

A BLOSSOMING PARTNERSHIP

USF Coverdell Fellows work with Greco Middle School technology teacher to build a rain garden on campus

Throughout Tampa Bay and other areas with heavy rainfall, flooding causes property damage and threatens the health of aquatic ecosystems. Rain gardens are a low-impact development technology used to promote water treatment and infiltration into the soil. Parts of Greco Middle School's campus in Temple Terrace have experienced chronic flooding, especially high-traffic areas with compacted soil. To improve stormwater flow, four Peace Corps Coverdell Fellows enrolled in engineering at the University of South Florida (USF) partnered with science and technology teacher Matt McKernan to educate students about stormwater management and build a rain garden on Greco's campus. This partnership was facilitated with previous education and community training partnerships between USF's Dr. Maya Trotz and her students with math and science instructors in the city of Tampa.



Rain garden on Greco Middle School's campus

The Paul D. Coverdell Fellows program is a graduate fellowship program for returned Peace Corps Volunteers. There are several Coverdell Fellows programs at the University of South Florida and only one in the College of Engineering. Engineering Fellows are enrolled in either a Master's or PhD program in civil or environmental engineering. Besides their traditional graduate school requirements, Fellows must complete an internship in underserved communities in the U.S. that allows them to bring home and expand upon the skills they learned as a volunteer.

To give the students some background knowledge about stormwater, Mr. McKernan used lessons and activities from the [Urban Stormwater Management](#) unit at TeachEngineering.org, an open-access planning tool for STEM teachers. The curriculum was developed by USF alumnus Dr. Ryan Locicero, whose initial involvement with rain garden planning at Young Middle Magnet School in Tampa inspired the project at Greco. The unit includes lessons about the natural stormwater cycle and how low-impact technologies can be used to mitigate stormwater issues. Mr. McKernan's students studied transpiration and infiltration rates while planning and building the garden, and the hands-on experiences gave them a deeper understanding of stormwater issues and the engineering concepts of the garden.



Students measure the infiltration rate of water within a soil layer

In the first infiltration lab, students measured the infiltration rate of various media types: soil, mulch, sand, and gravel. Each student group built a small-scale “rain garden” using a planter basket filled with their assigned media. The basket was clipped into a bucket and students poured water through the media, measuring the time taken to filter through and identifying properties of their media. While soil and mulch absorb some of the water, sand and gravel promote infiltration because of their large pore spaces and low porosity.

In the next infiltration rate lab, students created the same small-scale rain garden setup, but now used a combination of the media types of their own choosing. The results would help students determine what types of media they should incorporate into their garden plot. The rain garden on Greco’s campus is unique because 13 groups used different combinations and layers of media within their 7-foot by 7-foot plot, encouraging student involvement, ownership, and collaboration. Each group of 4-6 students used Minecraft, a construction video game, to design their plot and experiment with different media layers and plants. Many students said the Minecraft design was their favorite part of the project, and the ability to see their garden plot exposed students to the concept of systems modeling.



Students measure the infiltration rate of water flowing through a mixture of sand, gravel, mulch, and soil

In mid-March, the class was ready to break ground on the garden. The five days of excavation were tough – students worked hard and shared the responsibility of digging. Over the next few weeks, soil, gravel, and mulch were delivered to the site and students filled in their plots with the layers according to their plans. From the lab experience, students were able to draw connections between the infiltration rates of different media types and the potential impact of the garden. For example, the existing soil was mostly sand, so many students wondered by the site was draining so poorly. Mr. McKernan explained that because the bus loop was adjacent to the garden site, heavy foot traffic in the area had probably compacted the sand and worsened flooding.



Students excavate their group's plot within the garden

By April, the students had filled in the plots, leaving six inches for a final layer of soil and plants. While some students were busy with shovels, others researched appropriate plants for the local climate and garden conditions. Anything planted in full Florida sun should be hardy and drought-tolerant, but plants in a rain garden should also be able to tolerate having "wet feet." Florida-native plants like coreopsis and Muhly grass require less maintenance to stay healthy and support the local pollinator population. Some plants may not thrive; garden maintenance will include replacing dead plants with different ones to see what fares best.



Each plot in the garden was filled with different media layers according to the students' plans

"I really enjoyed picking out the plants for the garden.

Our group named the plants in our plot, and we check on them every day."

– Sydney Smith



Plants chosen for the garden include canna lilies, Muhly grass, and coreopsis

The partnership has been beneficial to the Coverdell Fellows, as they learned about classroom collaboration and communicating knowledge to students effectively. Coverdell Fellow Nicholas Ferreira described the project as "a breath of fresh air" during a challenging time of global pandemic, when many USF students were spending all day indoors behind a computer screen. The most important impact has

been for the students, who were exposed to project planning and design skills throughout the garden build. They used technology tools, laboratory experiments, and internet research to develop a garden design and worked together to implement it. The students share the responsibility of maintaining the garden and will continue to observe its impact on flooding as the plants mature. The Coverdell Fellows at USF look forward to a flourishing relationship with Greco Middle School and future rain gardens on the school's campus.

Matt McKernan and math teacher Jen Butler implemented the rain garden project at Greco Middle School. 2020 Coverdell Fellows Nicholas Ferreira and Elizabeth Vicario worked with Mr. McKernan's science and technology classes and coordinated the garden build. 2019 Coverdell Fellows Martha Mcalister and Chris Nenner organized the project and acquired funding. Dr. James Mihelcic oversaw the project as the Coverdell Fellowship coordinator. The Coverdell Fellows would like to thank the Association of Environmental Engineering and Science Professors Foundation, University of South Florida Operations, and the Temple Terrace Garden Club for their financial donations and support of the project.