

A Proposal to Reduce Flooding
by Planting Rain Gardens
at the University of Miami
Coral Gables Campus

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Facilities Management

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I. Introduction

The purpose of this paper is to persuade Facilities Management at the University of Miami Coral Gables campus to allow the CommUnity Gardening Club to install two to four rain gardens. The rain gardens would be planted by the Hecht-Stanford walkway and near the Ashe building to reduce the amount of flooding in those areas that occurs whenever there is moderate rainfall. Since it is a private university and the club does not own the land, permission is necessary to plant the rain gardens. Facilities Management is in charge of all of the landscaping on campus and therefore, the decision would be up to you. The only assistance needed would be a financial contribution of \$200 to \$400 for the materials necessary. If granted permission and given the financial contribution, these rain gardens would be installed and maintained by the CommUnity Gardening Club, a student group of volunteers interested in gardening. Planting the rain gardens would take approximately two days, depending on the number of volunteers, and maintaining the rain gardens would be simple and inexpensive.

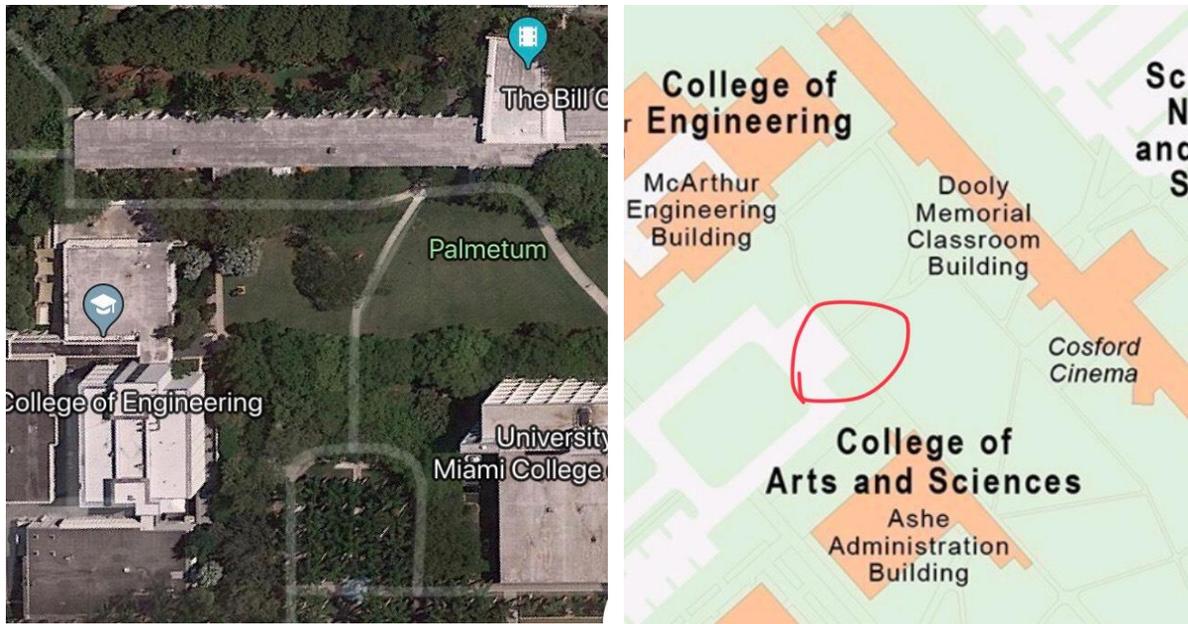
II. Needs Assessment

As a University of Miami student living on campus, I frequently have to walk across campus to commute to and from my classes. Within a couple of weeks of starting class this semester, I noticed that just about every time it rains, water gathers in two specific spots on campus. This flooding does not just occur when there is a hurricane or a heavy storm. Speaking from personal observation, any moderate rain causes a noticeable amount of water to flood these two areas.

The first area is located on a portion of the walkway between Hecht and Stanford residential colleges, as shown below. Whenever it rains more than a few inches, the shadowed area on the map on the right floods, with water anywhere from around half an inch to a few inches deep. The water seems to gather here due to having nowhere else to go. There are approximately 1,000 students who likely use this walkway, especially freshman living in Hecht and students in the theater department or other classes in the building. Although an alternative route may be taken by going across Fate Bridge and along the walkway by Eaton, that route provides no shelter from the rain. On the contrary, those who use the Hecht-Stanford walkway are able to walk under the shade along the front of the Shalala Center for a portion of the walk. This causes students going from the breezeway, Richter, Dooly, and any of the building on that part of campus to Hecht to have to choose between walking under constant rainfall for the entirety of their commute or walking under the shade of the Shalala Center but having to wade through water up to their ankles.



The second area I identified is a portion of sidewalk located on the intersection of the path from the Ashe Administration building to the McArthur Engineering building and the path from the Dooly Memorial building and the fountain at the end of Memorial Drive. The area affected is smaller than that of the Hecht-Stanford walkway, but the water gets deeper due to the surrounding sidewalk being higher up. The rainfall gathers and forms a pond of water on the sidewalk whenever there is moderate rainfall. While there are alternative routes in that area, if a student is going from Ashe to McArthur or vice-versa or perhaps to and from Dooly and Memorial Drive, this sidewalk is a straight, short path. Going a different way would add time to an affected student's commute, requiring a longer walk in the rain and potentially making them late to class.



My research regarding this topic was purely observational due to a lack of topographic evidence. Topographic maps for the region use a scale of ten feet, and the difference in elevation for these areas is more subtle. I determined that the flooding has been an issue from personal experience and from discussing the issue with my peers.

III. Proposed Solutions

There are several ways to help reduce the amount of excess water from rainfall. The water can be intercepted and redirected, captured and stored, or allowed to soak into the soil ⁽¹⁾. Each method has different approaches, as described in the subsections below.

A. Intercepting and Redirecting the Water

The use of swales, French drains, or catch basins would intercept the water and redirect it to a suitable area. This creates a question of what can be considered a suitable area. Do you want storm water and runoff to just go into Lake Ocoala? The water may be contaminated by nitrogen and phosphorus from the fertilizer used in the nearby landscaping ⁽²⁾, adding those chemicals to the lake. Aside from the need of a suitable area for the water, the strategy of intercepting and redirecting the water would also be costly and time-consuming.

Creating a swale, which is a wide, shallow ditch, would require a fair amount of digging and completely rearranging the soil in the areas. It would also need more room than the two specified areas can handle. Another option would be installing a French drain, an underground drainage device with a perforated pipe surrounded by gravel and connected to downspout pipes and sump pump pipes. The average national cost for installing a French drain is \$1,000 to \$1,500 ⁽³⁾, so this option would be too

costly. A catch basin, which is a collection box with a slotted drain at the top and a drainage outlet at the bottom, would cost around twice as much (4).

B. Capturing and Storing Runoff

Rain water is also able to be collected through the use of rain barrels or cisterns. The runoff water from a roof can be captured and stored for future use, such as irrigation. Overall, rain barrels are cheaper but cisterns hold more. Either one would be beneficial in regard to water conservation.

Rain barrels can cost anywhere from \$15 if you make one from a garbage bin to \$200 for a specially designed wall-hugging, 80-gallon barrel. They collect water from rooftops via a downspout, but an inch of rain on a 20x25 square foot roof would fill most rain barrels 4-5 times (5). Due to the amount of rain the specified areas receive, this alone would not be a practical solution. In addition, the flooding appears to be due to run-off from nearby land, not necessarily from the roof, so this would not resolve the issue.

A cistern, which is a much larger version of a rain barrel, would be able to collect plenty of the water, but the same issue would arise of the rainfall collecting on the walkways. Installing a cistern would cost a minimum of \$2,000 (6) and involve either building a decently large structure above ground or digging fairly deep underground to install one.

C. Infiltrating Water into the Soil

By installing dry wells, a compost blanket or soil amendment, or rain gardens, more water would be able to be infiltrated into the soil. Whenever the amount of rain exceeds the amount of water that the soil can infiltrate, or absorb, runoff occurs unless there is a physical barrier to stop it (8). The flooding problem in the two specified areas is due to having a difference in ground level that causes there to be more water than the soil can infiltrate, so these solutions may resolve the issue.

A dry well, also known as an infiltration trench, is an underground storage area filled with gravel. The void spaces between the gravel store water until it is either infiltrated slowly into the ground or flows through an underdrain. A dry well needs to be in a permeable soil layer for it to be a good option, so it may not work well in the given areas, depending on the soil content. The cost of installing a dry well can be anywhere from \$300 to over \$5,000 (7), likely on the more expensive end for the areas on campus because of the size and the amount of technical work needed.

Another approach to infiltration is to add organic matter or compost to the soil to reduce soil density and improve soil structure, making it more porous and susceptible to infiltration. This can be done either with low intensity, which uses a compost blanket or high intensity, by amending the soil. A compost blanket is a thin layer of compost that can be used to control erosion and retain sediment resulting from sheet-flow runoff. While the cost of this would be comparable to a straw mat, a compost blanket is not generally used where collected water flow occurs (8), such as in the selected areas.

Soil amendment is a more intense and costly version of a compost blanket that has the same effect but the results are seen more quickly. Like a compost blanket, soil amendment would not work for the given location. Both methods are visually unappealing, which would be an issue as well since the University of Miami is a college campus known for its beauty.

Rain gardens, on the other hand, are beautiful, inexpensive, and effective for infiltrating rain water. They can be made in many styles and sizes, but the general description is a landscaped depression placed in the path of runoff with perianal flowers and native vegetation that soak up rainwater. For the size needed, the cost would be \$100 to \$200 for each raingarden. Installation can be done by just about anybody, and maintenance is simple.

D. More on Rain Gardens

While planting a rain garden seems like an obvious solution, there are some potential issues that need to be addressed. The specified areas may not be able to have rain gardens installed due to problems with the soil and limestone. The soil may not be healthy enough to hold and infiltrate the water or for plants to grow in. In Florida, limestone is common, which would be difficult to dig through and require expensive, professional equipment.

The soil must be tested to see if amendments need to be made for the plants in the rain garden to survive. This can be done by digging a hole, filling it with water, and seeing how long it takes for the soil to soak in the water. If it takes less than 24 hours, the soil is suitable. A formal test may also be done for \$15 to \$75 (9), but that is optional.

There may be limestone since that is common in Florida, but that would be at least three to four feet underground. Unlike many of the other options for storm water control, installing a rain garden would require digging a maximum of two feet deep, as shown in the diagram below.



IV. Recommendations

Coral Gables, Florida receives 60 inches of rain per year, well above the national average of 39 inches ⁽¹⁰⁾. Most of this rain occurs during Florida's rainy season, which is from May through October. During those months, the Hecht-Stanford walkway and the sidewalk near the Ashe building flood frequently, affecting approximately one in 15 students at the University of Miami.

After conducting research regarding the issue, I have determined that the best and most cost-effective solution to resolve flooding on campus would be to install rain gardens. My recommendation is to plant one next to each specified area. Since each rain garden would cost \$100 to \$200 to install, the total cost would be \$200 to \$400. The price would be on the lower end of the range if seeds are planted instead of having to buy the plants. Also, this is assuming that the soil does not need to be amended and that no underdrain or overflow piping is needed. There are pre-existing plants by the Hecht-Stanford walkway that are growing well, so the soil should be fine.

For a rain garden to be effective, the selection of plants is crucial. The plants must be native to the area to grow naturally without the use of fertilizer and pesticides. They must have deep and variable root systems in order to infiltrate the excess water that will be directed towards the rain garden. Habitat value and diversity is also needed to maintain a balance in the nearby ecosystem.

To prevent additional cost and maintenance after the installation, the plants must also be sustainable once established. Starting from a seed, the plants would need to be looked after at first, but once they are grown, a yearly trimming would suffice. The plants also need to be aesthetically pleasing to fit in with the rest of campus.

A few plants that meet the requirements for a rain garden in the given areas are Muhly Grass, Spider Lily, and Sunflowers. Muhly Grass is an easy to grow ornamental plant commonly placed in groups for a stunning visual effect ⁽¹¹⁾. Spider Lily is fast-growing and known for its fragrant, long-lasting white flowers ⁽¹²⁾. Lastly, heat-loving sunflowers can grow in any soil type in a variety of warm colors ⁽¹⁴⁾. There are plenty of other plants suitable for a Florida rain garden, but these three would be a good start.



Before a rain garden may be planted, 811 must be called to ensure that there are no underground utilities in the way. Once we get the green light and buy the materials, such as seeds, shovels, soil, and gloves, the CommUnity Gardening Club can install each rain garden in approximately two days. For the plants to grow successfully, this should be done in early spring. By the time school starts in August, we should see a reduction in flooding in the selected areas.

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