Sustainable GW

THE GEORGE WASHINGTON UNIVERSITY WASHINGTON DC

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GWater Plan

A Road Map to Water Sustainability at The George Washington University




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June 2011

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The George Washington University's Sustainability Vision and Mission

The university envisions a future with resource systems that are healthy and thriving for all. In an effort to enhance its campus, the nation's capital and the world at large, GW is building a greener campus, providing research and intellectual discourse on policies and pathways to sustainable systems and equipping students with skills and knowledge to contribute to a sustainable future.

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EXECUTIVE SUMMARY

SUSTAINABILITY AT GW

As an institution of higher education, the George Washington University (GW) takes its responsibility to help solve national and global problems seriously. GW has a broad sustainability vision. The university envisions a future with healthy and thriving resource systems for all. In an effort to enhance its campus, the nation's capital and the world at large, GW is building a greener campus, providing research and intellectual discourse on policies and pathways to sustainable systems and equipping students with skills and knowledge to contribute to a sustainable future.

Sustainability has been a strategic initiative at the George Washington University since 2007, when President Steven Knapp assembled a Task Force on Sustainability. In 2010, the university unveiled its Climate Action Plan,[1] which calls for a 40 percent reduction in carbon emissions by 2025 and pledges to reach carbon neutrality by 2040. GW also launched a $2 million revolving fund – the Green Campus Fund – which has already funded $1 million worth of energy efficiency projects on its campuses.

In 2011, the university expanded its focus to water conservation and this GWater Plan is part of GW's broad sustainability vision. In the future, GW plans to expand this vision to include a strategy for ecosystem enhancement.

GWATER PLAN

"Our focus on the conservation and reclamation of water at George Washington is an important expression of our commitment to become a model of urban sustainability. Our GWater sustainability plan is one of the most comprehensive frameworks to address water consumption and water quality at any urban university."

- Dr. Steven Knapp
  President, the George Washington University
  Earth Day 2011

The GWater Plan addresses water conservation through the design, management and use of GW's campus water infrastructure, as well as through education and research – where the university has an even broader reach.

This is one of the most comprehensive plans for water sustainability issued by an American university, with eight clear goals and targets spanning across four major focus areas: **potable water, rainfall capture, wastewater and bottled water**. The plan is structured around the concept of GW being a responsible member of whole watersheds. The purpose of the plan is to improve GW's direct water

[1] GW signed the American College and University Presidents' Climate Commitment (ACUPCC), a high-visibility effort to address global climate disruption undertaken by a network of colleges and universities that have made institutional commitments to eliminate net greenhouse gas emissions from specified campus operations, and to promote the research and educational efforts of higher education to equip society to restabilize the earth's climate. By 2010, the network had 676 active members representing all 50 states and the District of Columbia.

footprint within the Potomac and Chesapeake Watersheds, and its indirect water footprint in other watersheds. By 2021, GW strives to reduce absolute total potable water consumption by 25 percent (from an FY08 baseline), while increasing permeable space on campus by 10 percent (from an FY11 baseline). Apart from these tangible milestones, the university is also working toward goals of zero runoff and zero water pollution, and reducing bottled water use on campus.

This plan summarizes the directional strategy GW will follow to achieve water sustainability; specific projects within each strategy will evolve and become more sophisticated with time. The university will periodically revise the GWater Plan to reflect changes in technology, policy and markets.

To address GW's water footprint, the GWater Plan follows the same three-pronged approach - **reduce, innovate and partner** – that are laid out in the Climate Action Plan.

1. **Reduce –** At its core, the GWater Plan aims to reduce its water footprint and enhance water quality. The two biggest water users on campus are residence halls and academic buildings, making up 63 percent of the university's total potable water use. GW plans to improve water efficiency in buildings to reduce usage of potable water in plumbing and for drinking. The university also plans to enhance rainfall capture technologies so as to reduce stormwater runoff. The GWater Plan also explores options to reduce the amount of contaminants in wastewater and the use of bottled water on campus.

2. **Innovate –** The GWater Plan outlines the university's intent to use its campuses as test beds to improve the university's impact on quantity and quality of the water in the Potomac Watershed. The university is committed to testing new technologies for water reclamation, permeable surfaces and sustainable drinking water systems, and to integrating these technologies into learning and research opportunities for students and faculty. By 2021, GW hopes to reuse all retained stormwater for gray water systems, cooling towers and irrigation.

3. **Partner –** The university will forge partnerships with policymakers, utility providers and other institutions in the watershed to generate dialogue and seek system-wide solutions that span greater areas to the challenges facing water sustainability.

In addition to affecting the GW water footprint, the GWater Plan outlines tactics for the university to provide water conservation and broader sustainability curriculum and research in an interdisciplinary manner. The plan emphasizes service-learning opportunities and a focus on urban sustainability. The plan also outlines how GW can use communication resources to provide transparency, encourage community participation and celebrate progress as it reaches these goals.

FINANCING AND NEXT STEPS

To achieve its water sustainability goals, GW will invest in water-efficient technologies over the next 10 years. These investments will be evaluated on life-cycle costs and projected return on investment to result in long-term savings. The university expects to finance some projects through existing budgets for new construction, major renovations and building maintenance, such as its capital project budget and its operating budget. Additionally, GW will rely on its Green Campus Fund to seed water efficiency projects. The university will also evaluate and pursue a range of future funding options including grants, rebate programs and donor opportunities to help fund its GWater Plan projects.

The GWater Plan not only serves as a blueprint for GW to address water sustainability, but also reflects the progress GW is making toward sustainability. Stakeholders from across the university community and beyond have substantively contributed to this plan, and are better positioned than ever to take strides to minimize GW's water footprint. The GWater Plan's success continues to rely on collective actions from the entire community.

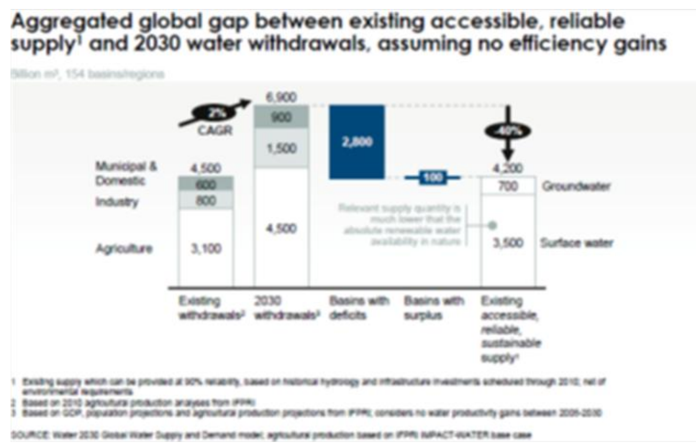
INTRODUCTION

FRESH WATER SCIENCE AND TRENDS

In recent years, the impact of climate change has gained considerable importance among the private, public and non-profit sectors. The discourse has focused primarily on how various actors can reduce greenhouse gas emissions, while neglecting many of the other implications of climate change, especially on the water cycle.[2] Increasing occurrences of drought, heat waves, and reduced water flows from melting glaciers, are creating disruptions in water supply worldwide. Water availability is a growing concern in the U.S. and abroad, and a number of institutions are increasingly vulnerable to water disruption.[3]

Assuming stable growth, global demand for water in 2030 is projected to exceed supply by 40 percent as shown in figure 1.[4] According to the National Resources Defense Council, one out of three U.S. counties is facing a greater risk of water shortages by mid-century due to climate change.[5]

Figure 1: Global Demand for Water by 2030



Despite these projections, there is little awareness, discourse and effort to mitigate the potential consequences for institutions in terms of water quantity and water quality. Disruptions in water supply will affect water quality, as the two are inextricably linked. Effective water treatment requires an adequate flow of water for dilution, and shortages in precipitation and surface water can prevent effective discharge of treated effluent. Focusing on water conservation, therefore, is a "win-win-win" situation as it encompasses water quantity and water quality benefits, and also leads to economic savings. [6]

Institutions are realizing that merely reporting on water usage and discharge is not enough. Water is a local resource and there is a need to further understand the geography of usage, the nature of the watershed, the amount of rainfall and the scale of overall impact resulting from discharge.[7]

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[2] The Pacific Institute. Water Scarcity & Climate Change: Growing Risks for Businesses & Investors (Boston: Ceres, 2009). 1-60.

[3] Barton, Brooke. Murky Waters? Corporate Reporting on Water Risk: A Benchmarking Study of 100 Companies. (Boston: Ceres, 2010). 1-98.

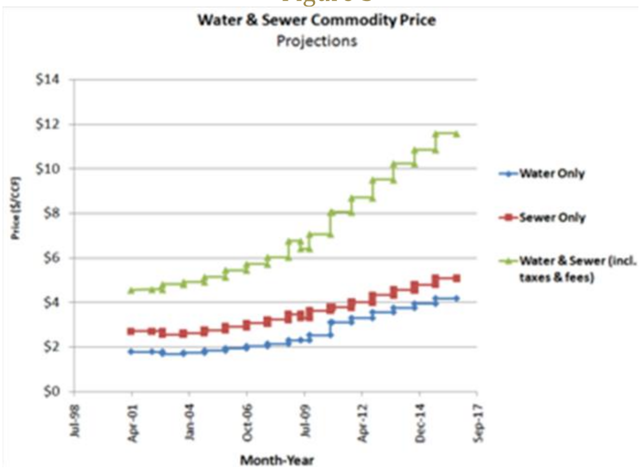
[4] 2030 Water Resources Group. Charting Our Water Future: Economic Frameworks to Inform Decision-making. (Washington, D.C.: International Finance Corporation, 2009). 1-32.

[5] National Resources Defense Council. Climate Change, Water, and Risk (National Resources Defense Council, July 2010). Web. 27 May 2011. <http://www.nrdc.org/globalwarming/watersustainability/index.asp>

[6] Environmental Protection Agency. Office of Water. National Water Program Strategy Response to Climate Change. (Washington, D.C.: EPA, 2008). Web. 1 February 2011. <http://www.epa.gov/ow/climatechange/docs/TO5_DRAFT_CCR_Revised_10-16.pdf.

[7] Environmental Resources Management Ltd. CDP Water Disclosure 2010 Global Report. (London: Carbon Disclosure Project, 2010). 1-52.

Figure 3



Even locally, there are challenges to water sustainability. Most of GW's campus areas lie in the watershed of the Potomac and the Anacostia Rivers, as well as Rock Creek – all of which empty into the Chesapeake Bay (See Appendix A). According to the 2010 Washington Metropolitan Area Water Supply Reliability Study, by the year 2040, the current system may have difficulty meeting the region's demands during periods of drought without water use restrictions, and/or the development of additional supply resources.[8] This will also lead to an increase in the cost of water in both the District and Virginia. GW's Division of Operations expects water rates in D.C. to increase by 5 to 10 percent every year, as shown in figure 2.

Currently more companies in the private sector are conducting water footprint analyses across their operations and supply chains, similar to the growing trend of conducting greenhouse gas (GHG) inventories.[9] The higher education sector is beginning to contribute to this momentum. Universities are examining campus water usage, but it is still a developing practice.

At the George Washington University, it is understood that there is no substitute for water. The challenge lies in managing the water the university has *now* – not when the well is dry. GW is committed to reducing its water usage and enhancing water quality, and this report outlines the university's goals and strategies around water sustainability.

GWATER PLAN PROCESS AND ENGAGEMENT

The comprehensive strategy of the GWater Plan was developed by key internal and external stakeholders so as to ensure best and innovative practices which can be feasibly implemented. The process was spearheaded by GW's Office of Sustainability (OS), which worked in conjunction with multiple internal stakeholders, including students, faculty members, Facilities, Campus Planning and Development, Athletics, Risk Management, and the Virginia Science and Technology Campus. The Office of Sustainability has vetted the framework, goals and targets with external stakeholders, including multiple departments at the District of Columbia Water and Sewer Authority (DC Water), and local NGOs such as Potomac Riverkeeper. The Office of Sustainability welcomes feedback and input to the plan, the goals and the implementation.

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[8] Sarah M. Ahmed, Karin R. Bencala, and Cherie L. Schultz. 2010 Washington Metropolitan Area Water Supply Reliability Study. (Interstate Commission on the Potomac River Basin, 2010) Web. 27 May 2011. <http://www.potomacriver.org/cms/index.php?option=com_content&view=article&id=180&Itemid=141#study>

[9] Environmental Resources Management Ltd. CDP Water Disclosure 2010 Global Report. (London: Carbon Disclosure Project, 2010). 1-52.

WATER FOOTPRINT

In order to set an appropriate strategy for water conservation, the university conducted a water footprint assessment.

The water footprint is considered a comprehensive indicator of water use. The methodology for GW's water footprint was developed by the Office of Sustainability and other partnering entities in GW's Division of Operations. GW's water footprint consists of two components:

1. *Potable Water Footprint,* which provides a detailed snapshot of potable water usage on campus
2. *Permeable Surface Footprint,* which helps GW understand the university's potential to capture and retain rainwater

Wherever possible, data from FY08 were used for the baseline assessment, so as to align all sustainability metrics with existing GW Climate Action Plan data.

POTABLE WATER FOOTPRINT

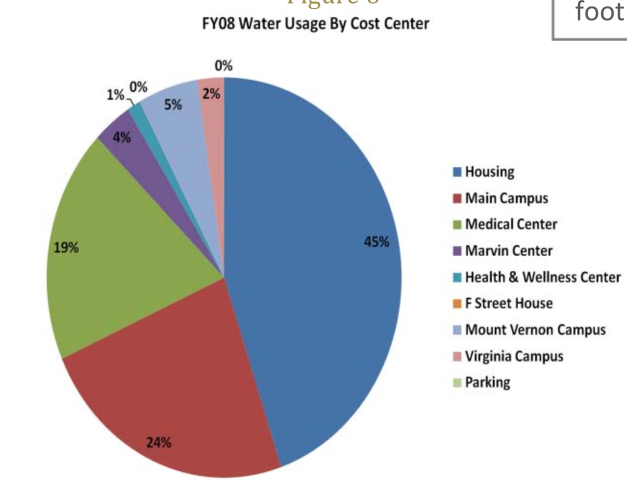
GW's Water Footprint

Water usage data were obtained from available DC Water and Loudoun Water bills. These data were analyzed in terms of total usage by building, activity and cost center.

Figure 5: FY08 Potable Water Use at GW

Total Annual Water Consumption (in kgal)	287,419
Annual Water Consumption per capita (kgal/weighted campus user)	10.81
Annual Water Consumption per sq. foot (kgal/sq. ft.)	25.72

Figure 6

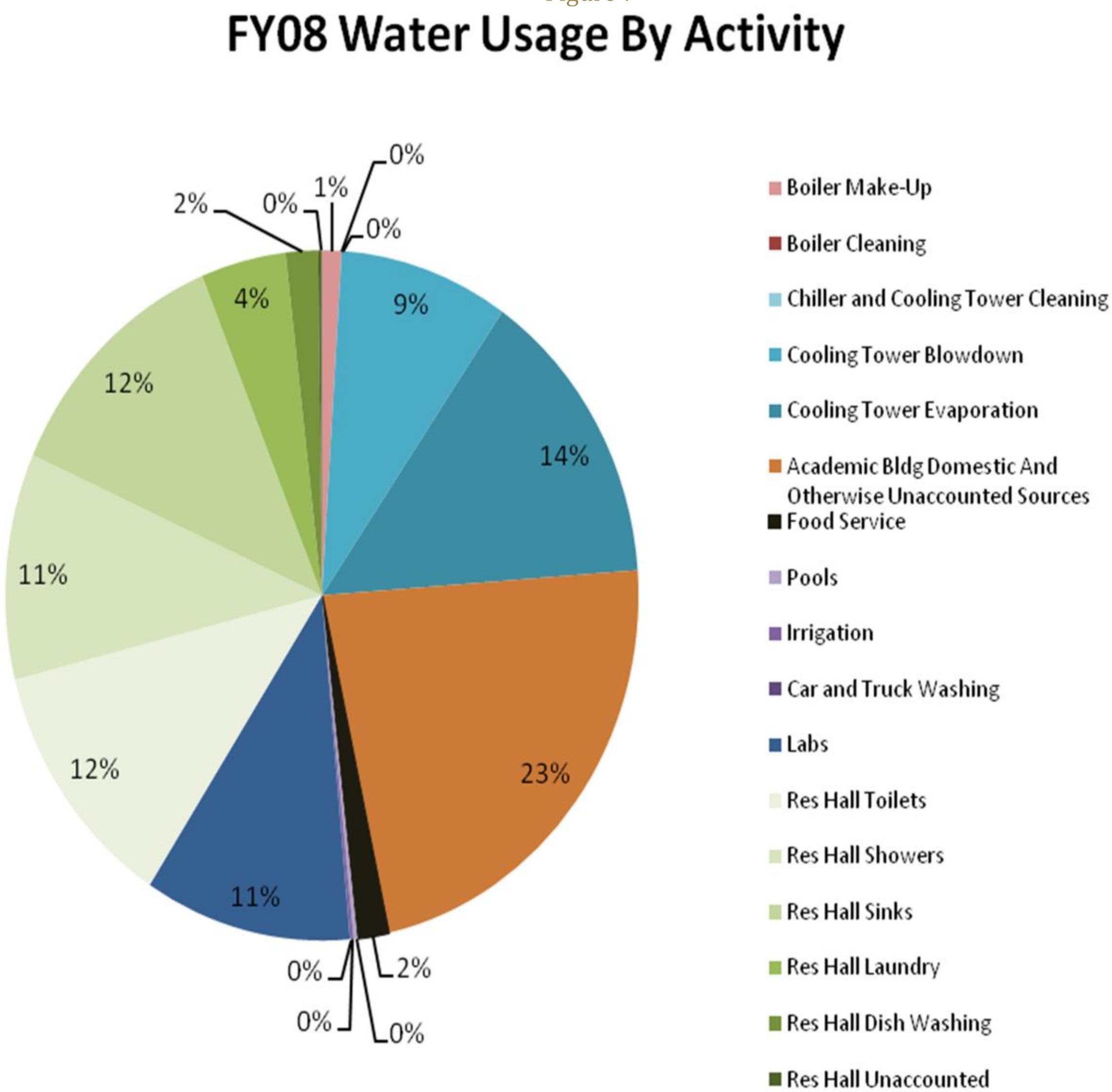


In 2008, GW's total annual water consumption was 287,419 kilo gallons (kgal), which amounted to 10.8 kgal per capita (See figure 3).[10] The annual water consumption per square footage of campus area was 25.72 kgal/sq. ft. This indicator helps identify the areas of intense water use on GW's campuses. The water usage data were analyzed in terms of cost center. The two biggest water users on campus are the residence halls and the academic buildings on the Foggy Bottom Campus (see figure 4).

[10] Per capita was assumed considering the weighted average campus user. The weighted average campus user was calculated using the STARS methodology i.e.
Weighted Campus Users = (1 × number of on-campus residents) + (0.75 × number of non-residential or commuter full-time students, faculty, and staff members) + (0.5 × number of non-residential or commuter part-time students, faculty, and staff members)

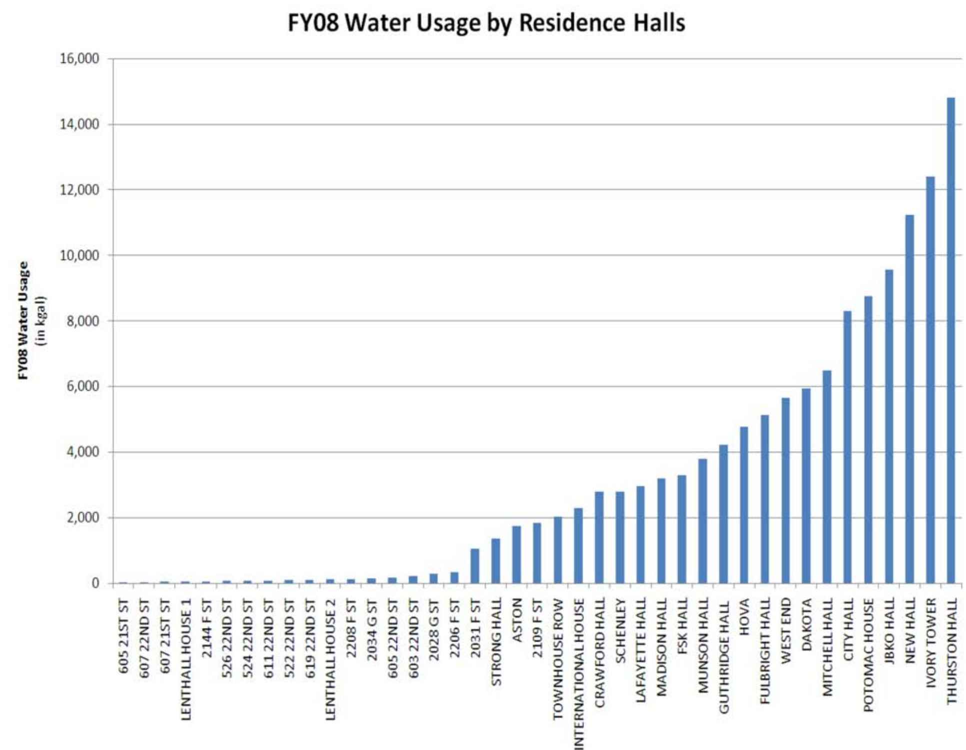
An analysis of water usage by activity shows that in FY08, domestic activities (such as using toilets, showers, and sinks, doing laundry and washing dishes) in residence halls accounted for 40 percent of total water usage, while domestic activities in academic buildings accounted for 23 percent of total water usage. Cooling towers and boilers used for the heating and air conditioning of buildings account for almost 24 percent of total water usage. It is estimated labs account for 11 percent of total water usage. Only 2 percent of total water is used for food services (see figure 5).

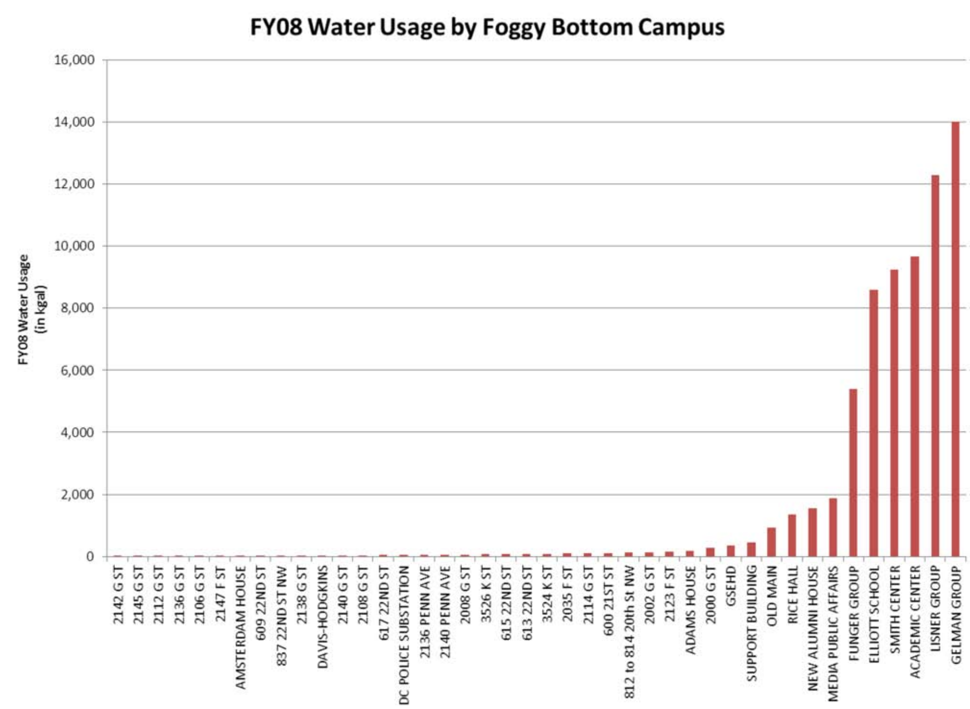
Figure 7



The Potable Water Footprint also provides a detailed snapshot of water usage in different buildings across campus (see figure 6). It enables GW to identify trends in water usage across campus, and identify 'water hogs' around which to prioritize potential tactics for water conservation.

Figure 8: Water Usage by Building





Potable Water Use - Benchmarking with Other Universities

Very few of GW's comparable schools (in terms of location, size and urban location), regularly publish water consumption data. As shown in figure 7, GW is among the lower total annual water consumers. While many of the schools within this group list water conservation initiatives, none of these comparable schools have published explicit targets.

Looking at a wider pool of schools that are less comparable to GW in terms of location, size, and campus characteristics (i.e., in an urban setting), GW's water consumption remains relatively low, as displayed in figure 8. In this group, only the University of Colorado, the University of California-San Diego and Stanford University have clear goals, targets and indicators for water conservation. The GWater Plan lays out clear goals and targets for GW, along with tactics to reach them through implementation.

Figure 9

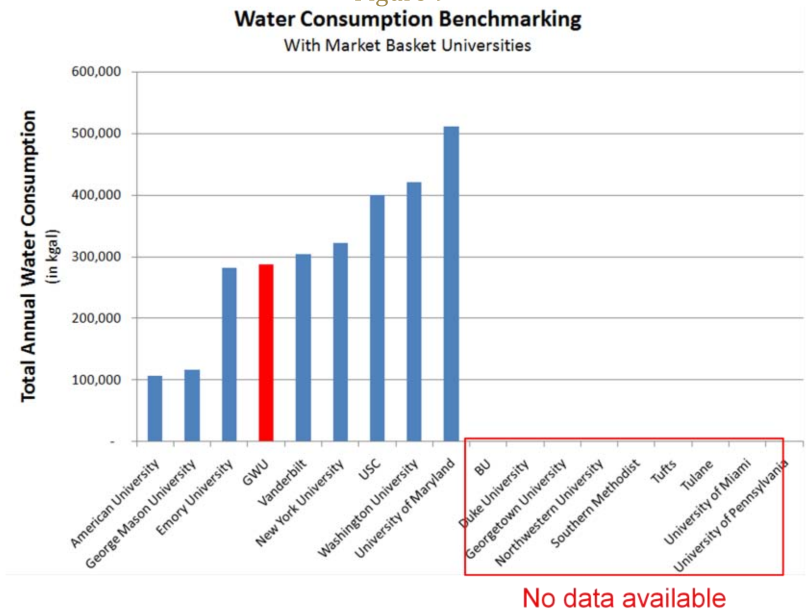
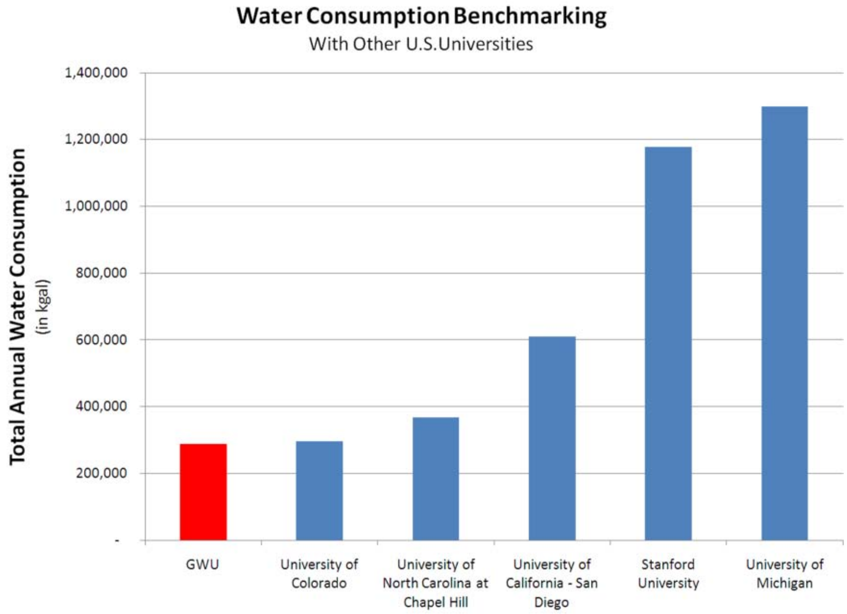


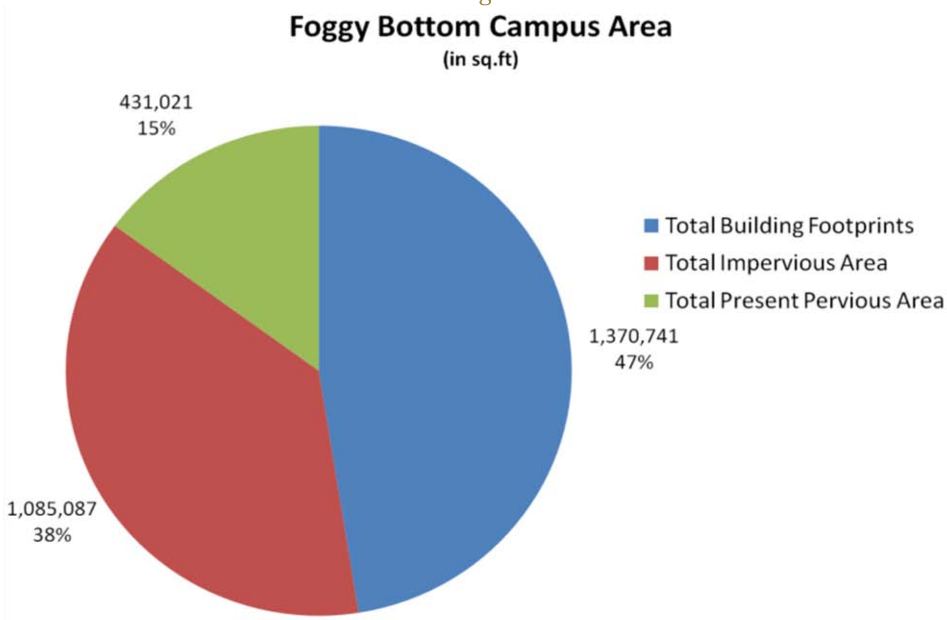
Figure 11



PERMEABLE SURFACE FOOTPRINT

Campus surface area data for the Foggy Bottom Campus were obtained from campus maps that are used by DC Water to calculate Impervious Area Charges.[11] Fifteen percent of the Foggy Bottom Campus area is permeable as shown in figure 9. This includes public space, the green roof area, and open space like Square 80 Pocket Park (see "*Spotlight on GW :: Square 80 Pocket Park*" on page 18).

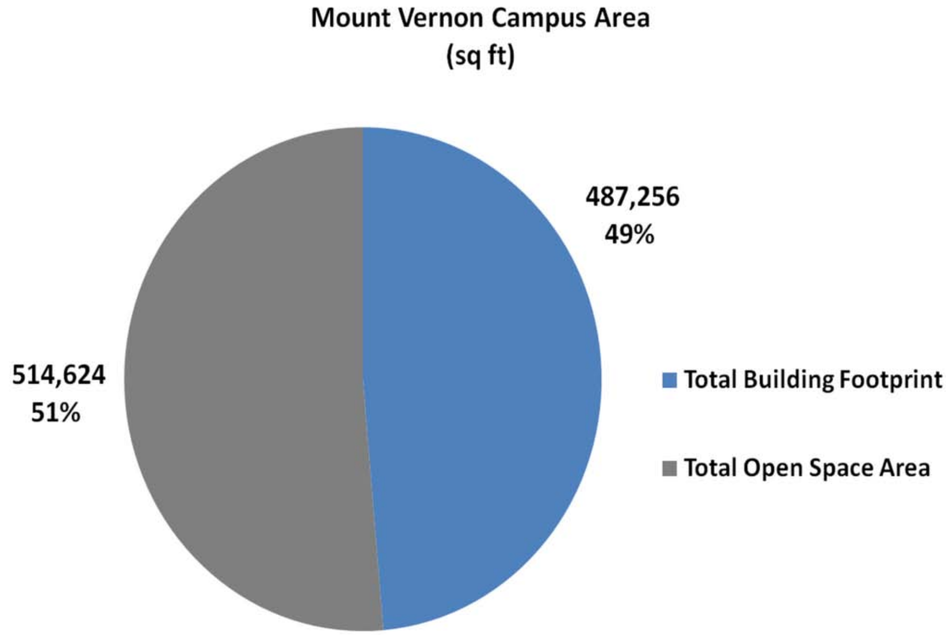
Figure 13

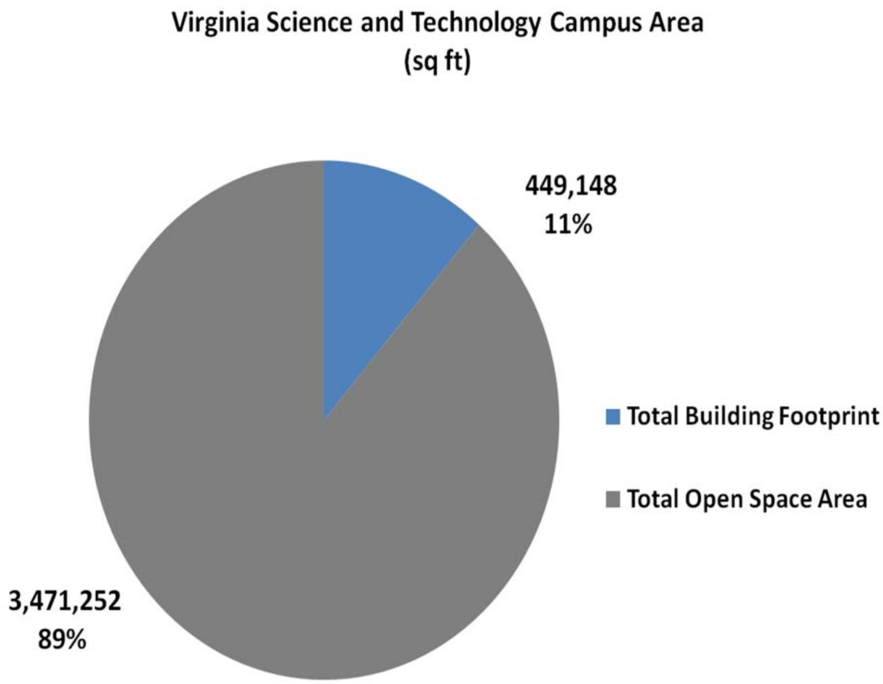


Estimates for the Mount Vernon Campus and Virginia Science and Technology Campus are calculated differently as there are no defined measures of permeable surface on these campuses at present. The total open space (i.e., area without buildings) for the Mount Vernon Campus and Virginia Science and Technology Campus amounts to 51 percent and 89 percent, respectively, as shown in figure 10. While this open space could include asphalt parking lots or paved alleys, this land is relatively undeveloped and has the potential to include more pervious surfaces.

[11] The Impervious Area Charge is a sewer fee that takes into account the area on a property made of impermeable surface, which contributes to runoff and combined sewer overflows. The charge is based on an Equivalent Residential Unit (ERU). An ERU is a statistical median of the amount of impervious surface area in a single-family residential property, measured in square feet. The FY 2011 monthly ERU value is $3.45.

Figure 14





After benchmarking with other comparable universities, GW stands out as one of the first universities to report its permeable surface area. No benchmarking data were available from comparable universities.

STRATEGIES FOR ACHIEVING WATER SUSTAINABILITY

Water scarcity is the next global challenge facing the planet. Universities can play an important role in developing frameworks for water sustainability by using their campuses as test beds for new strategies and technologies to reduce their water footprints. Water sustainability is a complex issue at GW since water is an accessible resource with multiple distinct uses and different points of interaction within the community. Therefore, the university must apply a holistic approach to planning for water sustainability across its campuses.

The GW water footprint is focused on both water quantity and water quality impacts. Tactics to reduce GW's negative impact on watersheds take on three strategic trajectories across water quantity and quality – Reduce, Innovate and Partner.

Below is an overview of the goals, targets and indicators laid out in the GWater Plan. Figure 11 provides an illustration of how these goals match GW's strategic trajectories and focus areas.

Figure 15

	Water Quantity			
	Potable Water	**Rainfall Capture**	**Wastewater**	**Bottled Water**
Reduce	**Goal 1:** Reduce potable water footprint **Target**: 25% absolute reduction over 10 years from FY08 baseline	**Goal 3:** Capture rainwater that falls on GW campuses: zero run-off **Target:** TBD as partnerships form	**Goal 5**: Reduce the amount of contaminants going into GW campus wastewater system: zero pollution **Target**: NA	**Goal 6**: Reduce use of bottled water on campus **Target:** 50% reduction in university expenditure on bottled water over 5 years from FY11 baseline
Innovate	**Goal 2**: Use GW campuses as test beds for new water reclamation technologies to reduce potable water consumption **Target:** By 2021, reuse all retained stormwater for greywater systems, cooling towers and irrigation	**Goal 4**: Use GW campuses as test beds to increase permeable space & improve stormwater quality **Target:** 10% absolute increase in permeable space over 10 years from FY11 baseline		**Goal 7**: Use GW campuses as test beds for new drinking water technology **Target:** 100% of new constructions and renovations incorporate in-line filters
Partner	**Goal 8**: 1. Partner with relevant external groups to enhance dialogue on urban water issues 2. Encourage academic cooperation and dialogue on urban water issues			
		Water Quality		

Goal 1: Reduce potable water footprint

Target: 25 percent absolute reduction over 10 years from FY08 baseline

Indicators: Total annual water consumption (in Kgal)

Goal 2: Use GW campuses as test beds for new water reclamation technologies to reduce potable water consumption

Target: By 2021, reuse all retained stormwater for gray water systems, cooling towers, and irrigation (GW will be required to retain high levels of stormwater runoff for new construction under the proposed EPA MS4 standards)

Indicators: Total stormwater reclaimed (in Kgal)

Goal 3: Capture rainwater that falls on GW campuses: zero run-off

Target: TBD as partnerships form

Goal 4: Use GW campuses as test beds to increase permeable space and improve stormwater quality

Target: 10 percent absolute increase in permeable space over 10 years from FY11 baseline

Indicators: Total Permeable Campus Area (in gross square feet)

Goal 5: Reduce the amount of contaminants going into GW campus wastewater system: zero pollution

Target: NA due to insufficient monitoring options

Indicators: DC Water Discharge Standards (pH, temperature, metals, cyanide, petroleum oil and grease, PCBs); EPA standards for parabens; perceived litter reduction

Goal 6: Reduce use of bottled water on campus

Target: 50 percent reduction in university procurement direct expenditure on bottled water over five years from FY11 baseline

Indicators: University expenditure ($) from GW Procurement on bottled water

Goal 7: Use GW campuses as test beds for new drinking water technology

Target: 100 percent of new construction and major renovations incorporate in-line filters

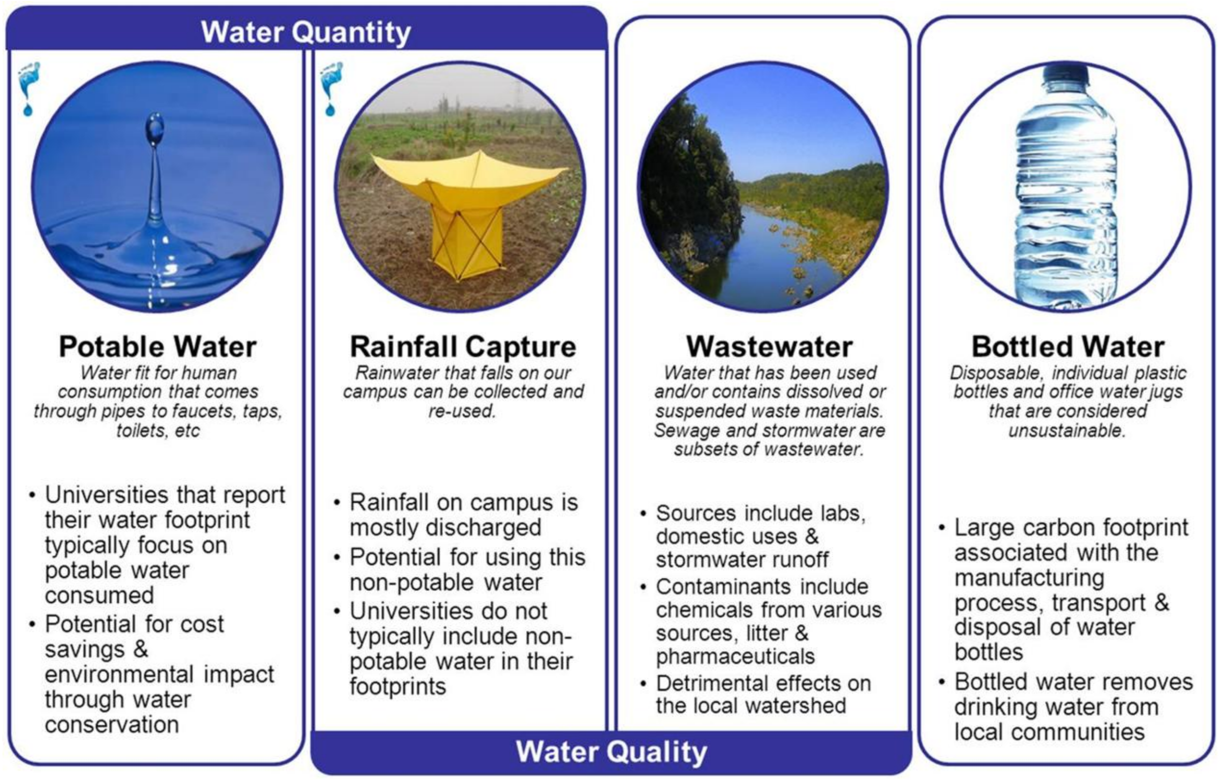
Indicators: Number of buildings with in-line filtration systems

Goal 8: Partner with relevant external groups to enhance dialogue on urban water issues; encourage academic cooperation and dialogue on urban water issues

STRATEGIES IN FOCUS

As shown in figure 12, the GWater Plan has four main areas of focus – potable water, rainfall capture, wastewater and bottled water.

Figure 16



POTABLE WATER

Potable water is defined as all water that is fit for human consumption that comes through pipes to faucets, taps, toilets, etc. Universities that report their water footprint typically focus on potable water consumed, as this category has the greatest potential for cost savings and environmental impact through water conservation.

Reduce

GW's goal is to reduce its potable water footprint by achieving an absolute reduction of 25 percent in total annual water consumption (in kgal) over ten years from FY08 baseline. The indicator for this target is total annual water consumption because it provides an overview of the total water used on campus per year.

Goals and Targets

Goal: Reduce potable water footprint

Target: 25 percent absolute reduction over ten years from FY08 baseline

Indicators:

1. Total Annual Water

In order to achieve this goal, the university will conduct an annual review of the water infrastructure of selected buildings on campus to identify potential retrofit projects to improve the university's overall water efficiency. The potable water targets and goals prioritize residential buildings first, because they account for the largest water consumption on campus.

This target was prepared using a sophisticated model that calculated a range of potential reductions in water consumption if low-flow fixtures were installed in selected buildings on campus. Apart from this, GW also conducted a benchmark survey of water reduction targets by universities around the world and found 25 percent over 10 years to be an ambitious yet practicable goal. A more detailed description of the methodology can be found in Appendix B.

Sample tactics to achieve this goal are listed below:

1. Prioritize the installation of low-flow fixtures in cases of plumbing repairs/replacement
2. Prioritize WaterSense[12] appliances where applicable
3. Continue Eco-Challenge[13] between residence halls to encourage water conservation
4. Continue expansion of Eco-Challenge to academic and administrative buildings
5. Create communications guidelines when low-flow fixtures are installed to ensure that users understand the new technology (i.e., signage, informational sheets, etc.)
6. Adopt improved leak detection and repair policy that institutes preventative leak investigation rather than focusing primarily on quick fixes

Innovate

GW's innovation goal to reduce potable water consumption is to use its campuses as test beds for new water reclamation technologies. Water reclamation is a process by which wastewater is treated and reused for non-potable uses. Some examples and uses of water reclamation technologies are described in Appendix C.

GW has committed to reusing all retained storm water for gray water[14] systems, cooling towers and irrigation by 2021. GW's target includes retained storm water from new construction (which will be required under new regulation[15]) and retained storm water from existing spaces.

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[12] WaterSense is a labeling program developed by the EPA to differentiate products in the marketplace that meet EPA criteria for efficiency and performance, as well as programs that meet EPA criteria for water efficiency.

[13] The GW Eco-Challenge is a friendly competition among residence halls to determine which hall can conserve the most water and electricity throughout the academic year.

[14] Gray water is wastewater from residential, commercial and industrial bathroom sinks, bath tub shower drains, and clothes washing equipment drains that can be reused onsite, typically for non-potable uses such as landscape irrigation.

Some sample tactics to achieve this goal are:

1. Incorporate new water sourcing technologies such as gray water systems into design standards for new construction and major renovations
2. Pilot new technologies to harvest, and reuse rainwater such as permeable paver technology, rain barrels, cisterns, green roofs, bioswales, rain gardens and tree box technologies
3. Work with DC Department of Transportation to incorporate water-saving technologies in public space as part of the landscaping for new projects on campus, e.g., larger tree boxes as part of GW's Streetscape Plan (a component of the 2007 Foggy Bottom Campus Plan)

Goals and Targets

Goal: Use campuses as test beds for new water reclamation technologies to reduce potable water consumption

Target: By 2021 reuse all retained storm water for gray water systems, cooling towers, and irrigation

Indicators:
1. Total storm water reclaimed (kgal)

RAINFALL CAPTURE

The approach to rainfall capture encompases collection and reuse of all rainwater that falls on GW's campuses in order to prevent stormwater runoff. Stormwater runoff occurs during rain and snowmelt events, when precipitation flows over land or impervious surfaces (paved streets, parking lots and building rooftops) and accumulates debris, chemicals, sediment or other pollutants before being discharged into the Potomac watershed. [16] Both GW's Foggy Bottom Campus and the Mount Vernon Campus are located in Potomac watershed (see Appendix A).

DC Water operates a wastewater collection system made up of both 'separate' and 'combined' sewers. Separate systems are those comprised of two independent piping systems – one for sewage from homes and businesses (sanitary sewage) and another for stormwater and discharges into portions of the Potomac, Anacostia and Rock Creek watersheds. Approximately two-thirds of the District of Columbia is serviced by the municipal separate stowm sewer system (MS4), including GW's Mount Vernon Campus (see Appendix D).

The remaining one-third of the District of Columbia (including GW's Foggy Bottom Campus) is serviced by a combined sewer system (as shown in Appendix D). This system takes both wastewater from homes and businesses and stormwater away from streets in a combined pipe. During heavy rains or rapid snowmelt, the pipes cannot contain the volume of water, and the entire contents of the pipe overflow through the more than fifty combined sewer outfalls in the D.C. area river network (this includes the Anacostia, Potomac and Rock Creek).

DC Water estimates that combined sewer overflow (CSO) events happen roughly 75 times annually in the Anacostia and Potomac rivers, dumping close to 850 million gallons into the Potomac. Poor

[15] Under proposed new regulation from the EPA, GW will be required to retain 1.2 inches of storm water runoff per storm event for new construction.

[16] Environmental Protection Agency. Stormwater Program - Office of Wastewater Management. 04 Jan. 2011. Web. 27 May 2011. <http://cfpub.epa.gov/npdes/home.cfm?program_id=6>

stormwater management, which leads to raw sewage and untreated stormwater flowing into the Potomac, is a leading cause of pollution in the river.[17]

The Virginia Science and Technology Campus is connected to the municipal sewer system in Loudoun County. A large portion of campus surface area is permeable as it has large open spaces that can absorb rainwater as well as retention ponds to hold stormwater on site.

Apart from water quality considerations around discharging untreated stormwater, rainfall capture also has implications for water quantity as this non-potable water can be used as gray water for building systems and cooling towers.

Reduce

GW's goal is to reduce stormwater runoff and capture rainwater that falls on campus. The volume of stormwater runoff at GW is determined largely by the impermeable surface area on campus. Presently, there are four methods for rainwater capture.

> **Goals and Targets**
>
> **Goal:** Capture rainwater that falls on campus: zero run-off
>
> **Target**: TBD as partnerships form

1. The most common method captures rainwater in interior roof drains or downspouts, redirecting this water into the storm sewer or allowing it to slowly percolate into the soil. This water is untreated and not processed through any filter.
2. Sand filters are similar to the previous method, except all the rainwater is sand filtered before being released to the storm sewer. The infrastructure required for this method, including an interior roof drain and a sand filter, exists in all construction after 1997.
3. Rainwater percolates into soil/pervious paving and is returned to the water table/aquifer naturally.
4. Rainwater is captured in cisterns and reused for non-potable water needs such as irrigation systems. An example of this is the pocket park in the middle of Square 80 (between F and G Streets and 21st and 22nd Streets NW on the Foggy Bottom Campus).

> **Spotlight on GW :: Square 80 Pocket Park**
>
> What is now the Square 80 Pocket Park was previously a large impervious utility area and parking lot for around 30 cars, with only 7 percent of pervious surface area. The site was redesigned in 2010 as one of the projects under the pilot Sustainable Sites Initiative™ program. The design combines multiple sustainable elements into one project and harvests 100 percent of on-site rainwater for irrigation, maintenance and other amenities, including: biofiltration planters, pervious paving, underground cisterns, rain barrels, native plants, rain gardens and a bioswale. Extensive interpretive signage, made of recycled content, has been installed at the site to explain how these elements work together.

[17] District of Columbia Water and Sewer Authority. "Combined Sewer System." Web. 02 June 2011. <http://www.dcwasa.com/wastewater_collection/css/default.cfm>

As GW enters the design phase for future projects, the university is committed to enhancing green and permeable spaces to help absorb and capture rainfall. The university also plans to pilot gray water systems in some upcoming projects to mitigate impact on the stormwater and sewer system. Additional sample tactics to reduce stormwater runoff on campus include:

1. Pilot new technologies to harvest rainwater such as permeable paver technology, rain barrels, cisterns, green roofs, bioswales, rain gardens, and tree box technologies
2. Use Square 80 Pocket Park as a model for future green spaces
3. Explore options to monitor storm water quality on campus
4. Increase low-impact development (LID) infrastructure on campus (such as green roofs and rain gardens) to help treat and filter storm water

Innovate

GW's innovation goal around rainfall capture is to use the campus as a test bed to increase permeable space and improve stormwater quality. The university is committed to increasing permeable space by 10 percent over the next 10 years from an FY11 baseline. The indicator for this target is total permeable campus area measured in gross square feet.

This target, as shown in figure 13, was calculated using the projected new green roof constructions on campus. Assuming all of these projects move forward, GW will be able to accomplish a 5 percent increase in the permeable space on campus within five years.

Goals and Targets

Goal: Use campuses as test beds to increase permeable space and improve stormwater quality

Target: 10 percent absolute increase in permeable space (including a 5 percent increase in projected green roofs) over next 10 years from FY11 baseline

Indicators:

1. Total permeable campus area (Gross Square Feet)

Figure 17: Projected Permeable Surface Growth

Foggy Bottom Campus		
	Square Footage	
Total Pervious Area – Present		431,021.00
New Projects		
Square 54	20,900.00	
Law Learning Center (LLC)	1,350.00	
School of Public Health & Health Services (SPHHS)	8,300.00	
Science & Engineering Hall (SEH)	10,000.00	
Total New Pervious Area - Planned		40,550.00
Total Pervious Area - After		471,571.00
Percent Increase		9.4%

Some sample tactics that the university can use to achieve this target are:

1. Pilot use of new permeable surface technologies on campus
2. Ensure that green space planning is integrated into renovation and construction projects
3. To the extent feasible, convert GW's undevelopable land area (amounts to 58,000 sf per GW's *2007 Foggy Bottom Campus Plan*) to permeable surfaces.

Spotlight on GW :: Elliott School of International Affairs Green Roof

The graduate student group Net Impact submitted a proposal in 2008 to create a green roof pilot project at GW. This green component was installed on a narrow strip of the roof between the Elliott School of International Affairs 7th floor Conference Center and the adjacent 1959 E Street Residence Hall. This location was well-suited for the retrofit and has high visibility for students, staff, and faculty. The green roof serves as a permeable surface and acts as an insulator for both temperature and sound – which reduces the amount of energy used for heating and cooling the building.

GW's Division of Operations joined with student volunteers to complete the installation and have continued this collaboration to ensure maintenance of the green roof.

WASTEWATER

Wastewater is water that has been used and/or contains dissolved or suspended waste materials. Sources of wastewater include sewage from labs and domestic uses of water, as well as stormwater runoff. The contaminants include chemicals from various sources, organic matter, litter, and pharmaceuticals that have detrimental effects on the local watershed.

GW's wastewater goal is to reduce the amount of contaminants going into the campus wastewater system: zero pollution. The university will use the water discharge standards established by the EPA as an indicator to measure progress toward the wastewater goal.

Goals and Targets

Goal: Reduce the amount of contaminants going into campus wastewater system: zero pollution

Target: NA

Indicators:

1. EPA discharge standards
2. Observed litter reduction

The university identifies priority areas to reduce the impact of its wastewater on the local watershed. See Appendix E for a detailed description of the major pollutants affecting GW's watershed. Litter is the primary issue of concern, as it can cause drainage problems in the water treatment process. Apart from drainage problems, litter can also cause pollution, as toxins in the litter can seep into the watershed. Pharmaceuticals are another source of water pollution that can be very dangerous if not disposed of properly. Cleaning products also affect wastewater, especially those that contain antimicrobials (triclosan and triclocarban), phosphates, quaternary ammonia compounds or parabens. Other sources of wastewater include chemical contaminants from labs, PCBs (which can be found in old transformers and capacitors) and mercury and mercury-containing chemicals.

Most water pollutants require strategies for source control, which can range from product substitution to pretreatment devices (such as limestone neutralization tanks, grease abatement systems, plaster traps, oil/water separators, etc.) and to public awareness and outreach campaigns. Some specific tactics include:

1. Create a responsible pharmaceutical disposable program
2. Continue to ensure proper treatment and disposal of lab contaminants
3. Educate GW community on responsible product purchasing to avoid harmful watershed contaminants such as parabens and phosphates
4. Integrate preferred purchasing policy to increase use of green cleaning products and green fertilizers on campus
5. Increase and position Big Belly Solar compactors on campus to encourage responsible trash disposal
6. Host biannual litter pick-up days on campus

BOTTLED WATER

Bottled water refers to drinking water that comes packaged in disposable plastic or glass bottles, ranging from small individual size bottles to large carboys used for water coolers. These bottles are considered unsustainable because of the large carbon footprint associated with the manufacturing process, transport, and disposal of water bottles. In many cases, bottled water also removes drinking water from local communities in unsustainable ways.

While some may argue that bottled water has more of an impact on the ecosystem from a waste and recycling perspective, GW includes bottled water in the GWater Plan in part due to its implications for perceptions of tap water.

Reduce

Tap or filtered tap water is an economical and sustainable option over bottled water. GW's goal is to reduce the use of bottled water on campus, with a target of a 50 percent reduction in direct university expenditure on bottled water over five years from an FY2011 baseline. The indicator for this target is the known dollar amount of spending on bottled water. Tap water is the the likely substitute for bottled water. Any increase in the use of tap water for drinking, however, would have a minimal impact on the potable water footprint because the majority of water is used by plumbing fixtures and cooling towers, as shown in figure 5.

Goals and Targets

Goal: Reduce use of bottled water on campus

Target: 50 percent reduction in University direct expenditure on bottled water over five years from FY11 baseline

Indicators:

1. University expenditure ($) from GW Procurement on bottled water

In order to achieve this goal, the university will consider using the following tactics:

1. Integrate preferred purchasing policy to decrease bottled water purchase and prioritize filtered water systems
2. Standardize and improve existing water fountains on campus
3. Increase signage and communications efforts to encourage GW community to drink tap water/filtered tap water
4. Partner with student groups to provide funding for reusable bottled water purchases
5. Encourage installation of dishwashers during renovation to enable the reuse of containers for tap water consumption

Innovate

The innovation goal around bottled water is to use the campus as a test bed for new drinking water technologies. The university's target is to ensure that 100 percent of all new construction and renovations incorporate in-line filters for tap water. In-line water filters can be installed on any water line where filtered water is desired.

GW is also considering integrating bottle filling stations into existing water fountains on campus. Bottle filling stations will increase the user-friendliness of existing fountains for people carrying their own reusable water bottles. GW will explore strategic sourcing with in-line filter and bottled filling station suppliers.

Goals and Targets

Goal: Use campuses as test beds for new drinking water technologies

Target: 100 percent of new construction and renovations incorporate in-line filters

Indicators:

1. Number of buildings with in-line filtration systems

PARTNERSHIPS AND ENGAGEMENT

The George Washington University strives to partner with local stakeholders and other relevant external groups to enhance dialogue on urban water issues. GW recognizes that it is part of a larger watershed and that water problems in the region are dependent on other actors and players in the watershed. Partnership is a crucial component of achieving GW's water sustainability goals.

GW COMMUNITY

GW is committed to engaging the entire community in water sustainability efforts. Please see Appendix F for a detailed description of initial engagement activities on the issue of water sustainability. For example, for Earth Month 2011, the Office of Sustainability launched the GWater Challenge to raise awareness about water issues.

The GWater Challenge featured an Earth Month passport designed to help educate GW community members about how they can make a difference in reducing their water footprint and improving water quality. Action items included taking shorter showers, using paraben-free soap, eating vegetarian for a day, and attending a film series on water issues.

In addition, the Office of Sustainability is working through its Green Office Program to engage faculty and staff on the issue of drinking water in offices, and encouraging them to reduce bottled water usage.

GOVERNMENT AND NGOS

GW has closely monitored local trends and new regulations related to water sustainability. The Office of Sustainability has been in regular communication with DC Water throughout the process of framing the GWater Plan, and will continue this dialogue as the strategy and implementation programs develop. GW is open to partnering with the DC community on water issues.

The university also seeks to partner with the District Department of Transportation (DDOT) and the District Department of the Environment (DDOE) on programs such as the Green Alley Program, which will fund the renovation of public alleyways to make them more permeable.

Together with local organizations such as Potomac Riverkeeper and other watershed organizations, GW will continue to discuss ways to collaborate to increase the quality and health of the waterways. GW will also work with area partners to promote programs that encourage drinking tap water and raise awareness about issues of water sustainability.

Sustainability and Water in Academics

GW approaches sustainability as a central part of its academic mission. The university's greatest opportunity for impact lies in its classrooms and in its labs by expanding the variety and quality of sustainability-related courses, programs, and degrees offered and creating new opportunities for interdisciplinary study. The university is leveraging its strengths in research and teaching to contribute to the understanding of urban sustainability, climate change and renewable energy, water availability, food and health, and sustainability governance and policy. Current academic offerings include more than 100 courses covering a diverse set of sustainability topics and issues as well as 14 academic degree and certificate programs.

One of GW's goals is to encourage academic cooperation and dialogue on urban water issues. The university has a role to play in sharing knowledge and increasing understanding of how the community of the Potomac Watershed and Chesapeake Bay Watershed can work together to improve water quality and availability, and lower costs to the rate payers.

To formally kick off the effort, on 22 March, 2011 (World Water Day), GW hosted the Symposium on Urban Water Issues. GW faculty, students and Washington Metropolitan region experts attended. As urban growth strains infrastructure, water emerges as one of top challenges for cities as they attempt to support and provide for their population. The GW World Water Day Symposium provided a platform for experts to convene and discuss the breadth of urban water issues affecting cities across the world, including Washington D.C.

On an on-going basis, faculty across the university are addressing a range of questions related to water sustainability and are using their research and classes to help students, GW, and partners in the watershed better manage water resources. Faculty are pursuing interdisciplinary work on water, climate and energy as related to urban sustainability and governance.

FINANCING

The university will invest in water-efficient technologies over the next 10 years to reach GW's water sustainability goals. The efficiencies that will result from this investment will continue to pay off even more in dividends as GW significantly reduces its water use.

Each project implemented as a result of the GWater Plan will be assessed based on life-cycle costs and projected return on investment to ensure the overall portfolio of water efficiency projects maintains a level of return in line with the university's expectations. Financial analysis has shown that the reduction in water usage due to retrofit projects will result in savings that can cover the costs of the retrofit projects as shown in Appendix G.

Additionally, GW will look to the future to bring more efficient and affordable technologies, as well as collaborative efforts from local stakeholders, to help reach its targets.

CAPITAL PROJECT AND OPERATING BUDGETS

The university's existing budgets for funding new construction, major renovations, and building maintenance are its capital project budget and its operating budget. The university typically allocates its capital budget for large-scale projects, including major building renovations, while the operating budget goes toward building systems maintenance.

Some water infrastructure retrofit projects will often fall within the scope of both of these budgets during the normal course of business for the university. When this occurs, the university will evaluate the projects to ensure they meet an acceptable return on investment threshold and will fund projects as appropriate; as a result, GW expects to finance some of its GWater Plan projects through existing designated funds.

GREEN CAMPUS FUND

On Earth Day 2010, GW launched the Green Campus Fund, a self-sustaining $2 million revolving fund to seed projects that will modernize university buildings to be more energy and water efficient. To date, the university has committed close to $1 million toward energy-savings projects. GW intends to continue to use the Green Campus Fund to seed water efficiency projects recommended by the GWater Plan and track both water and financial savings through the fund to understand the university's performance.

FUTURE FUNDING SOURCES

GW will evaluate and pursue a range of funding options, including grants, local utility (such as DC Water, DDOE, and DDOT) rebate programs, targeted donor opportunities, and other financing partnerships to help fund its water sustainability programs.

CONCLUSION

The GWater Plan is the culmination of GW's efforts to mark 2011 as its Year of Water. This document acts as a planning guide and reflects the real progress GW is making toward water sustainability. The process of creating this GWater Plan has been a powerful tool for organizational momentum and change. Staff from GW administrative divisions, faculty from several GW schools and academic departments, students from various organizations and programs, and experts in the public and private sectors have proposed, discussed, debated and created both the plan and the impetus for action.

2021 HORIZON

GW is committed to achieving all of its water sustainability goals by 2021, if not earlier. Most of the university's targets and commitments in this GWater Plan are based on FY08 conditions to ensure consistency with the Climate Action Plan.

It is important to note that factors outside of GW's control, such as policy changes, global economic conditions, and technological advances will affect the university's trajectory toward water sustainability. The strategies in this plan are therefore broad principles that will guide the university toward its targets, even though the specific projects within each strategy may change. Therefore, the university will periodically revise its GWater Plan to account for changes in conditions that influence its goals, starting with an initial revision in 2016.

A CALL TO THE WATERSHED COMMUNITY

The collective actions of the entire GW community will continue to be critical to the success of the GWater Plan. Leadership steps, in conjunction with incremental actions from GW students, staff, and faculty as well as other area partners will lead to reductions in potable water consumption and bottled water usage and improvements in wastewater quality.

Through climate, water and other sustainability commitments, the George Washington University is taking direct responsibility for ensuring a better quality of life for today and tomorrow. While the journey is not easy, direct or simple, collaboration and contributions from across the community will ensure that GW reduces its environmental impact and acts as a model for others in the community.

> *"Today GW is taking a leadership step. I hope that other universities and other large institutions who reside in the Potomac Watershed will disclose their water footprints too. After all, we're all in this together."*
>
> \- Meghan Chapple-Brown
> Director, GW Office of Sustainability
> Earth Day 2011

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From Meghan Chapple-Brown, director of The George Washington University Office of Sustainability:

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GLOSSARY

CAP
Climate Action Plan

Combined Sewer Overflow (CSO)[18]
The capacity of a combined sewer may be exceeded during periods of significant rainfall. Regulators are designed to let the excess flow (more commonly known as Combined Sewer Overflow) be discharged directly into the Anacostia River, Rock Creek, the Potomac River, or tributary waters. CSO is a mixture of storm water and sanitary wastes; its release is necessary to prevent flooding in homes, basements, businesses, and streets.

DDOE
District Department of the Environment

DDOT
District Department of Transportation

Graywater[19]
Gray water is reusable wastewater from residential, commercial and industrial bathroom sinks, bath tub shower drains, and clothes washing equipment drains. It is reused onsite, typically for non-potable uses such as landscape irrigation.

Impermeable Surface[20]
An impervious surface is a man-made surface that cannot be easily penetrated by water, such as rooftops, driveways, patios, tennis courts, swimming pools, parking lots, and other paved areas.

Impervious Area Charge[19]
Impervious Area Charge is a special charge by DC Water on the basis of the amount of impervious surface on your property. It was established to distribute the cost of maintaining storm sewers and protecting area waterways. The charge is based on a property's contribution of rainwater to the District's sewer system using an Equivalent Residential Unit (ERU). An ERU is a statistical median of the amount of impervious surface area in a single-family residential property, measured in square feet. The FY 2011 monthly ERU value is $3.45.

Low Impact Development[21]
Low-Impact Development (LID) is a strategy for land development (or redevelopment) that works with nature to manage stormwater. It employs principles such as preserving and recreating natural landscape

[18] District of Columbia Water and Sewer Authority. "Combined Sewer System." Web. 28 May 2011. <http://www.dcwasa.com/wastewater_collection/css/default.cfm>.
[19] Environmental Protection Agency. "Water Recycling and Reuse: The Environmental Benefits." Web. 28 May 2011. <http://www.epa.gov/region9/water/recycling/>.
[20] District of Columbia Water and Sewer Authority. "Impervious Area Charge." Web. 28 May 2011 <http://www.dcwasa.com/customercare/iab.cfm>
[21] Environmental Protection Agency. "Low Impact Development (LID)." Web. 28 May 2011. <http://www.epa.gov/owow/NPS/lid/>

features, minimizing effective imperviousness to create functional and appealing site drainage. LID treats stormwater as a resource, rather than a waste product, using practices such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels and permeable pavements.

Permeable Surfaces

Permeable surfaces (also known as porous or pervious surfaces) allow water to percolate into the soil to filter out pollutants and recharge the water table.

Potable Water

Potable water is all water that is fit for human consumption that comes through pipes to faucets, taps, toilets, etc.

Wastewater

Wastewater is water that has been used and/or contains dissolved or suspended waste materials.

WaterSense[22]

WaterSense is an EPA-sponsored partnership program that was launched in 2006 to promote water efficiency and enhance the market for water-efficient products, programs, and practices. Products carrying the WaterSense label perform well, help save money and encourage innovation in manufacturing.

Watershed[23]

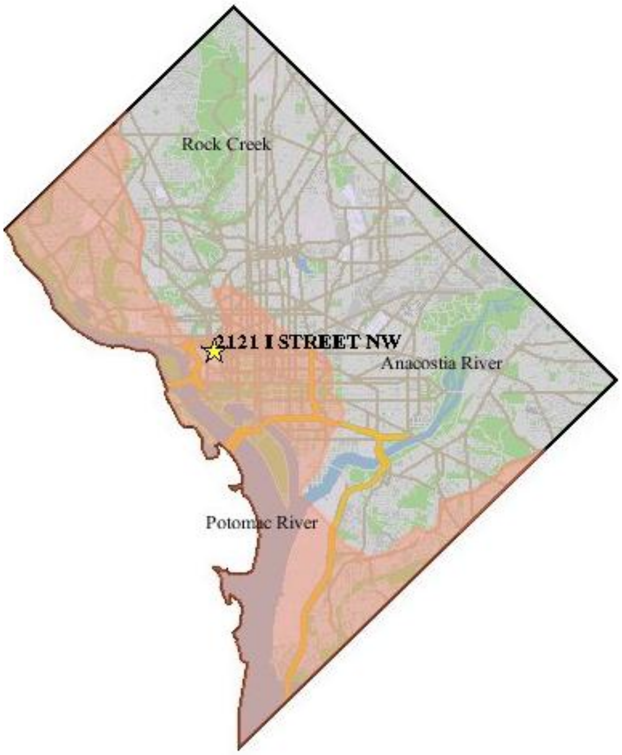
A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place. A watershed is an area of land — a bounded hydrologic system — within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community.

[22] Environmental Protection Agency. "Watersense: About Us." Web. 28 May 2011. <http://www.epa.gov/watersense/about_us/index.html>.

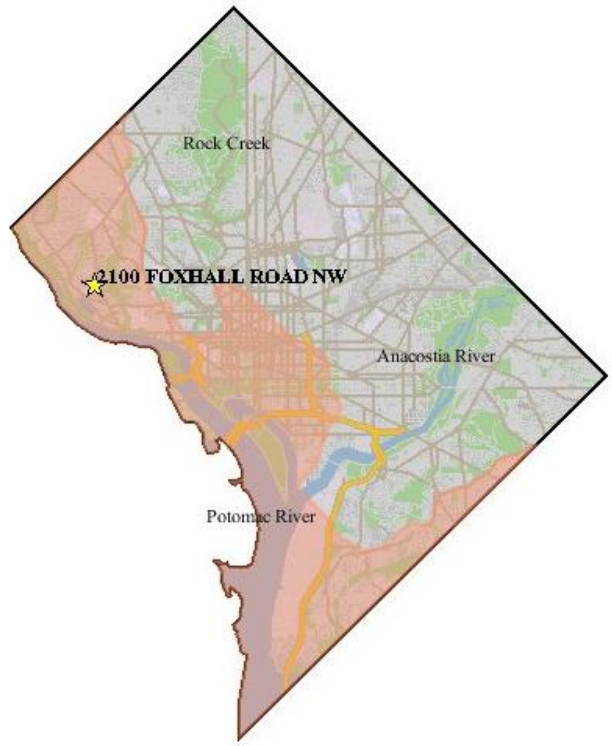
[23] Environmental Protection Agency. "What Is a Watershed?" Web. 28 May 2011. <http://water.epa.gov/type/watersheds/whatis.cfm>

APPENDIX A: GW WATERSHED MAP: POTOMAC RIVER

Foggy Bottom Campus



Mount Vernon Campus



Source: DC Atlas. "Locate Your Watershed." District of Columbia Government. Web. <http://dcatlas.dcgis.dc.gov/ddoe/>

APPENDIX B: POTABLE WATER REDUCTION METHODOLOGY

STEP 1: Estimated Potential Reductions

- Analyzed current *domestic water use* (including use of showers, sinks, dishwashers and washing machines, but not boilers and cooling towers) in selected buildings (selection reflects a range of per capita water consumption) on campus to develop a BEFORE scenario
- Modeled (using a model obtained from a local consulting firm) potential domestic water in selected buildings after installing low-flow fixtures to develop an AFTER scenario
- Percent reductions in water consumption were calculated using the BEFORE and AFTER scenarios

STEP 2: Verified Model Efficacy

- Calculated actual reductions achieved in water consumption from recent retrofit projects
- Compared actual results with model projections from STEP 1
- Determined a range of possible actual reductions

STEP 3: Finalized Water Sustainability Targets

- Considered LEED pre-requisites (20% reduction)
- Considered the federal government's commitment per Executive Order 13514 (2% annual reduction)
- Conducted a benchmark assessment of water targets set by other universities
- Established specific targets for water conservation for different building types

APPENDIX C: WATER RECLAMATION TECHNOLOGIES

Suggested Water Recycling Treatment and Uses			
Increasing Levels of Treatment; **Increasing Acceptable Levels of Human Exposure**			
Primary Treatment: Sedimentation	**Secondary Treatment:** Biological Oxidation, Disinfection	**Tertiary / Advanced Treatment:** Chemical Coagulation, Filtration, Disinfection	
• No uses Recommended at this level	• Surface irrigation of orchards and vineyards • Non-food crop irrigation • Restricted landscape impoundments • Groundwater recharge of non potable aquifer** • Wetlands, wildlife habitat, stream augmentation** • Industrial cooling processes**	• Landscape and golf course irrigation • Toilet flushing • Vehicle washing • Food crop irrigation • Unrestricted recreational impoundment	• Indirect potable reuse: Groundwater recharge of potable aquifer and surface water reservoir augmentation**
* Suggested uses are based on Guidelines for Water Reuse, developed by U.S. EPA. ** Recommended level of treatment is site-specific.			

Gray Water Reuse from Decentralized Onsite Systems	
Decrease Human Exposure	Treatment Levels Vary
Primary Treatment*:	
▪ Landscape irrigation**	
* Requires use of nontoxic and low sodium (no added sodium or substances with naturally occurring high levels of sodium) soap & personal care products. ** Discharged gray water as generated (not stored) used below surface, application away from populated areas and drinking water wells.	

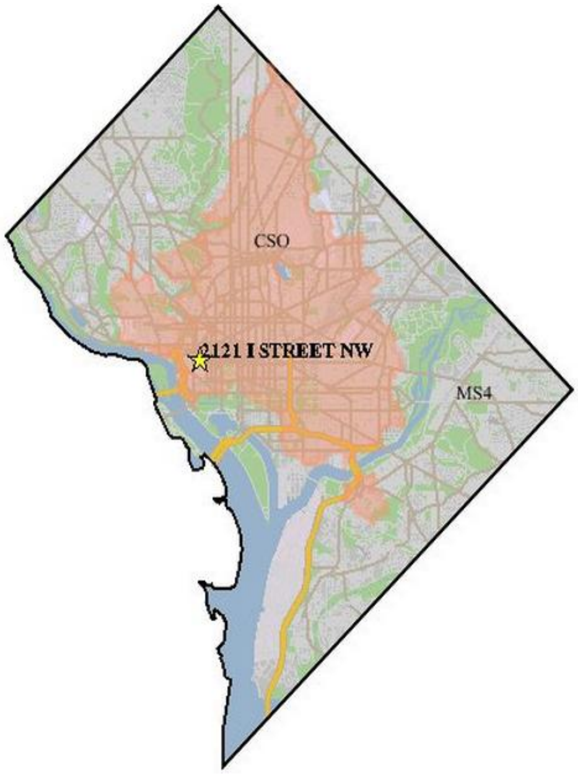
NOTE: While there are some exceptions, wastewater in the United States is generally required to be treated to the secondary level. Cost and treatment requirements for home use gray water system can be reduced through subsurface discharges that eliminate human contact and storage components.

Source: Environmental Protection Agency. "Water Recycling and Reuse: The Environmental Benefits." Web. 28 May 2011. <http://www.epa.gov/region9/water/recycling/>.

APPENDIX D: GW STORM SEWER SYSTEMS MAP

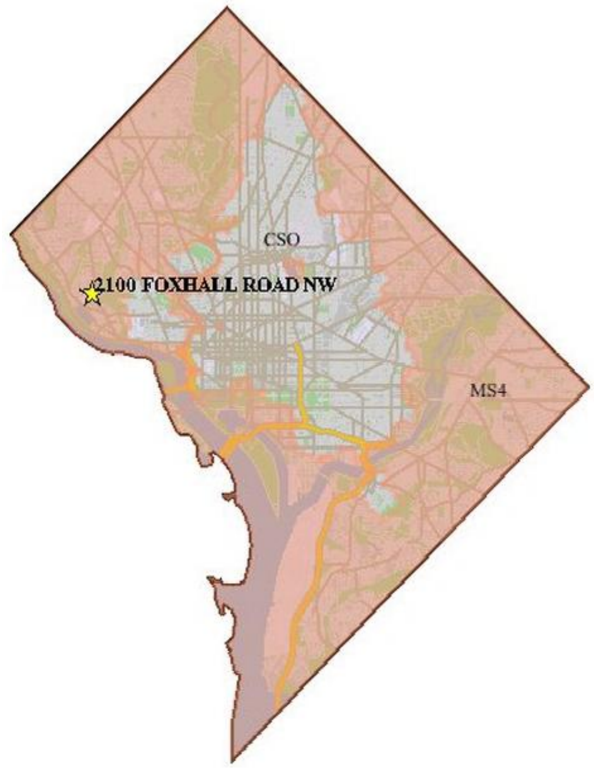
Foggy Bottom Campus

Combined Sewer System



Mount Vernon Campus

Municipal Separate Storm Sewer System



Source: DC Atlas. "Locate Your Watershed." District of Columbia Government. Web. <http://dcatlas.dcgis.dc.gov/ddoe/>

APPENDIX E: WATER POLLUTANTS

Source	Contaminant	Regulated?	Regulation[24]
Labs	Metals	Yes	**Total Concentration Limit** Arsenic: 0.23 mg/L Cadmium: 0.07 mg/L Copper: 2.3 mg/L Lead: 1 mg/L Mercury: <0.001 mg/L Molybdenum: 0.89 mg/L Nickel: 2.2 mg/L Silver: 1.3 mg/L Zinc: 3.4 mg/L
Building (Mechanical Rooms)	PCBs	Yes	**Non-detectible** Total PCBs will be measured using EPA Method 608 with a detection limit of at least 0.001 mg/L
Domestic (Sinks, Showers, Toilets and Laundry)	Quarternary Ammonia Compounds	Not Yet	
	Grease	Yes	**Total Concentration Limit:** 100 mg/L
	Oil	Yes	**Total Concentration Limit:** 100 mg/L
	Metals	Yes	*See above*
	Phosphates	Yes	
	Parabens	Not yet	
	Antimicrobials	Not Yet	
	Pharmaceuticals	Not Yet	
Stormwater (partial)	Litter	Not Yet	
Construction	Particulates	Only for Volatile Organic Compound particles	Measured: All quantifiable values greater than .01 milligrams per liter for the following toxic organics: Acrolein, Acrylonitrile, Benzene, Bromoform (tribromomethane), Carbon tetrachloride (tetrachloromethane), Chlorobenzene, Chlorodibromomethane, Chloroethane, 2-Chloroethyl vinyl ether (mixed), Chloroform (trichloromethane), 1, 1-Dichloroethane, 1, 2-Dichloroethane, 1, 1-Dichloroethylene, 1, 2-Dichloropropane, 1, 3-Dichloropropylene (1, 3-dichloropropene), Ethylbenzene, Methyl bromide (bromomethane), Methyl chloride (chloromethane), Methylene chloride (dichloromethane), 1, 1, 2, 2-Tetrachloroethane, Tetrachloroethylene, Toluene, 1, 2-Trans-dichloroethylene, 1, 1, 1-Trichloroethane, 1, 1, 2-Trichloroethane, Trichloroethylene, Vinyl chloride (chloroethylene)
Pools	Chlorine	Yes	

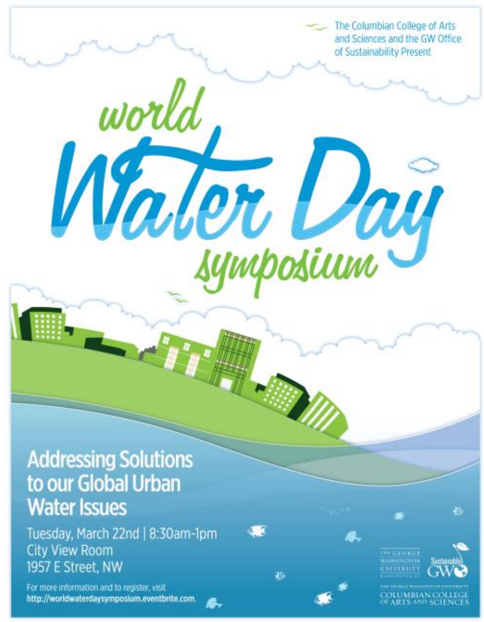
[24] District of Columbia. District of Columbia Water and Sewer Authority. "Discharge Standards." 21 DCMR 15.1501. 2010. Print.

APPENDIX F: INITIAL ENGAGEMENT ACTIVITIES

World Water Day Symposium

22 March 2011

On World Water Day, GW hosted a symposium on urban water issues. As urban growth strains infrastructure, water use emerges as one of top challenges for cities as they attempt to support and provide for their population. Lessons from abroad can inform policies at home, and the GW World Water Day Symposium provided a platform for experts to convene and discuss the breadth of urban water issues affecting cities across the world, including Washington D.C.



The GW World Water Day Symposium featured a diverse array of speakers and topics including Eugene Stakhiv (US Army Corps of Engineers) who talked about water in the context of national security, Justin Stoler (San Diego State University) who presented his research the privatization of urban drinking water in Western Africa and Katherine Bliss (CSIS) who spoke on the importance of integrating water, sanitation and hygiene into global health policy and programming.

To better understand the local context, George Hawkins (General Manager, DCWater) talked about why tap water matters in cities and Meghan Chapple-Brown (Director, GW Office of Sustainability) provided an update on GW's Year of Water efforts.

The GWater Challenge

April 2011

In order to highlight its commitment to water sustainability, the university held the GWater Challenge throughout the month of April. GW's Office of Sustainability created a checklist of activities that GW community members could do to reduce their own water footprints. More details about the GWater Challenge are available here: http://bit.ly/gwaterchallenge

To encourage participation, students were provided an Earth Month Passport, which they could use to check off the actions they did to contribute to water sustainability at GW, or the events they attended over the month of April. Students were also encouraged to take pictures of themselves participating in the GWater Challenge to be entered into a raffle held at the Earth Day Fair for exciting water prizes.

Greening the City - Service Event with Anacostia Watershed Society

9 April 2011

Every year, Anacostia Watershed brings together thousands of volunteers to participate in a massive trash cleanup along the shores of the Anacostia River in D.C. and several upstream tributaries in

Maryland. This year, more than 500 GW students volunteered alongside the Anacostia Watershed Society to celebrate the 41st Anniversary of Earth Day. An Earth Day Celebration followed the morning cleanup, featuring free food, music and exhibits from community organizations.

Water Film Series

18-20 April 2011

The Office of Sustainability organized a film series showcasing three movies on water sustainability issues:

I. *Flow: For the Love of Water* – This feature film takes a global perspective and confronts the disturbing reality that a crucial environmental resource is dwindling and greed just may be the cause.

II. *Poisoned Waters* – This documentary is an investigation into America's great waterways and the pollution that's killing fish, causing mutations in frogs – and threatening human health.

III. *Tapped* – This film examines the role of the bottled water industry and its effects on human health, climate change, pollution and mankind's reliance on oil. The screening was followed by a panel discussion with representatives from Coca-Cola, DC Water, Food and Water Watch, and Potomac Riverkeeper about bottled water. The event was cosponsored by DC Water.

Water Taste Test and Water Pledge

21 April 2011

In order to raise awareness about drinking water choices, the Office of Sustainability held a water taste test on campus. Students were made to blind taste samples of bottled, filtered and tap water to see if they could tell the difference.

Students were also encouraged to take a pledge to choose tap water or filtered tap water over bottled water whenever possible, as well as to carry a reusable bottle for this purpose and talk to their family and friends about reducing their bottled water use.

Earth Day Fair

22 April 2011

The George Washington University commemorated the 41st Earth Day by revealing its water footprint and unveiling its comprehensive plan to reduce water consumption and bottled water use, as well as to minimize pollutants in wastewater on its three campuses.

To celebrate Earth Day, the Office of Sustainability organized the Earth Day Fair, featuring a number of GW departments and external vendors who were showcasing their sustainability services and efforts. Some of the highlights included *Staples*, which offered eco-conscious office supplies, and *GW's Division of Information Technology,* which demonstrated its "paperless office" software that many GW offices are already using. *GW's Food Justice Alliance*, a student organization that runs the university's community garden, offered raw and unprocessed foods that still contain all of their original nutrients.

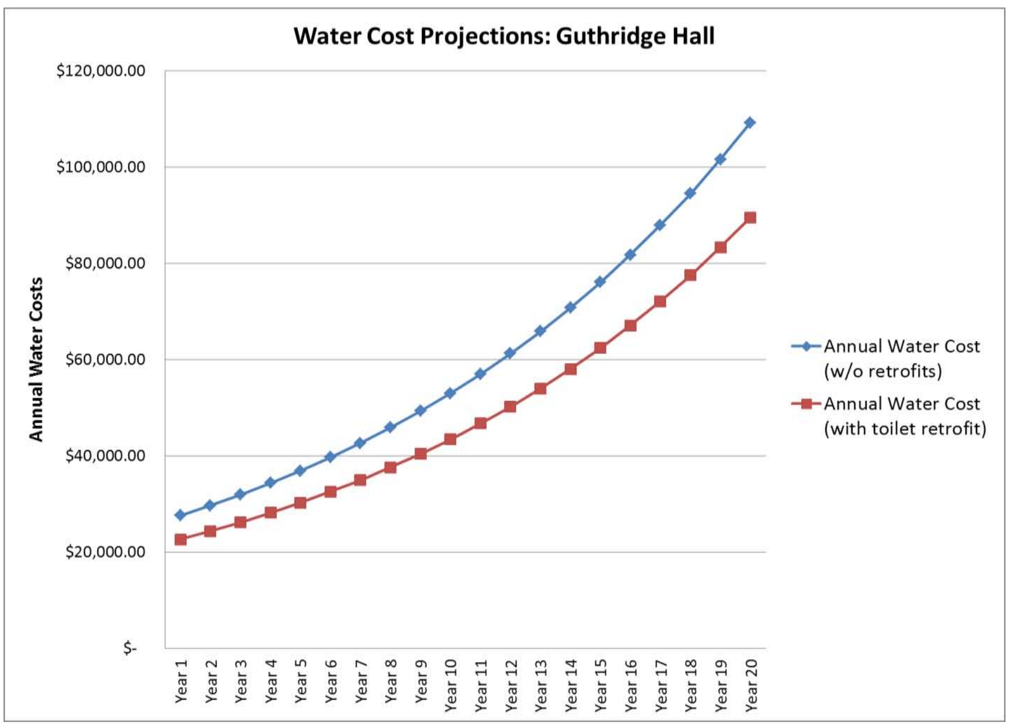
The Earth Day Fair also included Bike Day. Students, staff and faculty were encouraged to bring their bikes to campus for a tune-up, learn about local rides from the GW Cycling Club, meet with bike shops in the area to learn about safe biking, and get a helmet fitting done by GW UPD.

APPENDIX G: SAMPLE WAP PROJECT: COST-SAVINGS PROJECTIONS

Example: Proposed Guthridge Hall Toilet Retrofit Project

Retrofit all 96 toilets in Guthridge Hall

- Installing low-flow toilets results in net present savings of $55,805.14 over 20 years.
- Annual water cost savings from the project can pay for the project in eight years.
- Costs are significantly lower if retrofits are installed by internal staff (GW plumbers). However, in general, large scale retrofit projects are implemented by external contractors.



Assumptions

1. Labor ($175/toilet installation) and material costs ($365/toilet) of the project were obtained from estimates provided by GW Operations
2. DC Water prices are assumed to rise by 7.5% per year, and the discount rate assumed is 6%