Using a Rain Garden to Teach Hydrogeological Concepts in a High School Science Classroom

United States Environmental Protection Agency

Lauren E. Brase[1], Robert G. Ford[2], Heather Mayfield[3], Amy Parker[4], Adam Lehmann[5], Sarah Meadows[5]

Contact Information: lbrase@americangeosciences.org

[1]Former ORISE at USEPA-ORD, Cincinnati, OH; [2]USEPA-ORD, Cincinnati, OH; [3]Kenton County Conservation District, Independence, KY; [4]Deer Park High School, Taft, OH; [5]Hamilton County Conservation District, Cincinnati, OH

Overview

In early 2020, volunteers supporting the Cooper Creek Collaborative installed a rain garden at Deer Park High School (DPHS) in Hamilton County, Ohio. This initiated a collaborative effort to demonstrate the use of green infrastructure. An eight-day unit was created to raise awareness of local stormwater runoff issues, teach hydrogeological field skills, and provide an opportunity to collect and process unique data. The intended audience of the rain garden unit was physical science students; however, the unit was modified and used in physics classes as well. DPHS was especially eager to offer hands-on experiences for students returning from a year of remote learning due to COVID-19.

This initial effort laid the foundation to develop additional physical science curriculum materials linked to the rain garden including hydrogeologic skills such as analysis of staff gauge data, rain gauge data, and soil percolation tests.

Fig. 1 The Deer Park High School rain garden. Stakes were placed around the perimeter and across the rain garden to create 8 transects. White string was attached to the transect stakes so the string remained at a common elevation from which students could measure.

An Introduction to Rain Gardens

The rain garden unit began with an introduction to hydrology in an urban watershed. Students used an interactive Enviroscape™ Model to learn about stormwater pollution and to simulate how rain gardens collect and absorb runoff. The next day focused on how rain gardens are sized according to run-off areas, infiltration rates, and local storm sizes.

Surveying the Rain Garden

The students were tasked with determining how much water the rain garden could capture and divert from nearby storm drains. They were introduced to surveying and practiced a modified surveying method in the classroom using metersticks and bubble levels. The next day the classes conducted an elevation survey for a reference grid established within the rain garden.

Fig. 2 Students practicing the modified surveying procedure using meter sticks and bubble levels.

Fig. 3 Students surveying the rain garden. Measurements were taken from the ground up to the string that was at a consistent height across the rain garden.

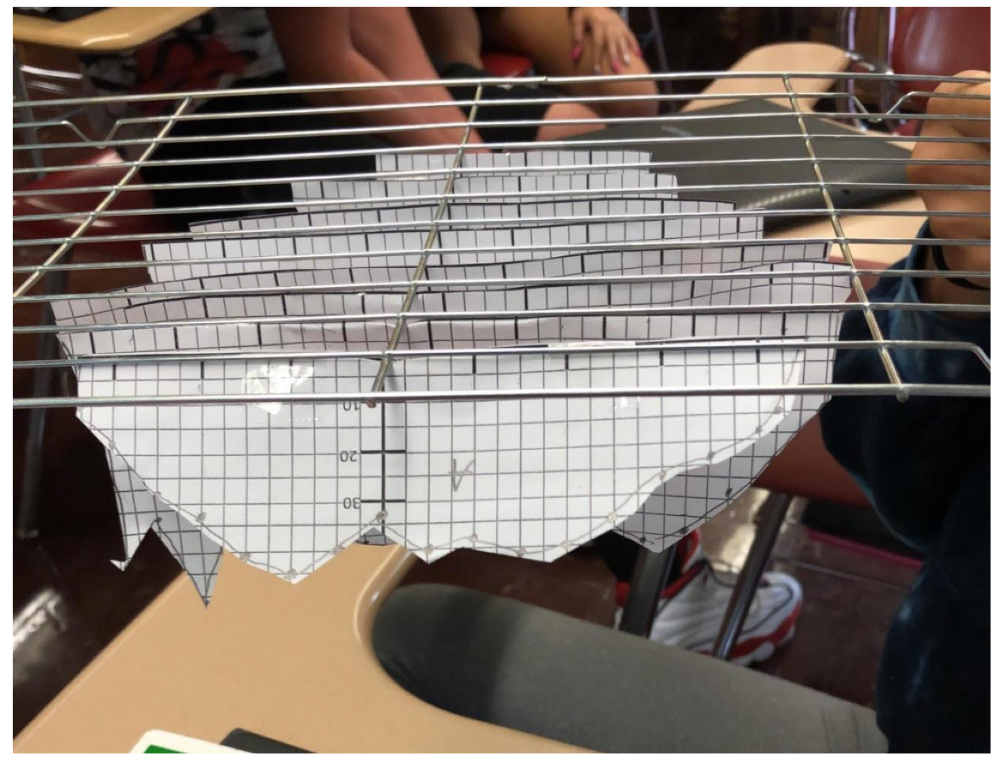

Fig. 4 Student work: a 3D model of the rain garden from the string (baking cooling rack) down to the ground (cut edge of graphs).

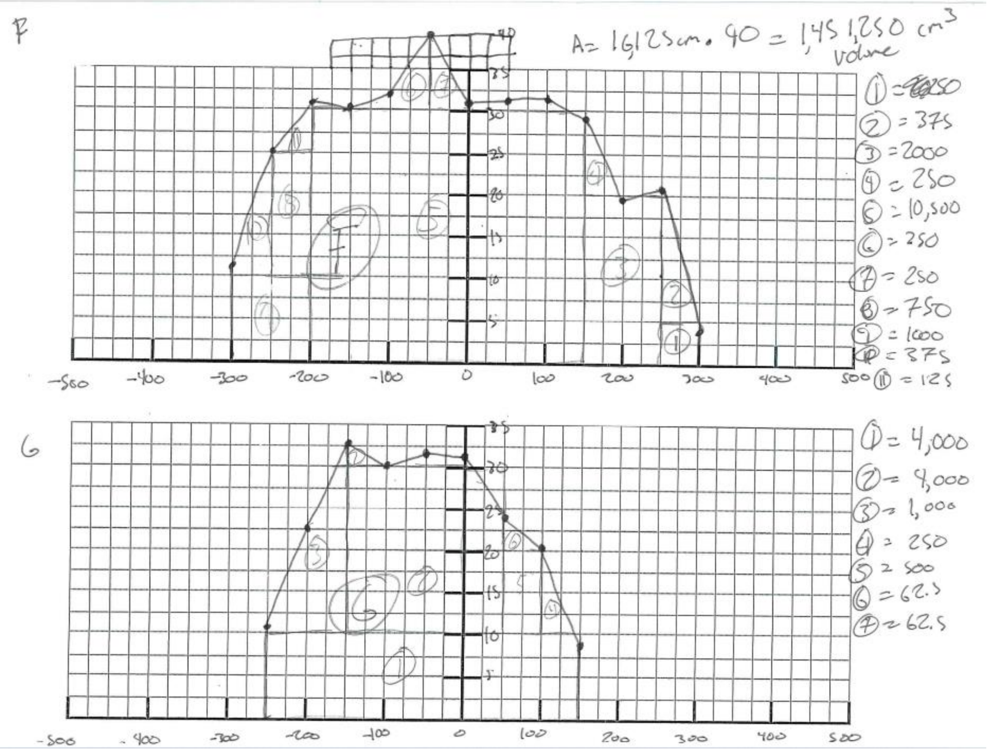

Fig. 5 Student work: area calculations for transects F and G.

Processing the Data

The relative elevation data was then used to teach graphing skills, and to construct 3D models to provide physical representations linked to their volume calculation estimates. Students estimated the rain garden volume by adding up the calculated volumes of each transect (estimated area times assigned transect thickness). Student data and volume estimates from the six classes were within 3-11% of volume estimates derived from traditional surveying measurements.

Next Steps: Rain Gauges

This spring, DPHS students are collecting rainfall data using soda bottle rain gauges to answer research questions related to rainfall distribution and rain gauge design. Students will process the data late this school year.

Fig. 6 Soda bottle rain gauge with collected rainfall. Gauges were constructed with 2L bottles, cement, and sealer.

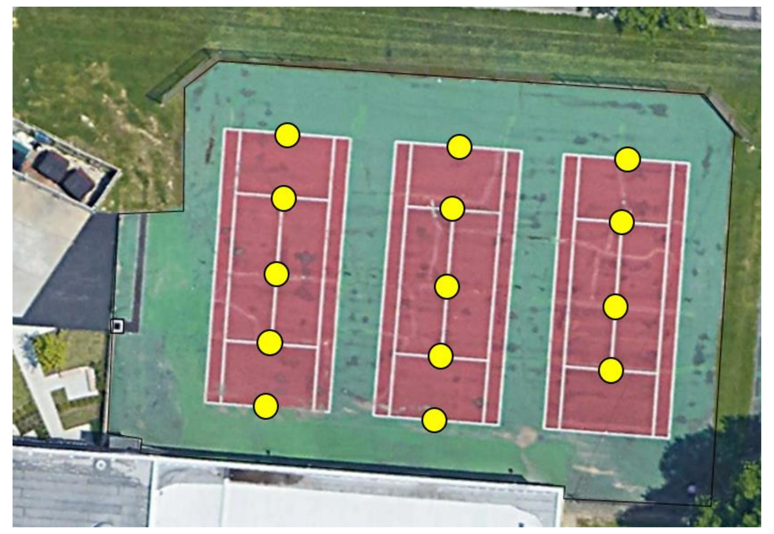

Fig. 7 Deployment map of the soda bottle rain gauges on the tennis courts near the DPHS rain garden.

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