2015 LAF CSI Program Landscape Performance Series:
The George Bush Presidential Library, Dallas, TX

Research Title: The University of Texas at Austin's Case Study Investigation 2015: The George W. Bush Presidential Center, Dallas, TX

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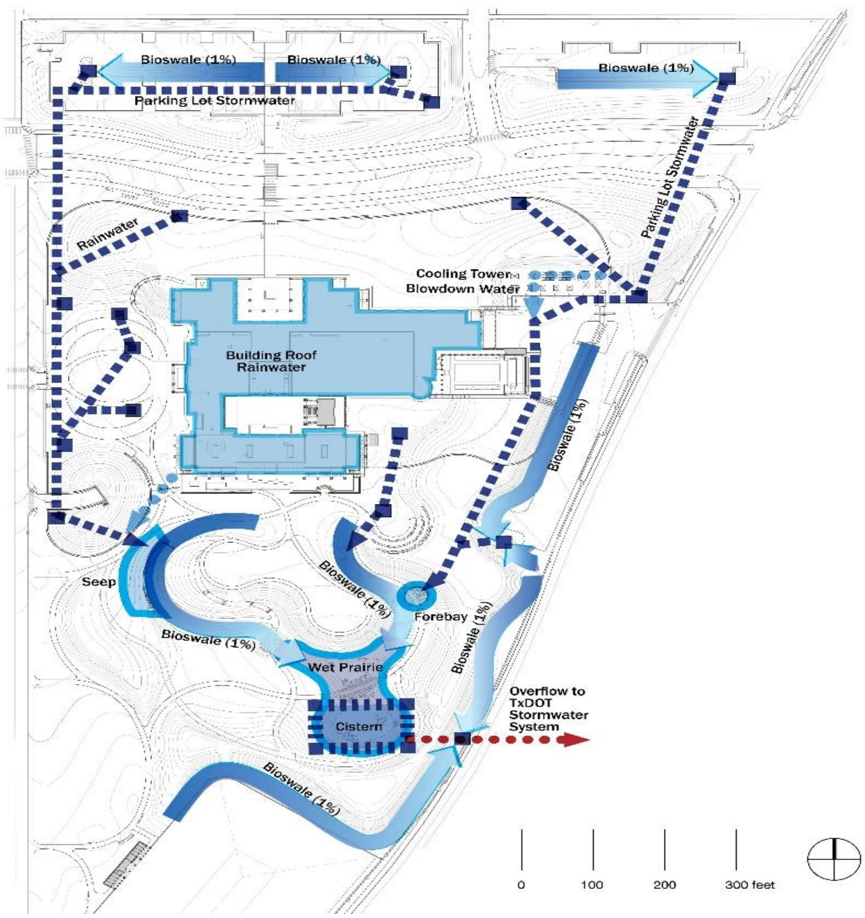
Project Firm: Michael Van Valkenburgh Associates, Inc., Herb Sweeny,
Sponsor/Research Partner: Landscape Architecture Foundation (LAF)

Performance Measures

Environmental Benefits

Treats more than 90% of average annual rainfall to remove an estimated 85% of total suspended solids.

Background
The George W. Bush Presidential Center (GWBPC) landscape incorporates an intricate water management system throughout the entire 24 acres of the site. All rainwater from the parking lots and building flows through the system along limestone seeps and bioswales, eventually collecting in a wet prairie at the end of the site. Below the wet prairie is a 250,000 gallon underground cistern. As water flows through water management systems, it is filtered and cleaned by soil and vegetation.



Methods
Data is collected from the LEED application compiled by the civil engineer, URS Corp. The engineer team first calculated the required drainage of the site based on the LEED requirements. The volumes treated by the different bioswales were then calculated.

Calculations

Step 1 REQUIRED DRAINAGE

976,500 ft^2 X 0.75 in X 1 ft / 12 in = 61031.25 ft^3 X 7.48 gal/ ft^3
= **456,513.75 gallons** ← 90% average rainfall

Step 2 AMOUNT OF AVERAGE TREATED PER BEST MANAGEMNET PRACTICE (BMP)

Parking Bioswale A = area collected = 54014 ft^2 X 0.75 in / 12 ft = 3,376 ft^3
= **25,251 gallons** / 456,514 gallons = **5.53%** of average rainwater on site treated by parking bioswale A

Parking Bioswale B = 36,590.4 ft^2 X 0.75 in/ 12 ft = 2,286.9 ft^3
= **17,106 gallons** / 456,514 gallons = **3.75%** of average rainwater on site treated by parking bioswale B

Parking Bioswale C = 44, 866.8 ft^2 X 0.75 in / 12 ft = 2,804.175 ft^3
= **26, 880 gallons** / 456,514 gallons = **4.59%** of average rainwater on site treated by parking bioswale C

Parking Bioswale D = 57,500 c X 0.75 in / 12 ft = 3,593.7 ft^3
= **26,880 gallons** / 456,514 gallons = **5.89%** of average rainwater on site treated by parking bioswale D

Parking Bioswale E = 27,007 ft^2 X 0.75 in / 12 ft = 1,687.95 ft^3
= **12,626 gallons** / 456,514 gallons = **2.77%** of average rainwater on site treated by parking bioswale E

Site Bioswale A = 211,266 ft^2 X 0.75 in / 12 ft = 13,204 ft^3
= **98,766 gallons** / 456,514 = **21.63%** of average rainwater on site treated by site bioswale A

Site Bioswale B = 266,587.2 ft^2 X 0.75 in / 12 ft = 16,661 ft^3
= **124,629 gallons** / 456,514 gallons = **27.3 %** of average rainwater on site treated by site bioswale B

Site Bioswale C = 35,283.6 ft^2 X 0.75 in / 12 ft = 2,205.225 ft^3
= **16,499 gallons** / 456,514 gallons = **3.61 %** of average rainwater on site treated by site bioswale C

Wet Prairie = 659, 063 ft^2 X 0.75 in / 12 ft = 41,191 ft^3
= **308,111 gallons** / 456,514 gallons = **67.49%** of average rainwater on site treated by wet prairie

<u>Totals</u>

5.53% + 3.75% + 4.59% + 5.89% + 2.77% + 21.63% +27.3% + 3.61% + 67.49% = **142.56 %** of average rainwater on site treated by BMPs

25,251 gallons + 17,106 gallons + 26, 880 gallons + 26,880 gallons + 12,626 gallons + 98,766 gallons + 124,629 gallons + 16,499 gallons = **656,748** gallons treated by BMPS

656,748 gallons (actual) / 456,514 gallons (required) = 1.44

Note that because the systems operated in series, most of the water is treated by more than one BMP.

Best Management Practice (BMP)	Description of BMP's Contribution to Stormwater Filtration	TSS Removal Efficiency (%)	% of Annual Rainfall Treated by BMP	Source of TSS Removal Efficiency data
Parking Area Bioswale	A vegetated filter strip captures water	65	5.53	National or regional sources
Parking Area Bioswale	A vegetated filter strip captures water	65	3.75	National or regional sources
Parking Area Bioswale	A vegetated filter strip captures water	65	4.59	National or regional sources
Parking Area Bioswale	A vegetated filter strip captures water	65	5.89	National or regional sources
Parking Area Bioswale	A vegetated filter strip captures water	65	2.77	National or regional sources
Site Bioswale A	A vegetated filter strip captures water	65	21.63	National or regional sources
Site Bioswale B	A vegetated filter strip captures water	65	27.3	National or regional sources
Site Bioswale C	A vegetated filter strip captures water	65	5.35	National or regional sources
Wet Prairie	An extended detention wet prairie	40	67.49	National or regional sources
Weighted average TTS Removal efficiencey for 90% for annual rainfall treated (%) (must be at least 80%)			85.47	
Total Annual Rainfall Treated (%)			144	

Limitations

The calculations are based on a 2 year storm event and do not account for larger storm events. The TTS removed is an estimation. The efficiency of pollutant removal can change over time.

Reference

- "SS Credit 6.2: Stormwater Design – Quality Control", LEED for New Construction Design, Jeffrey L. Bruce & Company, LLC
- Green Building Design and Construction. Washington, DC: U.S. Green Building Council, 2009. Print.

Reduces potable water consumption for irrigation by 73% or 6.126 million gallons per year compared to a baseline case.

Background

The George W. Bush Presidential Center (GWBPC) landscape incorporates an intricate water management system throughout the entire 24 acres of the site. All rainwater from the parking lots and building flows through the system along limestone seeps and bioswales, eventually collecting in a wet prairie at the end of the site. Below the wet prairie is a 250,000 gallon underground cistern. These water recycling techniques have successfully decreased the irrigation volume originally predicted for this project.

Calculations for the LEED baseline water quantities were generated by the irrigation designer, Jeffrey L. Bruce & Company, LLC, on the project for the LEED application process.

Methods

The LEED baseline case is calculated using average values for regional evapotranspiration rate (ETO), species factor (ks), density factor (kd) and microclimate factor (kmc) for each vegetation type and equipment used on the project.

Data

Month	Potable water (gallons)	LEED Baseline
March '14	264,000	553,555
April '14	-	700,529
May '14	-	1,021,948
June '14	-	1,153,812
July '14	127,000	1,192,273
August '14	357,000	1,107,110
September '14	1,312,000	824,152
October '14	191,000	569,136
November '14	-	370,868
December '14	1,000	255,487
January '15	-	255,487
February '15	-	346,144
Total Observed Demand	2,252,000	8,377,501
% reduction in actual water used compared to estimation	**73%**	

8,377,501 – 2,252,000 = 6,125,501 gallons

Limitations

Though the observed demand is a true observation of water use, the LEED baseline calculations are an estimation.

Reference

- Data Source, Jeffrey L. Bruce & Company, LLC, March 26th, 2015
- Green Building Design and Construction. Washington, DC: U.S. Green Building Council, 2009. Print.
- Http://www.usgbc.org/credits/existing-buildings/v2009/wec3. N.p., n.d. Web. 24 July 2015.

Achieves a Biomass Density Index* – a measure of the density of plant layers covering the ground – *of 3.24 for vegetated areas of the site, 62% higher than that of a traditional lawn.

Background
Biomass density index (BDI) is a measure of vegetation development appropriate to the specific regional climate.

"Environmental, economic, and social benefits emerge from all general characteristics of living vegetation, such as shading of structures or recreational spaces, atmospheric and building cooling, building protection from cold or otherwise damaging winds, reduced soil water evaporation (hence reducing irrigation), improved air quality (absorption of particulate PM10 and PM20 and low level ozone), noise reduction, storm run-off reduction (from improved soil permeability and vegetation canopy interception and transpiration), and improved water quality (as runoff or sub-soil recharge)." (Sites V2 Reference Guide, p.135)

Methods
The Biomass density index is calculated using the methods described in the Sites V2 Reference Guide.

1. Draw a map of the zones of land cover or vegetation types on site. Determine the percent of total area for each distinct zone.
2. Decide on a vegetated area or land cover zone categorized in the Sites reference book, areas should not overlap
3. Exclude areas of open water or invasive species

To be most meaningful for the purposes of comparing this site to a more traditional institutional site with vast areas of lawn, the BDI reported in the benefit is the BDI for the vegetated areas of the site – it was calculated without including the impervious areas (building, parking lots).

Land cover/vegetation type zone	Biomass density value*	Percent of total site area	Biomass density value x percent total site area (column B x column C)	Percent of total vegetated area of site	Biomass density value x percent total vegetated area (column B x column E)
A	B	C	D	E	F
Tree understory	6	13.13%	0.786	18.02%	1.081
Shrubs	3	8.05%	0.242	11.05%	0.331
Managed turf >3”(Habiturf ™)	3	22.02%	0.661	30.21%	0.906
Unmanaged grass layer (prairie/pasture) >9”	2	28.62%	0.572	39.27%	0.785
Wetland	6	1.62%	0.097	2.22%	0.133
Impervious cover (includes building footprint)	0	27.12%	0	-	-
BDI for whole site			**2.36**		
BDI for vegetated areas only					**3.24**

A typical lawn would be classified as Managed turf <3”, which has a BDI of 2.

(3.24 – 2)/2 = 62% higher BDI than a traditional lawn

Limitations
Vegetation type areas are an approximation.

References

- "Google Maps." Google Maps. N.p., n.d. Web. 20 June 2015.
- SITES V2 Reference Guide: For Sustainable Land Design and Development. Austin, TX: Sustainable Sites Initiative, n.d. Print. 2014
- The Bagby Street Reconstruction Project Planting Plan from Design Workshop’s Construction Documents

Social Benefits

Helped attract over 819,488 visitors to the Presidential Center in the first two years since it opened.

Background

Although the site offers docent led educational tours for children or adults, data on the number of tours is not yet collected. The only occupancy data collected is the number of people who have visited the facility since opening in April 2013.

Data

GWBPC opened: April 2013
Data Collected: July 2015
Number of visitors since opening: 819, 488

Limitations

The park is open to the public which makes monitoring the number of patrons difficult. Visitors who did not enter the site through the library are not accounted for in this benefit. The data reflects the number of people who visited the presidential library building. This does not ensure that all these patrons went outside into the landscape.

References

- Data source, Operations Director at the George W. Bush Presidential Library

<u>Economic Benefits</u>

Saved $821,000 in disposal costs by using all 100,000 cubic yards of excavated soil on-site.

Background

The 100,000 cubic yards of fill from building construction was used on-site instead of disposed of in a landfill. Doing so saved money on construction costs, it also saved space in the landfill and reduced the project's carbon emission footprint.

Methods

Numbers on cubic yards of fill provided by MVVA. The general contractor bids $8.21 per cubic yard for disposing excavated soil off-site.

Data

100,000 cubic yards X $8.21 = $821.000

Limitations

Calculations on the amount of fill are an estimate. This metric does not deduct the costs of moving fill around the site to create desired topography.

References

- Data source, Bid for soil removal, Manhattan Construction Contractor
- Personal communication, Herb Sweeny IV, Senior Associate, Michael Van Valkenburgh Associates Inc.

Reduces lawn mowing costs by approximately $41,160 by using native Habiturf ™, which requires only 4 mowings per year.

Background

The specially formulated short-prairie grass mixture of the native lawn is composed of buffalo grass, blue grama, texas grama, poverty dropseed, and curly mesquite. The lawn is maintained at 6-8 inches and mowed only four times a year. The nearly 9 acre lawn represents the largest use of Habiturf ™.

Methods

A standard lawn is mowed approximately 25 times per year. Calculations are made with this standard and the costs to mow the lawn at the GWBPC provided by the maintenance contractors.

Data

$1,960/mowing

4 mowings a year = 4 X $1,960 = **$7,840**

25 mowings a year = 25 X $1,960 = **$49,000**

$49,000 - $7,840 = **$41,160**

Limitations

The landscape at the GWBPC is treated in a holistic matter which supports the soil's food web. Only organic treatments are used and nearly no pesticides. As a result, manual hand-weeding is required until there is full establishment of native species and the desired ecosystems. The hand-weeding is costly but preferred to herbicides because it supports the design intent of the project which is to create working ecosystems with healthy soils.

References

- Data Source, Maintenance bid from Southern Botanical Contractor
- "Habiturf." Lady Bird Johnson Wildflower Center. University of Texas at Austin. n.d. Web. 17 September
- "The Landscapes of the George W. Bush Presidential Center" Commemorative Book, Michael Van Valkenburgh Associates, Inc., 2013

Reduced water costs by $1,846.70 during peak irrigation times with water recycling systems

Background

The LEED platinum certified building at the GWBPC recycles water to the landscape from the cooling towers and roof top rainwater collectors. In addition, water collected on the landscape is circled back to irrigate plantings.

Methods

Data on water usage was collected for the "Peak Irrigation Demand Detailed Non-potable Water Use Source" calculations compiled by the engineering group Jeffrey L. Bruce & Company, LLC. Costs for water in the City of University Park, TX were provided by the Director of Operations of the GWBPC. The non-potable water collected and used is given a nominal value to show savings.

Data

July water use

Irragation Desin Case (July)	
Subtotal TWA (gallons):	**1,057,408**
Non-potable water use (July)	
Cooling tower Blowdown (gallons)	110,357
Roof (gallons)	124,722
Site (gallons)	77,921
Total non-potable water use:	**313,000**
Irrigation Design Case TPWA (gallons)	**744,408**

Water costs

Consumption charge*:* $4.30 per 1,000 gallons consumed

Conservation surcharge: During the months of May through October, an additional $1.60/1,000 gallons is assessed for all consumption over 30,000 gallons/month

(30,000/1,000) X $4.30 = $129

313,000gallons – 30,000gallons = 283,000gallons

$4.30 + $1.60 = $5.90

(283,000gallons / 1,000) X $5.90 = $1,669.70

$129 + $1,669.70 = **$1,798.7**

Limitations

Data on non-potable water use was only available for one month during peak irrigation times. Months during low irrigation times would exhibit a higher savings.

References

- Data source, City of University Park municipal water charges, July, 2015
- "Peak Irrigation Demand Detailed Non-potable Water Use Source", Jeffrey L. Bruce & Company, LLC, July, 2015

Cost Comparison

Background

The pedestrian bridges on this project are made of black locust (*Robinia pseudoacacia*), a species favored by the MVVA firm. Black locust is a hardwood comparable to tropical hardwoods, such as ipa, and known for its rot and insect resistance. Unlike tropical woods, black locust is grown locally which decreases the carbon footprint of transportation and does not lead to rainforest degradation. Black locust lasts longer than pressure treated wood. Pressure treated wood, such as cedar or pine, is treated with various Red List chemicals. The lumber used on the GWBPC is sourced from black locust Lumber a vendor located in Pennsylvania.

Methods

The firm provided cost of the total black locust lumber bid. Using bridge dimensions, the cost per plank was calculated. This cost was compared to a typical pressure treated lumber of similar dimension. The pressure treated wood has been treated with Copper Azole.

Data

Bridge	Length (ft)	Width (ft)	Approximate number of black locust 4 x 8 x 8 planks	Approximate Costs
A	60	8	90	$15,233
B	42	8	63	$10,663.22
C	100	8	150	$25,388.61
				$51,285
Black Locust 4 X 8 X 8ft				
Total Cost	$51,285			
Total planks	303			
Cost per plank	$169.26			

	Cost per plank	Total cost for 303 planks
black locust	$169.26	$51,285.00
pressure treated	$44.97	$13,625.91
	Cost differnce	**$37,659.09**

Limitations

The dimension of the black locust planks used on the bridges (4 X 8 X 8ft) is not a standard dimension for lumber. The pressure treated wood used to compare costs is a 4 X 8 X 12ft dimension. A more in-depth study would incorporate service lifetimes for each type of lumber.

References

- Green, Jared. "Why Use Ipe When You Can Have Black Locust?" The Dirt. ASLA, 10 Nov. 2011. Web. 15 July 2015.
- "The Landscapes of the George W. Bush Presidential Center" Commemorative Book, Michael Van Valkenburgh Associates, Inc., [not published]
- Product Display. Lowes, n.d. Web. 13 July 2015.
- "Sustainability" Black Locust Lumber, U.S.A. N.p., n.d. Web. 13 July 2015.