

Rainwater Harvesting System in Carver Gym



Picture courtesy of BBC.com

By: Andrew Donaldson, Vince McLaughlin and Britni Gilliland

Table of Contents

- 1.0 Introduction**
 - 1.1 Purpose behind the project**
 - 1.2 Rainwater use benefits**
 - 1.3 Significance to Western Sustaining Water Use**

- 2.0 Methodology**
 - 2.1 Internet research**
 - 2.2 Contacts & meetings**
 - 2.3 Infrastructure Development**

- 3.0 Case Studies**
 - 3.1 Andrew's**
 - 3.2 Vince's**
 - 3.3 Britni's**

- 4.0 Research and Analysis**

- 5.0 Conclusion**

- 6.0 Future Works**

1.0 Introduction

1.1 Purpose of Project

Water is a “free” resource that Mother Nature gives us via the water cycle. Western has been behind the curve in rainwater harvesting among universities. There is potential to save on Western utility costs, while simultaneously educating students and faculty on green technology. Western could be an example to the Bellingham community on how to cut back on water usage. Students and faculty will see this project working and seek to become more “green” in their daily lives.

1.2 What is Rainwater Harvesting?

Rainwater harvesting is the accumulation and storage of rainwater for water intensive purposes (irrigation, toilet use, pool use). Rainwater could be collected from the roof of Carver Gym, diverted into storage tanks, and used instead of water from pumped out of Lake Whatcom. Lake Whatcom is the water source for Western. We have calculated that Western’s total water consumption would take 4 inches off the top layer of Lake Whatcom.

1.3 Significance to WWU

Western students and faculty are seeking to make our campus more sustainable. Right now Western is letting this valuable resource go down the drain. There is so much rain in Bellingham it seems wasteful not to apply it to better use. The renovation of Carver Gym, happening in 2011 – 2013, presents an opportunity to implement a rainwater harvesting system in to the infrastructure of the Carver Gym. There is potential for Carver Gym to become partially independent with its water use by simply collecting the water that falls on it. Carver Gym spent \$13,000 annually in water bill for 2009 to 2010. The amount of water used was 16,538,280 gallons.

2.0 Methodology

Implementing a rainwater harvesting system to the renovation of Carver Gym is a fairly easy task. The initial cost of a rainwater catchment system is a fraction of what economic and environmental resources Western would save. In order to figure out how to implement this program, we have combined personal interviews with internet research on how other Universities have successfully installed a rainwater catchment system, what challenges they encountered and how they have overcome them. We have also done research on the amount of water and money Western uses for Carver Gym.

2.1 Internet Research

Rainwater catchment systems are a popular topic among ‘going green’ Universities. We began searching for local universities that have successfully demonstrated the use of a rainwater catchment system. Portland State University was our first indication of a Northwest school that has used the wet climate to its benefit. Their rainwater operating system is leading the way for Northwest schools. The city of Portland also has taken the forefront of turning any eligible waterspouts into rainwater catchment programs.

2.2 Contacts & Meetings

We sought out the university's facilities manager to see what it would take to get this idea going on campus. At Wilson Library we spoke to David Willett. We found out that Western already has a few areas around campus where they store storm water runoff from the C parking lots, as well as an area by the track that has a rainwater natural filtration system, below the ridge dormitory. The key to opening the door to this pilot project is to have it be implemented into a restoration or remodeling of a building. Willett suggested Carver Gym to be the pilot building that could introduce sustainable water use in a building on campus. Over the next few years there will need to be a way to implement a benefit of how much rain Western's campus would collect to reduce the amount of water we take from other bodies of water such as Lake Whatcom.

2.3 Program Development

To introduce this concept to Western, we would create a pilot program and work with the sustainability and design departments on campus. For Western to design a rainwater catchment and storage system we will show how much water can be collected and stored for use in Carver Gym. Also, where we would use the water is an issue. If filtered with UV filters and chlorinated, the water would be aesthetically displayed.

3.0 Case Studies

We found that a number of colleges and universities have worked with the ideas of taking rain, and recycling it for a greater purpose. From a large to small scale, numerous cities and colleges have taken up the idea of a rainwater holding system. At Western, we know that the excitement is there for sustaining and recycling our resources.

3.1 Portland State University (our main focus)

PSU has rainwater harvesting systems on three buildings, their recreation center, Engineering building and Epler Hall. We are concentrating on one building, Epler Hall. This building harvests rainwater via an animated conveyance system that doubles as a design feature, something we would like to do. Four exposed downspouts deliver rainwater from the roof to river rock splash boxes located in the plaza at the foot of the building. After the water splashes, it filters down through river rock and enters an exposed Belgium block tunnel conveyance system that channels it across the plaza. The water then enters one of five raised planter boxes opposite the building where it percolates down through the soil to an underground storage facility. Water is drawn from the facility for ground floor toilet flushing and landscape irrigation. Toilet water undergoes sand filtration and UV disinfection prior to use.

The cost of their rainwater harvesting system was \$62,000. Total storage capacity for their system is 5,610 gallons and it is projected to save an estimated 9,660 gallons of potable water from use in landscape irrigation and nearly 101,000 gallons from use in flushing toilets annually, totaling to about 110,000 gallons of potable water saved. To put that into context, they saved enough water to meet the annual demand of an average four-person household. Annual water/sewer savings are predicted to be around \$1,000. Total storm water from the site is reduced 25 percent from existing conditions, which earned

the LEED Stormwater-Rate and Quantity credit. The system attenuates the rainwater falling on the southern half of a neighboring building as well.

The system is connected to the City's potable water supply to supplement water supply during the dry summer months. When rainfall exceeds storage capacity, excess rainwater overflows directly into the municipal storm system from the underground storage facilities.

Any new development within the City is charged "Systems Development Charges" to pay for infrastructure to deliver and remove water from the building. PSU projects that it was use about 40 to 50 percent of the water of a standard dwelling unit, largely due to the rainwater harvesting system that will reduce the amount of incoming water, thus saving roughly \$80,000.

Noelle Studer, sustainability coordinator at PSU, thinks saving money and resources is great, but the real benefit of having a rainwater harvesting system on campus is for education. "The real potential benefit is in education, though. Someday we hope to recruit some students to write about it on our website and develop curricula ideas around the systems so they can actually be used as a learning tool," Studer said via e-mail.

(Source: Epler Hall Case Study)

3.2 Humboldt State University

HSU implemented a rainwater harvesting system when building the Behavior and Social Science building. With the collection of rainwater in their 20,000 gallon tank, they recycle the water and use it for all of the toilets in the five story building as well as for local gardening around the premises.

Rainwater Flushes the Toilets

Rainwater (up to 20,000 gallons of it) is funneled into two massive water tanks, which are buried at the foot of the building. That water is then pumped throughout the building and used to flush toilets. The building's designers predict that the storm water will power at least four months of flushing. Calculations show that this system will reduce the need for municipally-provided potable water (to convey sewage) by almost 88 percent. The use of low-flow plumbing fixtures will also reduce overall water use (whether from the domestic or gray water system) by 65%.

(Source: <http://now.humboldt.edu/news/bss-building-dedication/>)

3.3 College of New Jersey

The engineering students at the College of New Jersey were able to introduce a rainwater catchment system pilot. We are concentrating on their pilot for a comparison of how beneficial a rainwater harvesting, catchment, filtration system that establishes irrigation water as well as drinking water. Two large, exposed barrels collect rainwater from a tower. The design feature of the barrel connects to a pump system that moves the collected water to a UV filtration system. The College of New Jersey designed this with a

tower collecting the water that way simple gravity would allow it to travel into the storage-filtration system. The water is drawn from the system and used for irrigation purposes in their pilot.

For the project, these students designed a rainwater harvesting system that will allow for the collection of a maximum of 1,500 gallons of water at a time. The collected water is intended to be used for the production and the irrigation of the landscape around their campus. Approximately 80,000 gallons of water will come through the system in an average year.

4.0 Research and Analysis

Western has demonstrated interest in making our campus more sustainable and environmentally friendly through many improvements. Miller Hall's green roof and Buchanan Tower East's design are just two examples of environmental awareness at Western. Buchanan Towers also acknowledges the pressure to reduce water consumption. According to Buchanan Towers Green features guide, water efficient landscaping has been incorporated into its design. "Water is becoming a limited resource. In efforts to conserve the maximum amount of water, the Buchanan Towers addition uses several ways of distributing water. This results in water irrigation being reduced by 50%. Another goal in achieving this LEED credit is to mitigate the use of water by using efficient irrigation methods, such as using captured rainwater and recycled wastewater."

Access Bellingham's rain barrel program here:

http://docs.google.com/viewer?a=v&q=cache:mx0RpJ5oARAJ:www.cob.org/documents/pw/environment/water-conservation/rain-barrell-maintenance-safety.pdf+anitra+city+of+beillingha&hl=en&gl=us&pid=bl&srcid=ADGEEShT6VS4DxR53L6Sg9C47w7a6DdqkqUdi9_AEuFPcDTzqByzDPd3O7fZQ5BAzS6CT51KcvS3KxQnEUfERmm-kDs9p47LVHSQn68wUBR8ZRCU-DNkFneKeYcMr7u6pUFUrbDsyp&sig=AHIEtbQq0iQiUcbpjKO4cmwPGDMUWr5zHQ

Western was a leader in green construction, Western's Wade King Recreation Center was the first center of its kind in the nation to earn a LEED certification, according to an April, 2007 university communications article. Also Western was the first university in the nation to purchase 100 percent of its energy with renewable credits. Western must keep being a leader when incorporating green technology to its buildings. Installing a rainwater harvesting system into a building that is already scheduled for renovation is the right thing to do. A rainwater harvesting system that could double as a piece of art will be a visible reminder of how Western cares about the environment.

Developed by the U.S. Green Building Council (USGBC), Leadership in Energy and Environment Design (LEED) standard, or Green building design, is a measurement tool for green building in the United States. One component LEED looks for when granting certification is water use. Western is required by the state to obtain a LEED Silver certification because of the size of Carver gym, according to Tim Wynn, facilities

manager of Western (All buildings over 5,000 square feet are required by the state to seek LEED silver certification). A rainwater harvesting system would be beneficial to Carver Gym when Western pursues LEED Silver certification.

According to Wynn, The Design for Carver Gym will take place during the next biennium (2011 to 2013) if the legislature decides to give Western funding for it.

5.0 Conclusion

Our goal for this project is to move Western toward a more sustainable campus. By implementing a rainwater harvesting system in Carver Gym, Western will be one step closer to being independent with its consumption of natural resources. This report covers the basic logistics of how and why it is important to utilize the water that falls on every roof on campus.

6.0 Future Works

The next step in the process of installing a rainwater catchment system in Carver Gym is to convince facilities management it is a worthy cause. Carver Gym's design will be decided during the next biennium (2011 to 2013). It will be crucial to the success of this project to put pressure on the designers of Carver Gym to work with us and include this system in the building. We will present facilities management with the benefits of a rainwater harvesting system. We predict they will see that the benefits in education and sustainability outweigh the initial cost, causing them to become enthusiastic about this project.

Contacts:

Tim Wynn, Director of Facilities Management, 360-650-3496, Tim.wynn@wwu.edu

Dave Willett, Project Manager at Western, 360-650-6813, david.willett@wwu.edu

Anitra Accetturo, Water Conservation Specialist for Bellingham Public Works, 360-778-7700, aaccetturo@cob.org