

Storm Water Management Plan for the PUPR & Guidelines for LEED certification of the PUPR Library



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Abstract

This project consist in the construction of a stormwater management plan for the PUPR. The needed storage volume was obtained, using calculation method. The proposed technology for mitigation was StormTech, which are subsurface chambers of high capacity. Using computer programs, a location and design layout was constructed. The construction of this project will control the flooding in the campus in major rain events.

The second part of the project was to set base guidelines so in the future the PUPR can achieve a LEED certification for the Library building. Using the LEED v4 O+M, a guidance was constructed for the pre requisites and potential credits. This guide will help forthcoming submittal to the USGBC.

Introduction

The main objective of this project was to create a flood management plan for the Polytechnic University of Puerto Rico (PUPR). The PUPR, faces a problem of storm water control and management, causing flooding in major rains events. The purpose of the second part of this project, was to set a base guidelines so in the future the PUPR can achieve a LEED v4 for Operation and Maintenance of an Existing Building certification, in this case the Library of the PUPR. The PUPR is makings efforts to move into an innovative educational institution and a LEED certification will help to accomplish this.

Problem and Methodology

The PUPR has historically record several rain events, where facilities have been affected by flooding. These events have caused, loss and damage to property, also it represents a risk to public health. Using historical data of rain obtained from NOAA, a statistical analysis was performed to obtain the monthly and annual precipitation averages with a 95% confidence interval. Also the Maximum precipitation registered in one day was obtained.

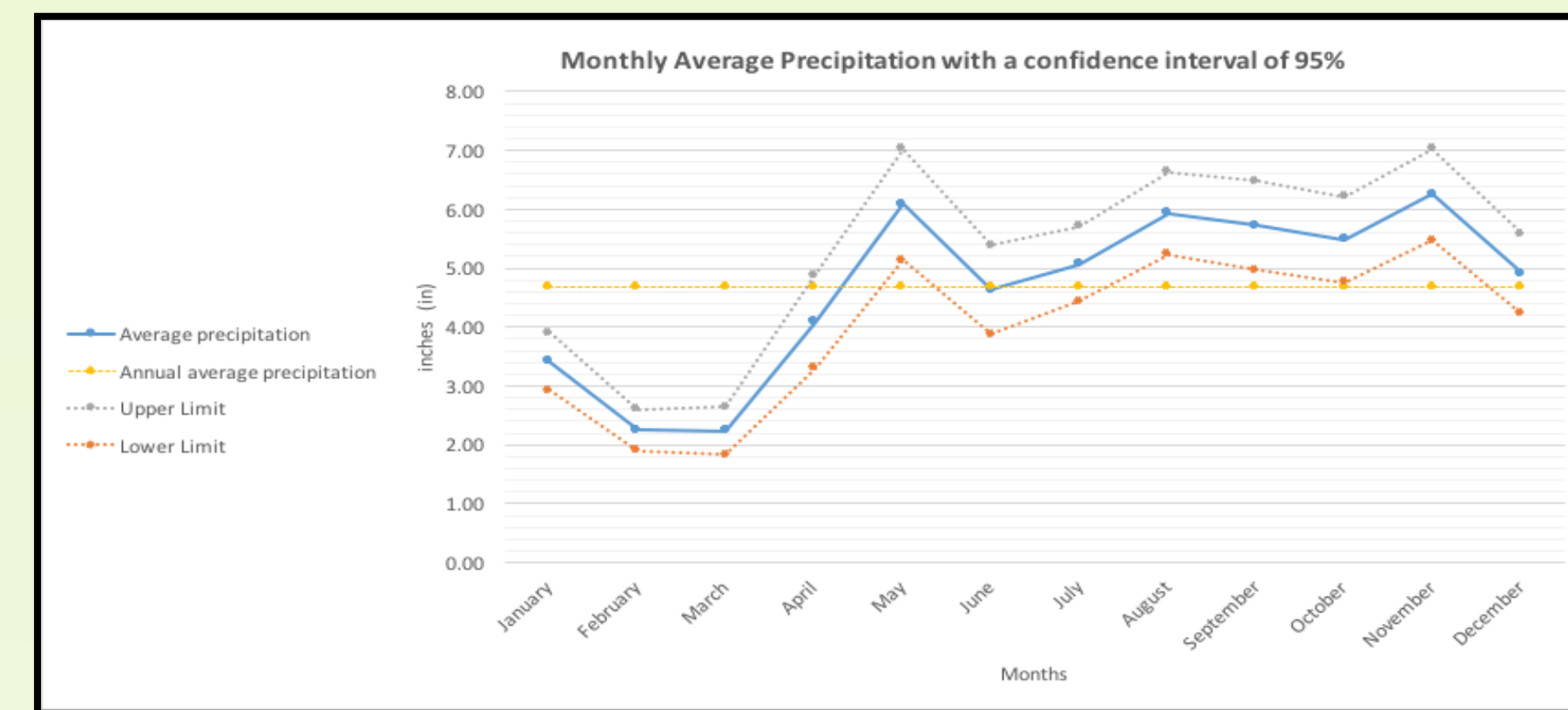


Figure 1. Monthly Average precipitation

Table 1. Maximum precipitation registered in one day

Year	Maximum Precipitation (inches)
2006	3.35
2007	2.44
2008	2.91
2009	3.85
2010	3.52
2011	5.76
2012	3.09
2013	9.23
2014	3.82
2015	1.82

With these data and area, using the rational method; $Q = C * i * A$ (Rational Method Equation) and the manning equation; $Q = \frac{1.49}{n} * AR^{2/3} * S^{1/2}$ (Manning Equation)

The storage area and redirection pipes diameters and slope needed for the mitigation project were obtained. In terms of the second part of the project, The LEED v4 of the USGBC, establishes that in order to achieve a certification, the project must meet a minimum program requirements, twelve (12) categories credits requisites and at least forty (40) credits. Following the guide, we were able to stablish a base guideline to start certifying the Library building of the PUPR.

Design

The technology proposed for mitigation is StormTech. The design specification as follows:

Table 3. Stormtech chamber design specification

Stormtech Chamber Design	
Required Storage Volume(cfs)	97686
Chamber Model	MC-4500
Stone Foundation Depth (in)	9
Stone Above Chambers (in)	24
Number of Chambers Required	533
Number of Endcaps Required	28
Max. Length(ft)	168.25
Max. Width (ft)	129.02
Area Required (ft ²)	26393



Figure 2. Stormtech chambers

StormTech consist of chambers of high storage capacity, the proposed location of these chambers is:

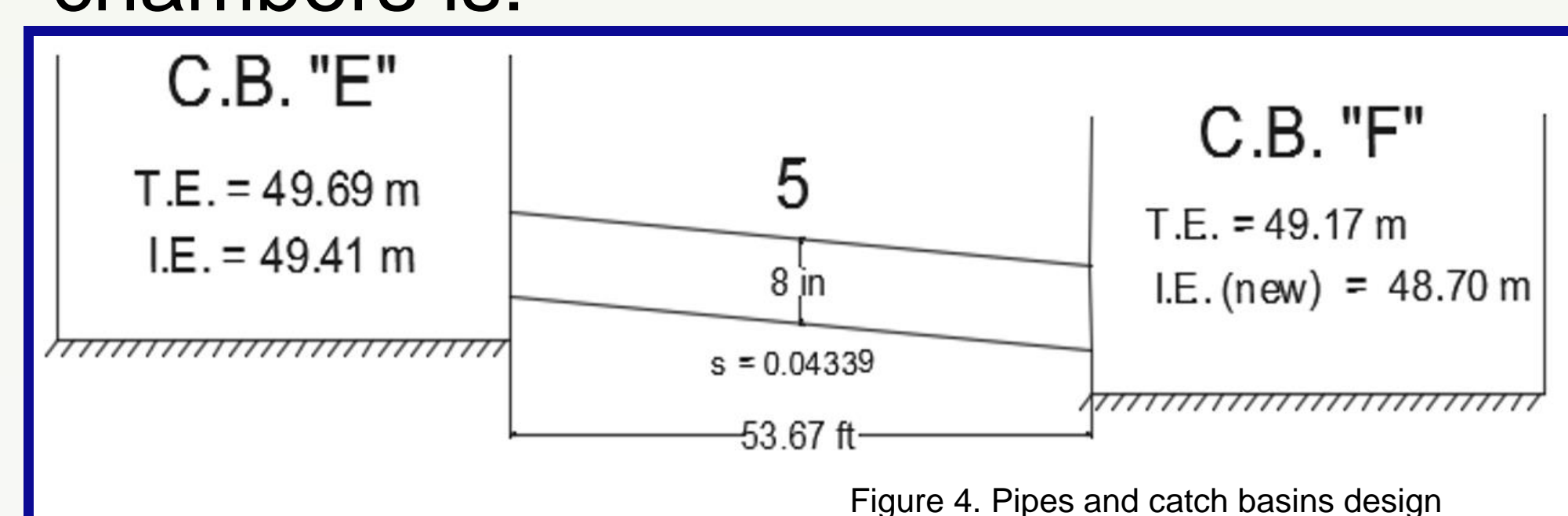


Figure 4. Pipes and catch basins design

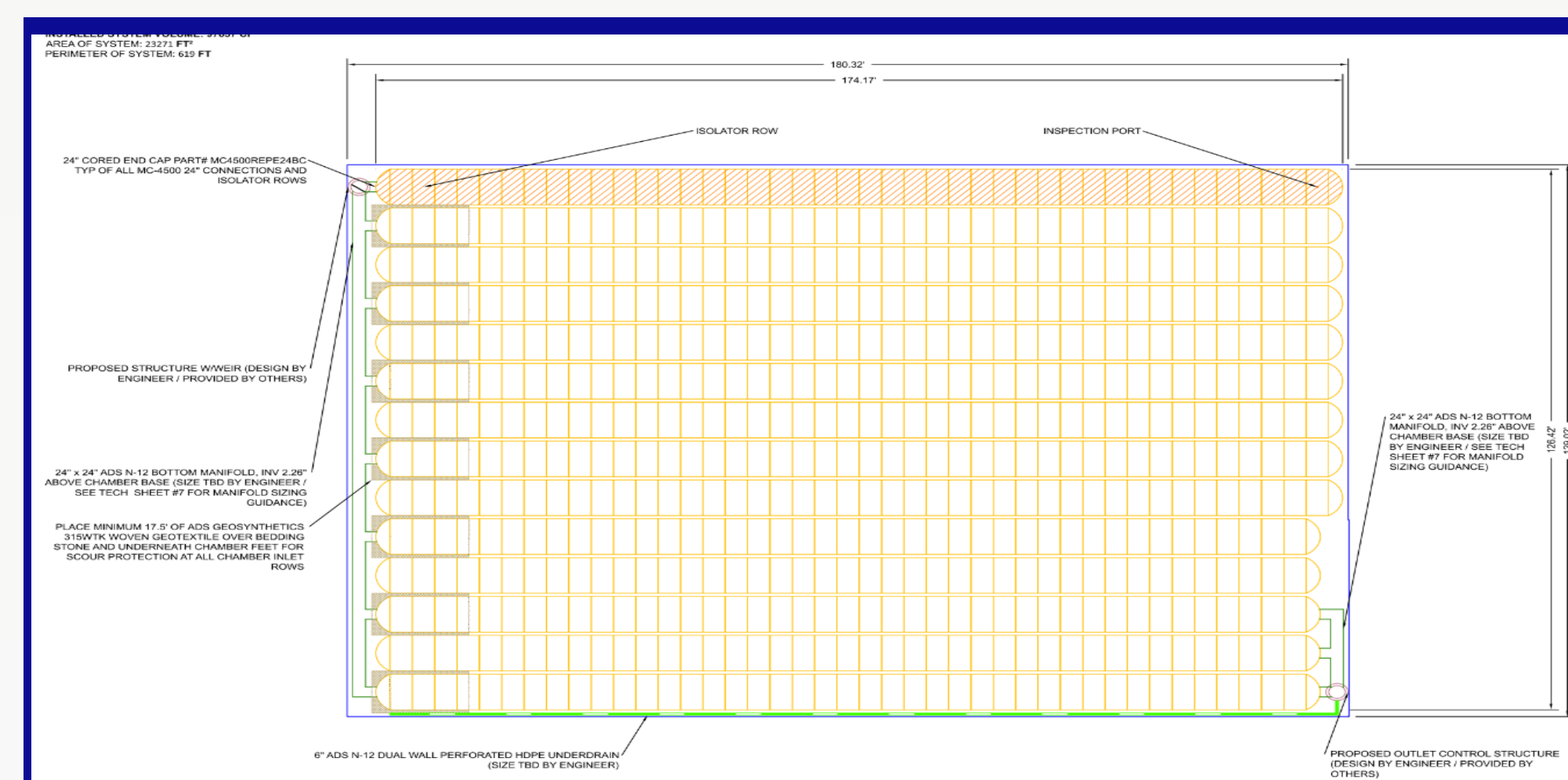


Figure 5. Computer generated conceptual layout

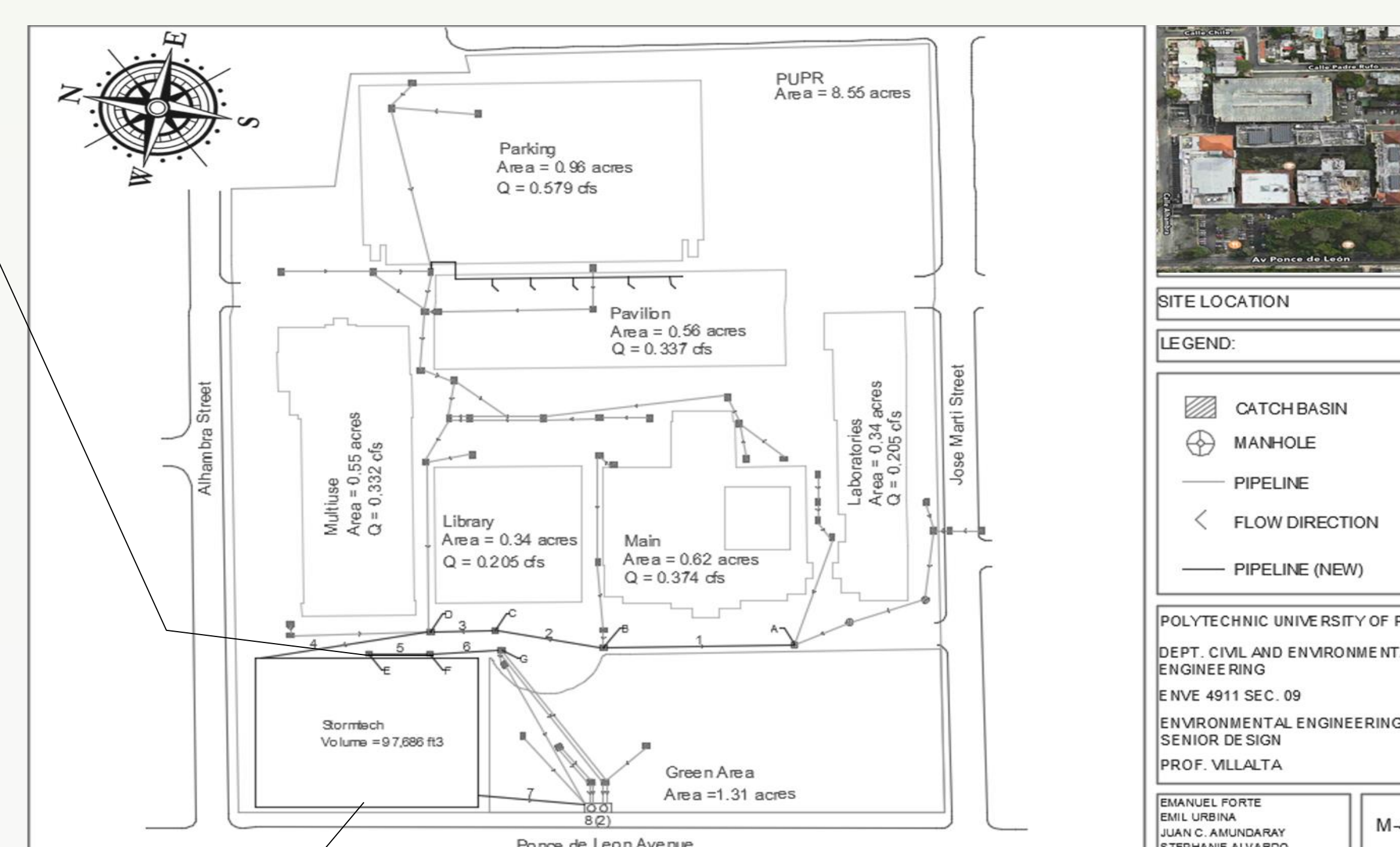


Figure 3. Proposed location for Stormtech chambers at PUPR

Results and Discussion

Flooding occurs with precipitation events of 2 inches in 3 hours. Rainfall intensity selected for mitigation project: 0.67 inches/hour. The required storage volume is 97,686 cfs. The pipelines diameter and slope calculated are summarized in the following table:

Table 2. Pipelines slopes and diameters

Pipe	Diameter (in)	Length (m)	Slope (%)
1	18	51.63	0.271
2	12	26.02	2.231
3	18	13.19	5.082
4	18	43.14	4.568
5	8	16.36	4.339
6	8	16.36	1.467
7	12	20.35	1.965

From these results, and considering the available space, the appropriate technology was chosen.

Regarding the LEED certification, the project was focused in evaluate the current infrastructure and the areas of opportunities to gain credits points and comply with the prerequisites of LEED v4 for Operation and Maintenance of an Existing Building.

Conclusion and Future Work

After performing this project it was concluded that the construction of this project will soothe significantly the amount of stormwater that is generated in a rain event, prevent the flooding in the PUPR and improve the quality of life of the university community. For the LEED certification, future work is needed to complete the compilation of information for all the credits and submit the paperwork to USGBC.

References and Acknowledges

- Maps & Data | NOAA Climate.gov. (n.d.). Retrieved March 26, 2016, from <https://www.climate.gov/maps-data>
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