



LANDSCAPE PERFORMANCE SERIES

Sidwell Friends Middle School – Washington, D.C.

Methodology for Landscape Performance Benefits

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Environmental

Prevents over 317,900 gallons of wastewater from entering the District of Columbia's overburdened sewer system in one year, saving \$1,687 in sewer charges.

Flow meters from Sidwell Friends Middle School record the volume of wastewater that is treated on site. According to Pete Munoz, senior engineer at Biohabitats, the wastewater system is a "closed loop system", meaning the cleansed wastewater is recirculated to be reused in the school toilets. Sidwell's flow meters indicate that 317,909 gallons of wastewater from the middle school's toilets were produced from April 2011 through March 2012.

Wastewater data was collected by measuring the duration of pump use from wastewater leaving the settling tank. These measurements are posted online at: (<http://buildingdashboard.com/clients/sidwell/>) by Lucid Design Group.

Month	Volume (gal.)
April (2011)	23,400
May	26,732
June	10,387
July	25,372
August	26,121
September	25,384
October	16,632
November	30,664
December	25,941
January (2012)	34,004

February	41,083
March	32,189
TOTAL	317,909

District of Columbia Water and Sewer Authority sewer rate is \$5.29 per 1,000 gallons of wastewater that enters their sewer system. The calculation of the total saving is:

$$(317,909 \div 1000) \times \$5.29 = \$1687.74$$

References

District of Columbia Water and Sewer Authority Rates and metering. Retrieved July 2012 from <http://www.dewater.com/customercare/rates.cfm>

Sidwell Friends School (n.d.). Graph illustration from the Building Dashboards Webpage retrieved July 2012 from <http://buildingdashboard.com/clients/sidwell>

Reduces potable water consumption by an average of 8,500 gallons per month by reusing treated wastewater to flush toilets.

The “closed loop” system treats and cleanses 100% of the middle school's wastewater, which is then stored and reused to flush school toilets.

Recycled water volume data, shown in the table below was gathered by the Sidwell Friends Building Dashboard web page. Recycled water estimates were calculated by Lucid Design Group, which measured the duration of water pump usage that was used to carry cleansed wastewater from the basement cistern to the middle school's toilets. The total duration of pump usage was converted to gallons pumped by using the manufactures specs that indicate pump capacity per minute.

Monthly recycled volume data from January 2011 to June 2011 indicate that a total of 51,535 gallons of wastewater was recirculated to the school's toilets, equivalent to a monthly average of 8,500 gallons.

Month	Volume (gal.)
January	5008
February	15,838
March	10,937
April	3816
May	15,835
June	101
Jan-June	51,535

District of Columbia Water and Sewer Authority water rate is \$4.57 per 1,000 gallons of water used. The calculation of the total saving is:

$$(51,535 \text{ gal.} \div 6 \text{ months}) = 8,589 \text{ gal.} \div \text{month on average}$$

$$(8,589 \div 1000) \times \$4.57 = \$39.25$$

References

District of Columbia Water and Sewer Authority Rates and metering. Retrieved October 2012 from <http://www.dewater.com/customer-care/rates.cfm>

Sidwell Friends School (n.d.). Graph illustration from the Building Dashboards Webpage retrieved July 2012 from <http://buildingdashboard.com/clients/sidwell>

Captures 68% of rainfall from a 1-year storm, 9,820 gallons, in the green roof on the middle school addition.

Storm event rain data was gathered using the USDA Natural Resource Conservation Service program TR-55. The volume of rain for each event was calculated by multiplying the square footage of green roof by the depth (in feet) of the rain event. Square footage of green roof was calculated by measuring the area of green roof using a scaled site plan.

$$\begin{aligned} \text{Area of green roof} &= 8,561 \text{ sf} \\ \text{1 year storm event} &= (2.7 \text{ inches} \div 12) = .225 \text{ feet} \end{aligned}$$

$$8,561 \text{ ft} \times .225 \text{ feet} = 1926 \text{ cf}$$

According to Michael Furbish, owner of Furbish Company and the contractor who installed the green roof media, there is an average 4 inch media depth on the green roof with a water holding capacity of 46%. The storage volume was calculated using the area multiplied by the media depth (in feet). The total volume was multiplied by 46%.

$$(4 \text{ inch} \div 12) \times 8,561 \text{ sf} = 2,854 \text{ cf} \times .46 = 1,312.68 \text{ cf}$$

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$$1,312.68 \text{ cf} \times 7.48 \text{ gals/cf} = 9818.85 \text{ gals}$$

The percent storage for a one year storm event is equal to the storage volume divided by the total storm volume.

$$1,312 \div 1926 = .68 \text{ or } 68\%$$

Percent Storage by Storm Event

Storm Event	Inches	Volume (cf)	Storage/Storm Volume
1 Year	2.7	1926	.68
2 Year	3.3	2354	.56
5 Year	4.3	3068	.43
10 Year	5.3	3781	.35

25 Year	5.9	4209	.3
50 Year	6.6	4709	.28
100 Year	7.4	5279	.25

Prevented over 100 tons of material from entering landfills by using 8,000 board feet of reclaimed wood and 77.5 tons of reclaimed stone for decking, walls, and stairs.

Salvaged Greenheart piling from the Baltimore Harbor was milled to provide 8,000 board feet of decking for the middle school project. Greenheart is a durable South American hardwood that is highly resistant to termites as well as decay. (Beckwith, 1998) It is estimated that 8,000 board feet of Green Heart decking weights approximately 46,400 lbs., or 23.2 tons. One board foot of Green Heart weights approximately 5.08 lbs (<http://www.surveyorslexicon.com/index.php?RefNum=1644>)

$$8,000 \times 5.08 = 46,400 \text{ lbs.} = 23.2 \text{ tons}$$

According to the Sidwell Friends website, the stone used to make the wetland walls and stairs was reclaimed from various sources. The stone used for the terraces came from a barn in Bucks County, Pennsylvania. The blue stone for the courtyard steps came from an abandoned quarry in Wayne County, NY. The millstone at the cascade overflow came from a mill in Camden, NJ.

Through measuring the lengths of the retaining walls and the linear feet of stairs using a scaled site map, the total weight of the recycled stone was calculated by taking the volume of each material multiplied by the estimated density.

- Bluestone:** $161 \text{ ft}^3 * 160 \text{ lbs.} = 25,815 \text{ lbs} = 12.9 \text{ tons}$
- Drystack fieldstone wall:** $783 \text{ ft}^3 * 165 \text{ lbs} = 129,195 \text{ lbs} = 64.6 \text{ tons}$
- Total Material Weight:** $23.2 \text{ tons} + 12.9 \text{ tons} + 64.6 \text{ tons} = 100.7 \text{ tones}$

References

Beckwith, J. R. (1998). Durability of Wood. Retrieved from <http://warnell.forestry.uga.edu/service/library/index.php3?docID=326&docHistory%5B%5D=14>

Social

Promotes environmental awareness with over 10,000 visitors touring the site in its first five years. Over half of these tours were led by 8th grade students.

According to Sidwell Friends School archivist, Loren Hardenbergh, 10,446 visitors have toured the Sidwell Middle School building since its completion in September 2006. Over half of these tours were led by 8th grade students. An average of 24 8th grade students lead 75% of the tours during each school year, while summer and weekend tours are led by volunteer adult guides.

The tours of the middle school explore the sustainable features of the landscape as well as the built environment. Tour guides explain the function and benefits of the wastewater system, green roof, and rainwater harvesting.

References

L. Hardenbergh (personal communication, July 10, 2012)