Abstract

The focus of this thesis will be on the hydrologic response the green roof has to storms of various lengths and intensities as well as the thermal effects throughout the summer, fall, and winter. The Javits green roof retained 81.0% of the precipitated water from May 31, 2015 to October 10, 2015 and 77.8% from May 2014 to October 2015. The Javits green roof fully retained precipitation from rain events with less than 12.7 mm of rain. For rain events with greater than 12.7 mm of rain, the Javits green roof retained 66.2% of the volume. Detention period estimated for the JGR ranges from 0 minutes to 8.2 hours depending on the antecedent dry period and storm intensity and the typical detention period for any given storm was one third of the storm duration. The JGR is most effective when a window of at least 60 to 70 hours separates subsequent storms. A statistical analysis was performed to determine the relationship between lysimeter mass and antecedent time and to determine the effects each parameter (precipitation, runoff, retention time, antecedent, and detention time) has on the change in lysimeter mass. The runoff and precipitation were determined to have the greatest effect. A relationship was found for storms greater than 24 hours with an R^2 of 0.54 and this equation can be used to predict the change in lysimeter mass with the antecedent time and can estimate the runoff using the water balance equation. The evapotranspiration was calculated using the Penman-Monteith during the thirty two rain events of 2015and was found to make up a small portion of the overall water balance. A sensitivity analysis was performed to determine the effects of assuming a crop type for the Penman-Monteith equation. The assumed crop did not have a significant effect on the calculations. The infrared surveys demonstrated the insulating effects on the green roof

during both extreme summer and winter temperatures. Temperatures from infrared surveys performed on 08/08/15, 08/22/15, and 01/22/16 were plotted against the respective evapotranspiration, net radiation, and lysimeter mass values. As the temperatures increase so do the evapotranspiration and net radiation and as the temperatures decrease, the evapotranspiration and net radiation decrease. The lysimeter mass decreases as the temperatures increase and increase as temperatures decrease. During the summer, the exterior temperature on both roofs ranged from 16.6˚C to 40.0˚C and the indoor temperatures underneath both roofs ranged from 27.7˚C to 30.3˚C. During the winter, the exterior temperature on both roofs ranged from -11.7˚C to 1.6˚C and the indoor temperatures underneath both roofs ranged from 18.4˚C to 20.8˚C.