Clean Water or Green Water?

Andrew Bonaventura (CS), Ethan Campbell (AE), Avery Wallis (ECE), and Nathan Walzer (CS)
Advisors: Professor Marja Bakermans (BB), Professor David Spanagel (HUA)

Stormwater Pollution

Polluted stormwater runoff is able to find its way to aquatic ecosystems and cause harmful changes in the population dynamics of the area due to its high content of phosphorus, often leading to an increase in algae and a decrease in every other species.

©Tahoe Pipe Club

Natural vs. Man-Made

There are two categories for filtration that our research looked at: natural and man-made. Natural filtration includes rain gardens and wetlands while man-made filtration includes filter devices. In general, the choice of which filtration to use is dependent on a variety of factors regarding installation and maintenance, Our project aims to propose a decision matrix for which filtration method to utilize in relation to these various factors.

Methodology

- Water Quality Samples
  - Our Data
  - BRC Data
- Interviews
- Research
- Discussion

Which Filter Should You Use?

Our chart looks at four different types of filters that are then graded based on nine different factors from excellent to poor. This chart is meant to explain which filter might want to be implemented based on what the consumer values the most in terms of quality.

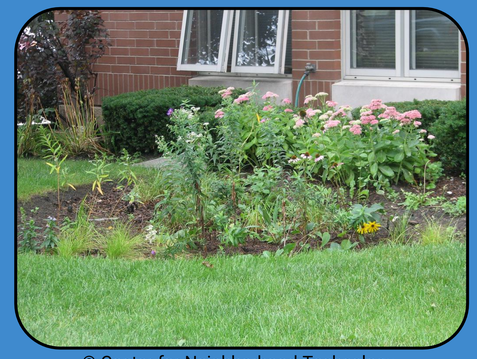
Decision Factors	Drain Inserts	Drain Cover	Catch Basin	Rain-garden
Season	Excellent	Good	Excellent	Fair
Size	Excellent	Good	Excellent	Good
Price	Fair	Fair	Poor	Excellent
Installation	Excellent	Excellent	Good	Good
Maintenance	Good	Excellent	Fair	Fair
Aesthetic	N/A	Poor	N/A	Fair
What is Filtered Out	Fair	Poor	Excellent	Excellent
Flow Rate	Excellent	Poor	Fair	Excellent

Key to Color Codes

- Excellent
- Good
- Fair
- Poor
- N/A

© Robert Lawton

© Transpo Industries



© Center for Neighborhood Technology

Our Data

Location	Turbidity (NTU)	Phosphates (mg/L)	Nitrates (mg/L)
Salisbury Pond	Fair	Fair	Good
Puddle in Elm Park	Fair	Good	Excellent
Lincoln Pond	Fair	Excellent	Excellent
Overflowing Storm Drain	Fair	Poor	Excellent

We collected four water samples from around Worcester. They were tested by volunteers for the Blackstone River Coalition.

Key to Color Codes

- Excellent
- Good
- Fair
- Poor
- N/A

Blackstone River Coalition Data

These data are from samples collected by the Blackstone River Coalition. Water quality is the average of multiple samples at a location

Location	Aesthetics	Nutrients
Tatnuck Brook	Poor	Good
Beaver Brook	Poor	Poor
Broad Meadow Brook	Fair	Good
Coal Mine Brook	Good	Poor

References

Alamillo, J., Barret, K., Cressey, R., Dermand, J., Ervin, C., Glasser, A., . . . Wang, G. (1999). The Health Effects of Swimming in Ocean Water Contaminated by Storm Drain Runoff. *Epidemiology, 10*(4), 355-363. Retrieved October 5, 2017.

Boesch, D. F., Conley, D. J., Havens, K. E., Howarth, R. W., Lancelot, C., Likens, G. E., Paerl, H. W., & Seitzinger, S. P. (2009). Controlling Eutrophication: Nitrogen and Phosphorus. *Science, 323*(5917), 1014-1015. doi:10.1126/science.1167755

Brown, R. R., Fletcher, T. D., Ladson, A. R., Roy, A. H., Shuster, W. D., Thurston, H. W., . . . Wenger, S. J. (2008). Impediments and Solutions to Sustainable, Watershed-Scale Urban Stormwater Management: Lessons from Australia and the United States. *Environmental Management,42*(2), 344-359.

Cobourn, J. (1994). Cleaning up urban stormwater: The storm drain stenciling approach (or getting to the nonpoint source). *Journal of Soil and Water Conservation, 49*(4). Retrieved October 5, 2017.

Groundwater pollution. (2011). In D. S. Blanchfield (Ed.), *Environmental Encyclopedia*. Detroit: Gale. Retrieved from http://libraries.state.ma.us/login?qwurl=http://link.galegroup.com/apps/doc/CV2644150655/SCIC?u=mlin_c_worpoly&xid=f0c4c4de

Line, D., & White, N. (2007). Effects of Development on Runoff and Pollutant Export. *Water Environment Research, 79*(2), 185-190. https://doi.org/10.2175/106143006X111736

Liu, D., Liu, J., Miao, L., Sun, J., Wang, X., Zhang, Q., . . . Zhu, L. (2015). The Capacity of Greening Roof to Reduce Stormwater Runoff. *Landscape and Urban Planning, 144*, 142-150. doi:https://doi.org/10.1016/j.landurbplan.2015.08.017

Liu, R., Kang, Y., Zhang, C., Pei, L., Wan, S., Jiang, S., . . . Yang, Y. (2014). Chemical fertilizer pollution control using drip fertigation for conservation of water quality in Danjiangkou Reservoir. Nutrient Cycling in Agroecosystems, 98(3), 295-307.

Acknowledgements

We would like to thank the Blackstone River Coalition, Martha Gach and the Mass Audubon Society, Peter Collins and the Lake Quinsigamond Commission, Jacquelyn Burmeister and the Worcester DPW, Paula Lomas and the Worcester Water Filtration Plant, and Professor Orr