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RAINWATER SYSTEM TO CONCRETE LABORATORY – AN INTERDISCIPLINARY APPROACH TO SUSTAINABILITY EDUCATION

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Abstract: Rainwater collection is an environmentally sustainable way to reduce the demand on public water supplies and to mitigate the impacts of storm water runoff. While untreated and treated rainwater is used for a number of purposes ranging from garden irrigation to toilet flushing, a more extensive use of rainwater resources is currently hindered by the lack of uniform regulations. Considering that many regions suffer from droughts and that water scarcity is becoming one of the main environmental issues in the United States, a change in regulations, as well as in sustainable water design practices, is needed. University of Washington's (UW) Civil and Environmental Engineering (CEE) department is aiming to facilitate this change by educating a new generation of engineers to become familiar with the economic and ecological advantages of rainwater harvesting, know how to design and operate rainwater treatment systems and have a holistic understanding of sustainable water management practices in urban areas. In spring 2015, the UW Campus Sustainability Fund (CSF) grant awarded the construction of a rainwater collection and purification system in and adjacent to the construction materials laboratory space in the CEE department. The goal of the project was to provide the laboratory with a supplementary source of water for various uses, and serve as a campus wide educational tool for innovative, sustainable water management practices. The student-designed and built rainwater collection & purification system was brought online in March 2017. This presentation summarizes the lessons learned from implementing the interdisciplinary student project and discusses the experience from both students' and project lead's perspective.

1 Project Background

Seattle, WA, experiences heavy rain during winter months but receives almost no rainfall in the summer (ClimateData 2017). Heavy winter rain in the urban environment causes flooding, sewer overflows and stream erosion. To mitigate these issues and to encourage sustainable water practices, the city of Seattle has launched programs such as RainWise that incentivize residential rainwater collection (SPU 2017). Similarly to many states and cities in the US, Seattle allows the use of systems that supply untreated rainwater for non-potable fixtures, e.g. toilets and laundry machines, in both residential and non-residential occupancies. The use of rainwater for potable water supply is allowed in detached family houses, but rainwater cannot be the primary source of potable water supply (EHSD 2011). Allowing rainwater to be used as the primary water source would expand the range of its possible uses in residential, commercial, industrial and institutional buildings. However, this more extensive use of rainwater resources is currently hindered by the lack of uniform regulations: While some states have come up with specific policies on rainwater harvesting and use, others have left the issue completely unaddressed (Kloss 2008). Considering that large areas of the country are suffering from droughts and

that water scarcity is becoming one of the main environmental issues in the United States (NIDIS 2017; Schnoor 2012), a change in attitudes, as well as in rainwater regulations is needed. Higher education institutes such as University of Washington can facilitate this change by educating a new generation of engineers, administrators and policy makers who are familiar with the economic and ecologic advantages of rainwater harvesting, know how to operate and maintain such systems and most importantly understand its role as a part of more sustainable water resources management practices.

In spring 2015, the UW Campus Sustainability Fund (CSF) fund awarded the construction of a rainwater collection and purification system in and adjacent to the construction materials laboratory (CML) space in the CEE department. The goal of the project was to provide the laboratory with a supplementary source of water for various uses, and serve as a campus wide educational tool for innovative, sustainable water management practices. The rainwater project design was started in April 2016 with the objective of having the system online in fall 2016. The project team met once a week and conducted project work on several spring weekends. The final system design included four roof structures, of which three were covered with typical roofing materials in the Pacific Northwest (asphalt shingles, corrosion proof metal and cedar shingles) and one with glass. With this setup, the student team could explore the impact of the roofing material on the untreated rainwater quality. The roof structures that were placed on the CEE department roof were built on-site by the student team. Construction was completed during the dry season in May 2016. While the project team worked hard to meet the original schedule, there were several delays over summer and fall 2016 due to unexpected treatment system delivery issues, which extended the project completion timeline to March 2017. Despite the unforeseen delays, student group's motivation remained high throughout the project – only one out of the nine initial team members dropped out of the project before its completion. Support from CEE department technical staff was invaluable in all project stages in facilitating project lead's work and in providing students diverse and unique learning opportunities.

2 Future Work

From spring 2017 on, UW students in junior-level construction materials classes will conduct experiments with rainwater by using it for mixing and curing concrete during a "sustainability lab" session. The rainwater project group will continue their work by collecting operation and maintenance data and monitoring water quality at different points of the rainwater system. The conference presentation will discuss student experience from a "sustainability lab" participant's point of view through anonymous surveys and from a project group member's point of view through interviews.

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