of the parking lots for longer than traditional methods. Not only did this decrease run-off, but the overall infiltration rate of water into the soil increased; other improvements include reduced water use due to the connection of the sprinkler systems to bioswale water collection, an increased permeability in the area, and an increase in the amount of carbon dioxide sequestered by the added vegetation.

Select Sources

"NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: OH." Hydrometeorological Design Studies Center, https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=oh.

Gribbin, John E. Introduction to Hydraulics & Hydrology: With Applications for Stormwater Management, Ed. 4. Delmar, Cengage Learning, 2014.

Acknowledgements: Jeff Smith of MS Consultants for assistance with civil design; Blake Walker of YSU for assistance with project outline and basic research

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