

**HANOVER SCHOOLS STORMWATER MANAGEMENT MASTER PLAN (SWMMP)  
AND DEMONSTRATION PROJECT**

PA DEP GROWING GREENER GRANT NO. C990000662  
GRANTEE: BOROUGH OF HANOVER

**PROJECT DESCRIPTION:** The project developed a stormwater management master plan (SWMMP) for the 65-acre Borough of Hanover School campus; and implemented demonstration projects using Biochar soil amendment and a non-destructive compressed air injection soil decompaction technique to enhance infiltration with credential research of the results. Management of stormwater via soil infiltration both reduces flooding and stormwater-borne pollution. The efforts are further described below.

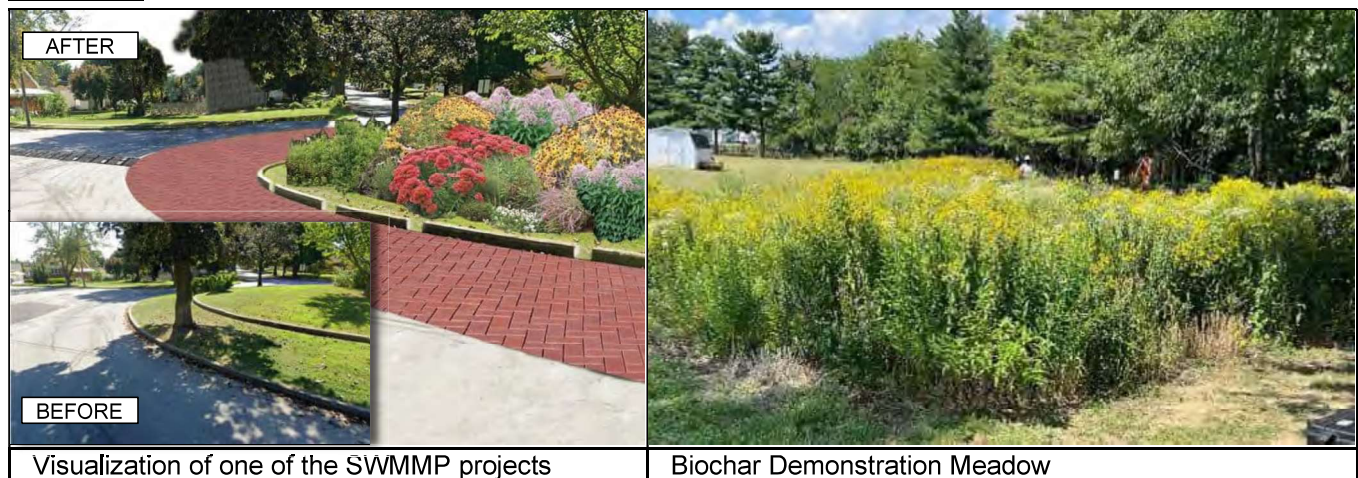
1. **SWMMP:** The Skelly and Loy, Inc. authored master plan evaluated 26 potential sites on the schools' campus and selected a top ten list for future design and construction to mitigate flooding and reduce sediment conveyed in stormwater. The plan provides a framework for ongoing stormwater management project implementation at the campus. The property offers unfettered public access and educational opportunities, making it an ideal location for community demonstration projects and environmental education modules that can be incorporated into the scholastic curriculum.
2. **DEMONSTRATION PROJECT:** Conversion of a compacted lawn area east of the High School parking lot into a meadow with Biochar soil amendment was the first field-based research effort to measure the effect of Biochar for enhanced infiltration in the U.S. The soil decompaction sites north and south of the same parking area represented the first credentialed experiments in the region using the compressed air injection to improve soil infiltration. The University of Delaware collected and analyzed data and produced two academic research papers. The results of the field-based experiments will continue to be shared in academic circles and will influence other research and ultimately aid in updating hydrology modeling variables relating to the effect of the studied practices.

**PROJECT GOALS:** The goals of this project were (1) to provide a list of preliminarily vetted projects for ongoing implementation to reduce flooding and stormwater pollution in Hanover; and (2) to quantify use of Biochar soil amendment and air-fracturing of subsoil for enhancement of soil infiltration through credentialed research.

**PROJECT RESULTS:** If all ten SWMMP projects were implemented, they could collectively reduce runoff volume by approximately 160,500 cubic feet, reduce the peak rate in a two-year storm event by 30%, and reduce sediment pollution by 115,031 pounds per year.

Results of the research performed at the Biochar demonstration site and at the decompaction sites were unexpected because they countered results of previous testing performed in laboratory-controlled experiments and other anecdotal reporting. The Biochar amendment yielded slower rates after than before implementation, and the soil decompaction showed no substantial change to compaction stemming from the subsoil fracturing. However, results were still informative and influenced methodology at other research sites including use of alternative equipment used for Biochar incorporation and inclusion of gravel backfill into the fractures opened for decompaction.

**PICTURES**



**PROJECT COST:** \$562,335 PADEP Growing Greener Grant; and \$119,880 In-kind Match

**LESSONS LEARNED:** The project spanned the COVID pandemic and a multiplicity of team changes at the Borough, DEP, and consultant staffing. The research project yielded unexpected results. The project team learned the importance of good communication and flexibility needed to re-focus experiments.

**PARTNERS:** Hanover Borough; Hanover Public School District; PA DEP; and Consultants: Skelly and Loy, Inc. and the University of Delaware

**CONTACT INFORMATION:** Borough of Hanover, Eric Mains, P.E., [emains@hanoverboroughpa.gov](mailto:emains@hanoverboroughpa.gov)