**Introduction**

Water is a crucial resource for the survival of all life forms. Unfortunately, with the increasing threat of climate change, fresh water is expected to become a pressing issue in the future for many countries, including the southeastern region of the United States (EPA, 2013). Water management is likely to become a challenging issue, due to rising temperatures, and demand due to economic and population growth (EPA, 2013). Increased temperatures are likely to lead to longer, more intense, and more frequent droughts in the Southeast, putting more stress on water resources (EPA, 2013). This is also a concern that saltwater may mix with shallow aquifers of groundwater in coastal areas, due to expected rise in sea levels, contaminating the groundwater (EPA, 2013). One way to adapt to the changing climate and rain patterns, is to start harvesting rainwater.

**Background**

In 2007 President Ayers signed the American College and University Presidents’ Climate Commitment (ACUPCC). The plan is committed towards measuring the carbon footprint of the University. Updates and changes to the Climate Action Plan occur every two years to ensure the University of Richmond will reach its goal of becoming carbon neutral by 2050 (Climate Action Plan 2012). The University of Richmond has made great efforts to address climate change and water conservation. For example the University has implemented conservation techniques by irrigating some fields, such as the baseball field, with water from the Westhampton Lake (Glass). Other notable water conservation methods include using the water from showers and using drought tolerant landscaping at several LEED certified buildings (Glass). A potential new project for the University to explore is a rainwater harvesting system. Rainwater would be collected from the roof of Booker Hall. The water would then be transported through gutters into rain barrels, and used to irrigate flowerbeds around campus.

**Study Site**

Booker Hall would be a great building to test a rainwater harvesting and irrigation project because of its large size, and there is a storage area for the rain barrels (figures 2, 3, and 4). On the Westhempton Way side of Booker Hall there is a large rectangular cement floor. This cement floor is hidden from the view of pedestrians, and receives no foot traffic. No one will see the rain barrel unless they enter Booker Hall from the basement entrance by Westhempton Way. Also, there are five gutters that extend downward from the roof to the cement floor. Once the rain is collected in the gutters, facilities will drive their trucks up to the rain barrels and siphon the water from the barrels into an irrigation tank on the back of their trucks for further use (Glass, 2014). Facilities already have irrigation tanks on their trucks that they use to irrigate flowerbeds around campus (Glass, 2014). Our goal is to help facilities switch from using city water to rainwater for irrigation.

**Methodology and Calculations**

Booker Hall’s roof is a complex structure, which makes calculating the amount of rainwater collected difficult to determine. From aerial pictures of Booker Hall on Google Maps and ArcGIS we struggled to determine where the roof would be able to drain to our rain barrels, and how much rain would be collected. To address climate change and water conservation, for example the University has implemented conservation techniques by irrigating some fields, such as the baseball field, with water from the Westhampton Lake (Glass). Other notable water conservation methods include using the water from showers and using drought tolerant landscaping at several LEED certified buildings (Glass). A potential new project for the University to explore is a rainwater harvesting system. Rainwater would be collected from the roof of Booker Hall. The water would then be transported through gutters into rain barrels, and used to irrigate flowerbeds around campus.

**Observed Changes in Precipitation**

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>31.59</td>
</tr>
<tr>
<td>2008</td>
<td>30.73</td>
</tr>
<tr>
<td>2009</td>
<td>29.23</td>
</tr>
</tbody>
</table>

Based on our calculations we have determined that collecting water using rain barrels can be effective, however, our calculations were conservative in nature. Our calculations suggest that with the exception of April, the 200-gallon rain barrels would be filled half the time. In order to collect as much rain as possible, we will be placing the rain barrels at the most affected points of the roof, and this can yield relatively significant rainwater capture.

**Payback**

The payback period for the 200-gallon rain barrel is estimated to be 16 years. This project will help us create a greener university and ultimately a greener world. Due to monetary and time constraints, our pilot project must start on a small scale. We will be using ten 200-gallon rainwater barrels in our designated area. In order to capture the optimal amount of rain in our designated area at Booker Hall we are requesting the purchase and use of ten 200 gallon rain water barrels seen in Figure 3. Our project would not have been possible without the help of many people. We would like to thank Andrew McBride, Paul Loiz, Steve Glass, George Soliven, Megan Eide, Andrew Parick, and our professors Dr. Salisbury and Dr. Smallwood.