Design of a Rainwater Harvest System for Botanical Garden of the Ozarks

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Introduction

- **B**otanical Gardens of the Ozarks (BGO), located in Fayetteville, Arkansas, began in 1994.
- **B**eginning in 2018, a 15 year multi-phase project known as the Master Plan will be implemented to expand BGO across its remaining 60 acres of land.
- **T**he first and largest building in the Master Plan is the visitor's center, which consists of classrooms, a convention hall, a conservatory, and a 2-acre field-to-fork garden.
- **T**he building will be about 28,000 square feet .

Objectives

- **T**o provide water for irrigating plants in the 2000 ft2 conservatory.
- **T**o store enough rainwater to last throughout dry seasons.
- **R**educe runoff from new Visitor's Center.
- **P**rovide points towards LEED certification.
- **S**erve as an educational tool.
- **S**ave money on well pumping costs.
- **E**asy to maintain and aesthetic to building's exterior.

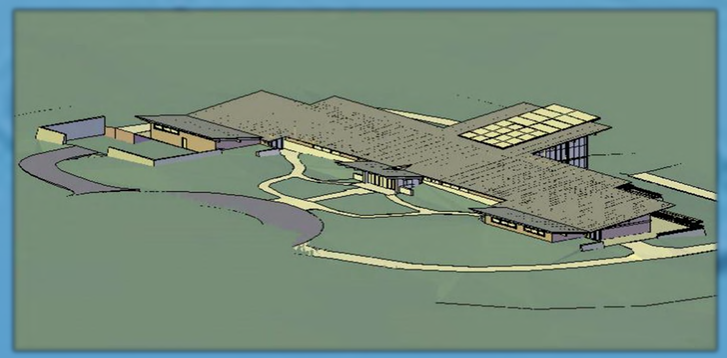
Components

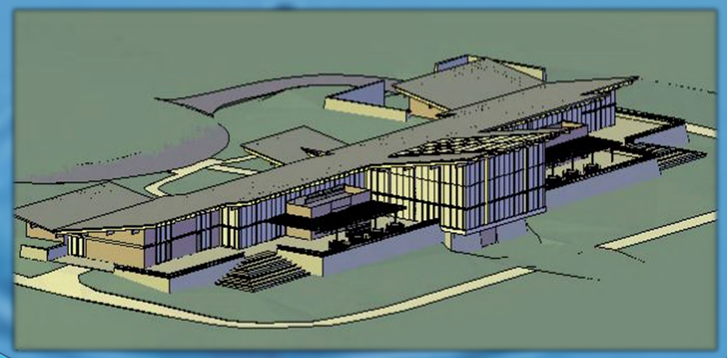
- **R**ainwater Collection
- **F**irst-Flush/Filtration
- **T**ransportation to Storage Area
- **S**torage Area
- **T**ransportation to Conservatory
- **O**verflow Mechanism
- **E**ducational Addition to System

Methods

- **K**inematics: $v_f^2 = v_i^2 + 2ad$
- **S**CS Method: $q_p = q_u A Q$
- **B**ernoulli's Equation:
  $h_1 + \frac{P_1}{\rho g} + \frac{v_1^2}{2g} + W_{1-2} - F_{1-2} = h_2 + \frac{P_2}{\rho g} + \frac{v_2^2}{2g}$
- **R**ainfall Amount: $RF_{collected} = A * \frac{0.4675\ gal}{in\ ft^2} * P$
- **W**ater Balance:
  $H_2O_{stored} = RF_{collected} - Irrigation$

Proposed Visitor's Center





Sustainability

Our system lessens the risk of:
- depleting a natural resource
- water overconsumption or waste
- debris in Lake Fayetteville due to our first flush system.

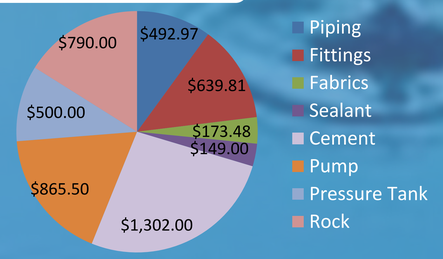
The system requires minimal maintenance, is easily operated and is a well publicly perceived Low Impact Development (LID) project.

From the six core principles for sustainable design of buildings, we have:
- protected and conserved water
- optimized energy use
- optimized building space and material usage.

For the visitors, this can be educational and motivational to incorporate small rain water harvesting systems in their home gardens which will enhance sustainable social interaction and participation and lessen utilities costs for families.

Capital Cost

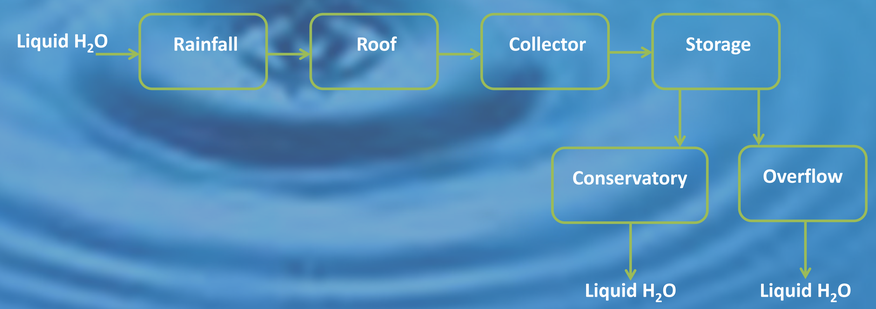
Total System: ~$4915



System Overview

- **P**rovides 600 gallons per day of rainwater to the plants in the conservatory.
- **S**tores approximately 6500 gallons in a cement cistern in the basement area.
- **I**s functional to provide the irrigation requirements an average of 80% of days annually.
- **I**s capable of carrying the peak flow rate of runoff from the roof of up to the 10-year 24-hour storm.
- **U**tilizes a 4" and 8" piping system to transport rainwater from the roof to the storage area.
- **C**onsists of a pump and pressure tank combination to deliver rainwater to the plants.
- **E**mploys a passive overflow measure for safety.
- **A**dditional suggested educational components include a diorama, decorative hose, and a bike pump.

Process Flow Chart



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