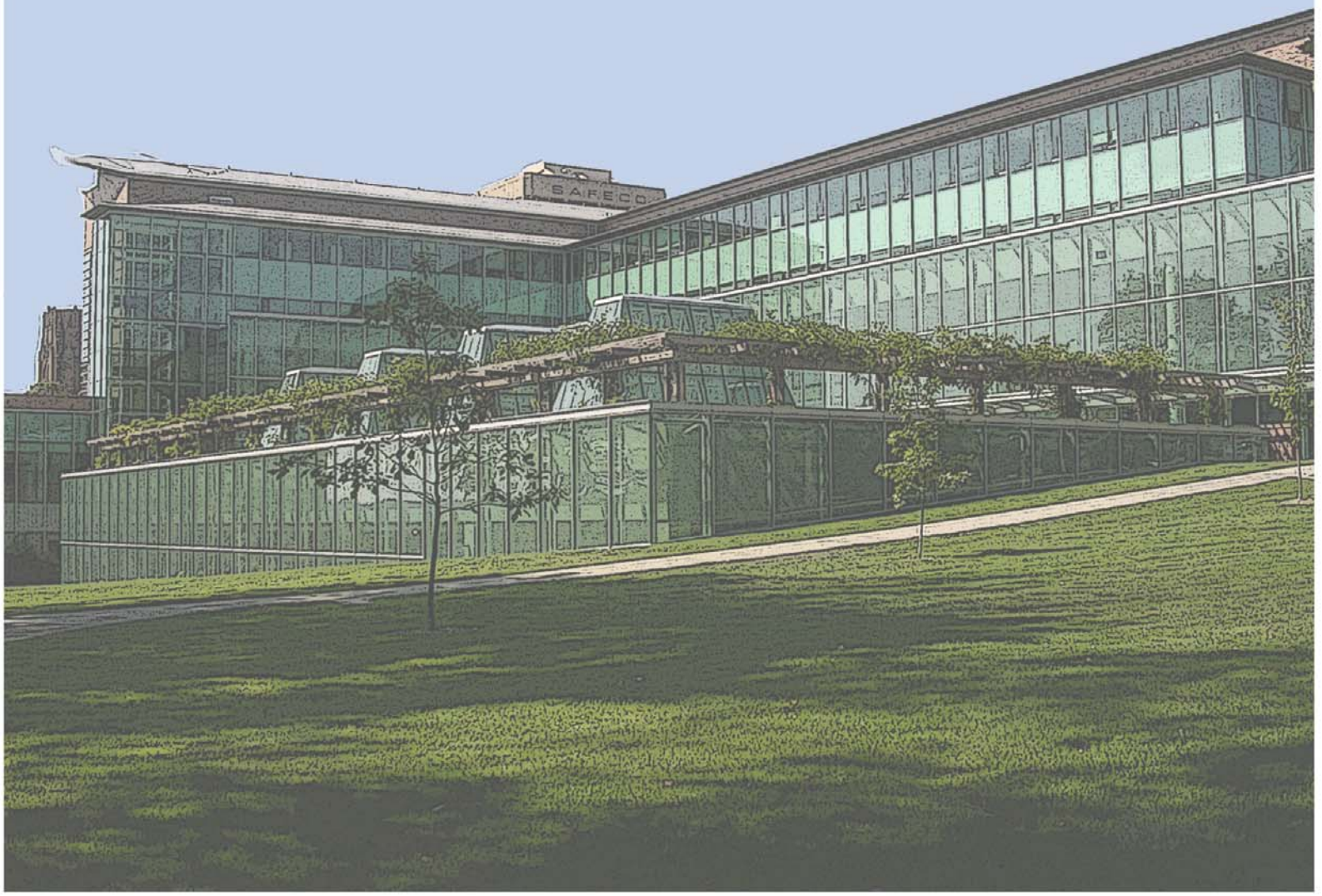
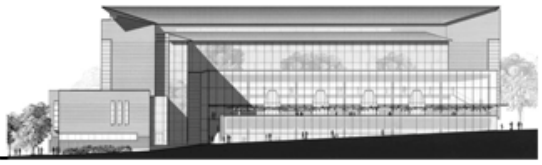
Construction Managment Breadth

Cost Analysis of Rainwater Catchment System





Introduction

In the LEED Breadth portion of this report, the feasibility of implementing a rainwater catchment system to offset the cooling tower water makeup requirements in William H. Gates Hall was studied. This analysis looked at the how much such a system could offset the water demand of the cooling towers, as well as the other components that would be required for functional operation of the system. While the rainwater catchment system proved to offset the water required for the water makeup, the cost implications of such a system need to be analyzed to determine if the first cost are justifiable in the lifecycle of the system. The Construction Management Breadth examines these cost and the payback period of implementing a rainwater catchment system.

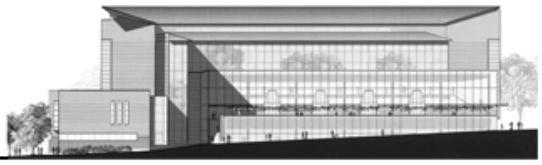
Rainwater Catchment System First Cost

The following table looks at the first cost for implementing the rainwater catchment, including both the cost of the actual components of the rainwater catchment system and the cost associated with increasing the size of the cooling tower pit, where the cistern will be located. All cost values were obtained from R.S. Means and include overhead and profit.

Table 7.1 – Rainwater Catchment System First Cost

Proposed System First Cost			
Rainwater Catchment System			
Component	**Quantity**	**Unit Cost**	**Cost**
Cistern - 10,000 gal	1	$10,000.00	$10,000.00
First Flush Diverter	1	$137.46	$137.46
PVC Piping - 2"	40 L.F.	$3.30	$132.00
		Subtotal	**$10,269.46**
Cooling Tower Pit Addition			
Component	**Size**	**Unit Cost**	**Cost**
Excavation	192.6 C.Y.	$11.40	$2,195.64
Slab On Grade	260 S.F.	$6.05	$1,573.00
Foundation Walls	51.1 C.Y.	$325.00	$16,607.50
(Including Formwork, Concrete, Reinforcement & Finishing)			
		Subtotal	**$20,376.14**
Total System First Cost			**$30,645.60**

This cost analysis of the rainwater catchment system incorporates only the costs that are unique and specific to this system. This creates a first cost that is generated when adding these extra components to a typical chilled water plant system and makeup water requirements. In determining the first cost for this system there are several assumptions that were made. First, roof drains and downspouts are assumed to already be considered into the cost of the building and the piping required to divert rain water to the cistern is negligibly different from the piping requirements of sending storm water to a storm water collection system. Additionally, it is also assumed that cooling tower water treatment and filtration



components are typical for supplying makeup water to the cooling towers, and a typical makeup water supply incorporates the same water treatment types at the water supply from the rain water catchment system.

Water Cost Savings

The following charts look at the total monthly and yearly water cost for a makeup water system using 100 percent supply water and the system utilizing rain water to offset a portion of the supply water. Additionally, the total potential yearly savings of water cost by offsetting a portion of the demand is determined.

Table 7.2 – Total Makeup Water Cost for !00% Supply Water

Month	Makeup Water (Gallons)	Cost per 100 gallons	Cost per Month
January	714,240	$0.43	$3,071.23
February	645,120	$0.43	$2,774.02
March	714,240	$0.43	$3,071.23
April	691,200	$0.43	$2,972.16
May	714,240	$0.43	$3,071.23
June	691,200	$0.43	$2,972.16
July	714,240	$0.43	$3,071.23
August	714,240	$0.43	$3,071.23
September	691,200	$0.43	$2,972.16
October	714,240	$0.43	$3,071.23
November	691,200	$0.43	$2,972.16
December	714,240	$0.43	$3,071.23
Total Yearly Makeup Water Cost			**$36,161.28**

Table 7.3 – Total Makeup Water Cost After Rainwater Contribution

Month	Makeup Water (Gallons)	Cost per 100 gallons	Cost per Month
January	557,100	$0.43	$2,395.53
February	528,720	$0.43	$2,273.50
March	603,660	$0.43	$2,595.74
April	618,450	$0.43	$2,659.34
May	661,860	$0.43	$2,846.00
June	644,640	$0.43	$2,771.95
July	688,050	$0.43	$2,958.62
August	679,320	$0.43	$2,921.08
September	635,910	$0.43	$2,734.41
October	618,210	$0.43	$2,658.30
November	525,330	$0.43	$2,258.92
December	539,640	$0.43	$2,320.45
Total Yearly Makeup Water Cost			**$31,393.83**

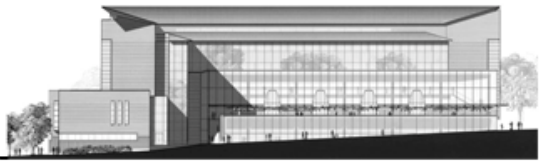


Table 7.4 – Water Cost Savings

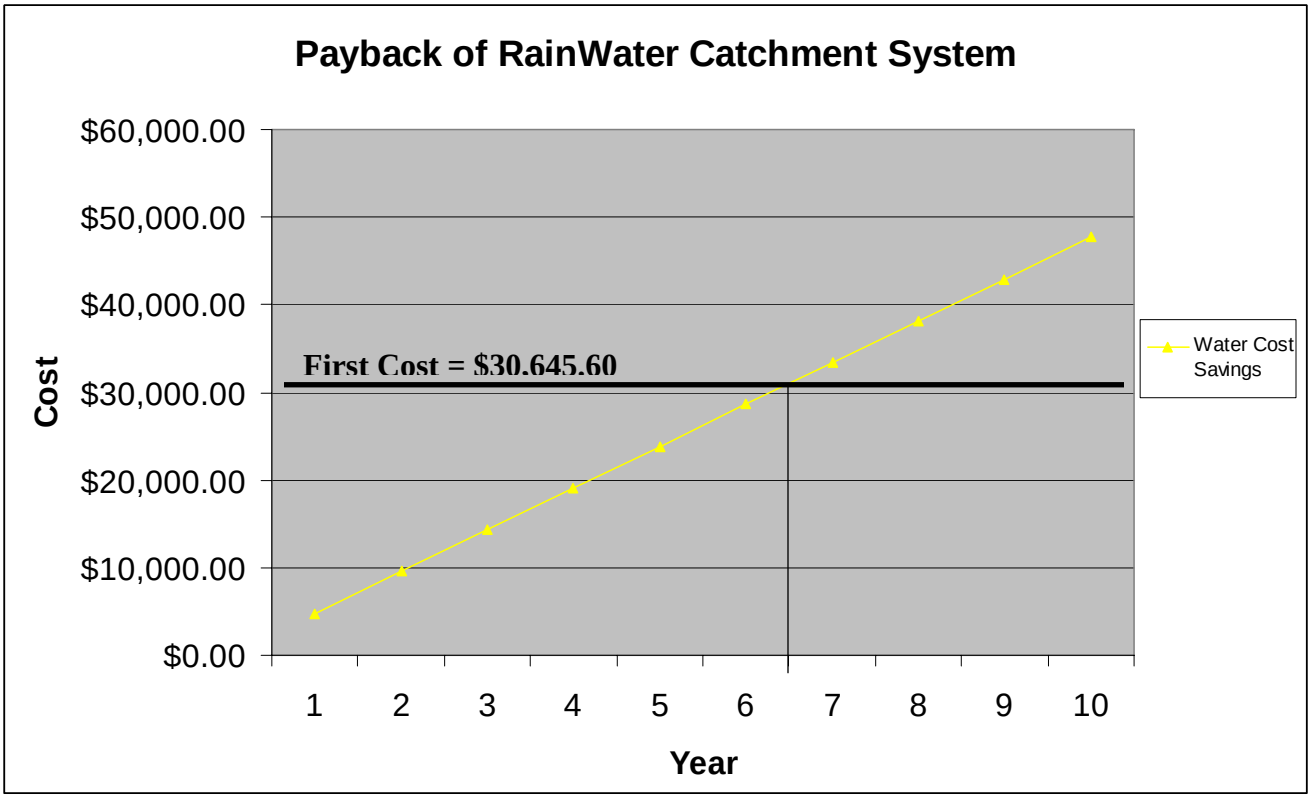
Yearly Water Cost Savings	
Existing System	$36,161.28
Proposed System	$31,393.83
Savings	**$4,767.45**

By using the total collectible rainwater each year and supplying it to the cooling tower water makeup, a total of $4,767. 45 can be saved each year in water cost.

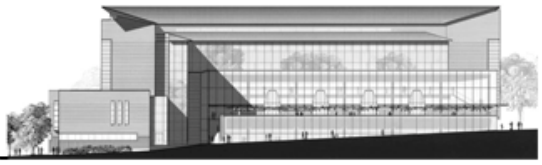
Payback Period

The following payback period looks at the length of payback of implementing a rainwater catchment system in William H. Gates Hall. The following figure and the payback analysis looks at how long the water savings from utilizing rain water takes to offset the initial increased cost of the rainwater catchment system.

Figure 7.1 – Payback Analysis of Rainwater Catchment System



As the graph indicates, the water savings pays back the increased initial cost of the system over a period of 6.5 years. This payback analysis assumes constant water rates throughout the entire period studied. In reality, water rates would most likely increase throughout this



time period, which would increase the rate at which the rainwater catchment system reached its payback.

For the purpose of this analysis the projected life of the rainwater catchment system is 25 years. A payback period of 6.5 years with an estimated life of 25 years is reasonably acceptable for this system. The system will incur almost 19 years of savings on water cost at almost $5,000 dollars per year, for a total return on investment of approximately $95,500. This value will increase over time as water rates continue to rise.

Conclusion

When considering the feasibility of implementing a rain water catchment system for William H. Gates Hall to offset cooling tower water makeup requirements, both the initial system first cost and the payback period of the system are considered. The first cost of the system totals $30,645.60 and includes both components of the rainwater catchment system and the construction/structural components need to expand to cooling tower pit. Additionally, the amount of water conserved by utilizing the rainwater catchment system allows for financial savings of approximately $4,767 per year, when considered at the current water rate. When the system first cost and system's resulting water savings are directly compared, it is determined that the rainwater catchment system has a payback period of approximately 6.5 years. This payback period is acceptable and allows for significant water cost savings throughout the life cycle of the system. It is recommended that a rain water catchment system be implemented in the design of William H. Gates Hall to offset the building non-potable water demands acquired by the cooling towers.