

# Dunbar High School

Creating a High-Performance, Sustainable Learning Environment for Washington, DC

ARCHITECTURE  
CONSULTING  
INTERIOR DESIGN  
PLANNING  
PROGRAMMING

Perkins Eastman





## Dunbar High School

Creating a High-Performance, Sustainable  
Learning Environment for Washington, DC

Perkins Eastman



## Creating a High-Performance, Sustainable Learning Environment for Washington, DC

Located just a few blocks from the US Capitol, the new Dunbar High School campus is striving to raise the bar for sustainable, high performance school design. The school has been designed to target LEED for Schools Platinum certification – the highest level of certification by the US Green Building Council. This will result in a design that conserves energy and water, creates a healthier and more comfortable place to learn and fosters a commitment to environmental stewardship among students and staff.

The attributes of the building that will support these goals are a radiant heating system in the floor of the “Armory,” the school’s main public space; a ground source heat pump (aka “geothermal”) system under the football field; a

482-kW photovoltaic array on the roof; two 20,000-gallon cisterns adjacent to O Street for collecting and reusing rainwater; and enhanced acoustics, low-VOC materials and plentiful daylight and views throughout.

The reconstruction of Dunbar High School is being led by DC’s Department of General Services (DGS). DGS and the District of Columbia Public Schools have engaged EE&K | Architects & Engineers – a collaboration of Perkins Eastman, Setty & Associates International and SK&A Structural Engineers, LLC – as well as Moody Nolan and Smoot/Gilbane Construction for the redesign and construction of Dunbar Senior High School.



## ENERGY

A ground-source heat pump system (also known as a geothermal system) under the athletic field and radiant flooring in the Armory support Dunbar's commitment to energy efficiency.



## EXTERIOR

The building exterior, or "envelope," is like your skin – it protects you from sun, wind, rain, and snow. The envelope is designed to allow natural light and fresh air into the building while keeping excess heat and cold out.



## INTERIOR

Low-emitting, recycled and regional materials, green housekeeping, and pervasive daylighting and views enhance the quality of the interior environment.



## SOLAR

Solar panels, also known as photovoltaic (PV) panels, convert natural energy from the sun into clean, reliable electricity.



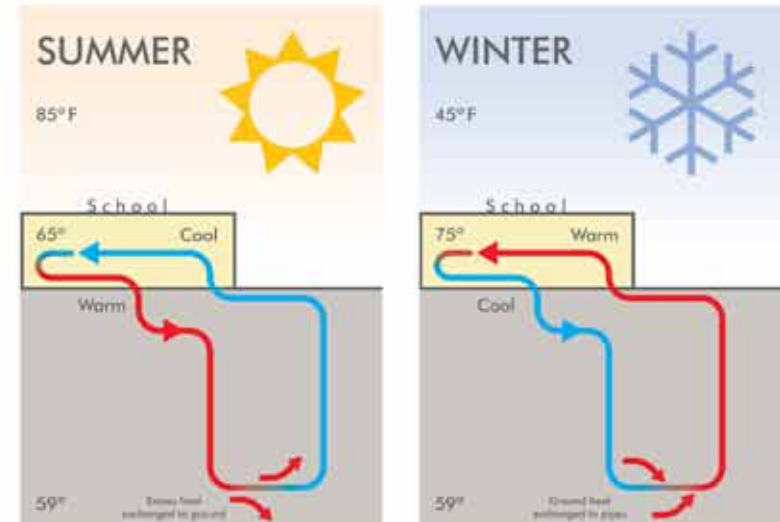
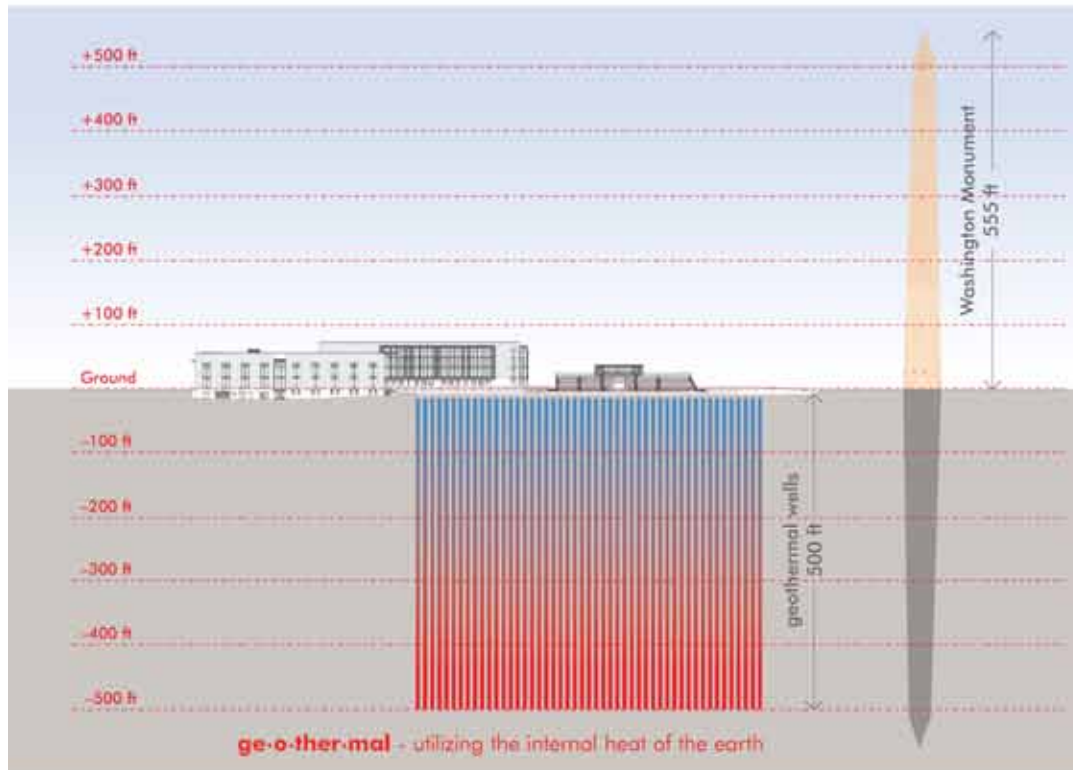
## WATER

Rainwater collection and water efficient fixtures reduce demand for fresh water and help retain storm water runoff.

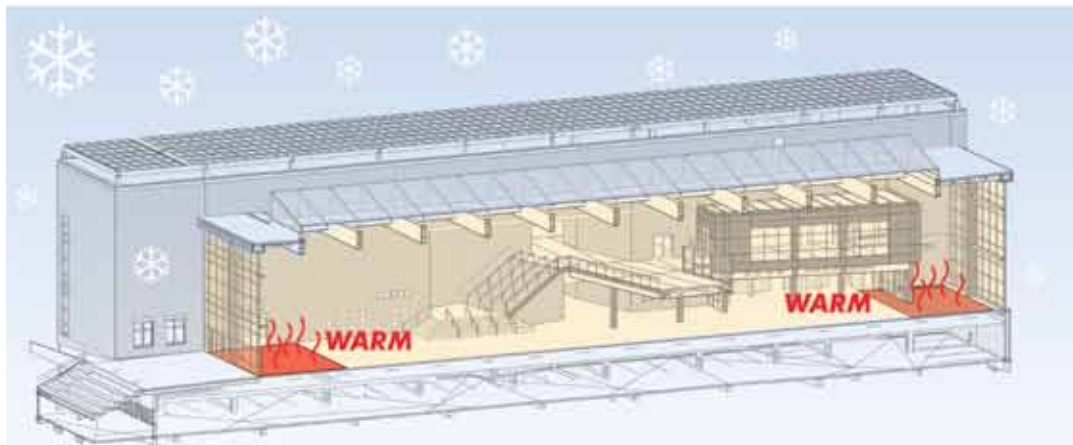
Graphic Design by Perkins Eastman

# ENERGY

A ground-source heat pump system (also known as a geothermal system) under the athletic field and radiant flooring in the Armory support Dunbar's commitment to energy efficiency.



**Geothermal wells** take advantage of the earth's constant year-round temperature of 59° F. Water is pumped through pipes that are buried underground. In the summer, the water absorbs excess heat from the building's mechanical system, then transfers that heat into the ground. In the winter, the opposite happens: the water draws heat from the ground to provide pre-warmed air and water to the heating system of the building. This system reduces the building's demand for energy from fossil fuels.



**Radiant flooring** in the Armory improves thermal comfort of occupied areas near the glass in the winter by warming the space from below. Because fans and air ducts are not needed for radiant flooring, the system is silent and efficient. Independent east and west loops allow the occupants to control the amount of heat throughout the day.



## DID YOU KNOW THAT...

- ⚡ 362 wells are buried under the track and field to a depth of 500 feet.
- ⚡ \$250,000 - \$300,000  
Estimated annual energy cost savings when compared to average DC schools.
- ⚡ In all, the system has more than 68 miles of tubing, longer than the Capital Beltway!



# EXTERIOR

The building exterior, or “envelope,” is like your skin – it protects you from sun, wind, rain, and snow. The envelope is designed to allow ample natural light into the building while keeping excess heat and cold out.



## Morning

The rising sun brings daylight into the building and helps to warm the interior. The lower altitude of the sun in the winter months allows more sunlight and solar gain to reach classrooms; the higher summer sun is blocked by roof overhangs and sun shades.

## Noon

The bright, high sun heats the walls and roof. Roof overhangs block the sun, shading the interior. Horizontal louvers or sun shades prevent glare (direct sunlight on reflective floors and work surfaces), while admitting ample daylight to the interior.

## Afternoon

The low afternoon sun shines directly on the western exposures (sides) of the building. Vertical fins help to reduce heat gain. Exterior sun shades are supplemented by interior shades that occupants can use to control brightness and room comfort.



## DID YOU KNOW THAT...

1 East-west building orientation (5%) + passive solar design (10%) can produce up to 15% energy savings.

2 The building's facade is not only decorative, but also performs vital functions throughout the day.

The climate zone has important implications for the design of the exterior. In a temperate and humid climate, creating waterproof and thermal barriers between the inside and outside of the building helps keep the interior air comfortable and prevents water damage from humidity and condensation.

## U.S. Climate Zone



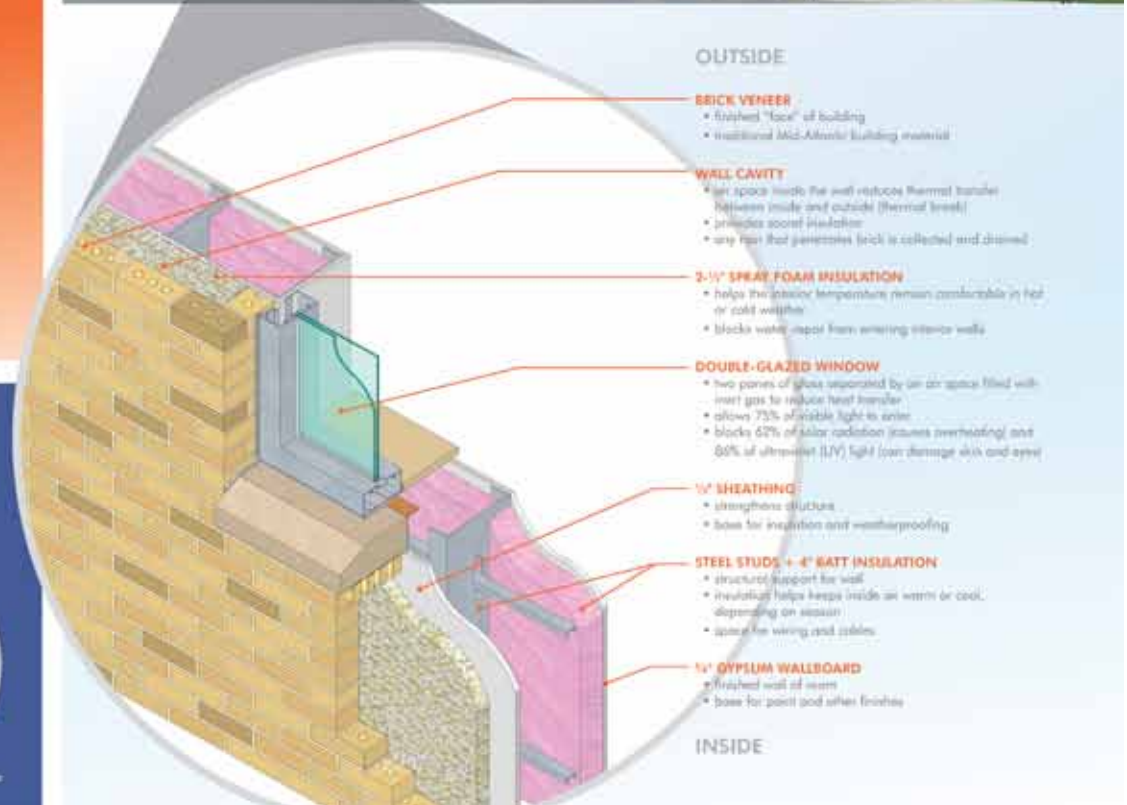
## R-Value

A measure of a material's resistance to the passage of heat, R-value is used to describe the different types of insulation used in buildings. The higher the number, the better the building insulation's effectiveness.

	Existing Dunbar HS	New Dunbar HS
Walls	Up to 6	Up to 27
Roof	Up to 15	Average 43

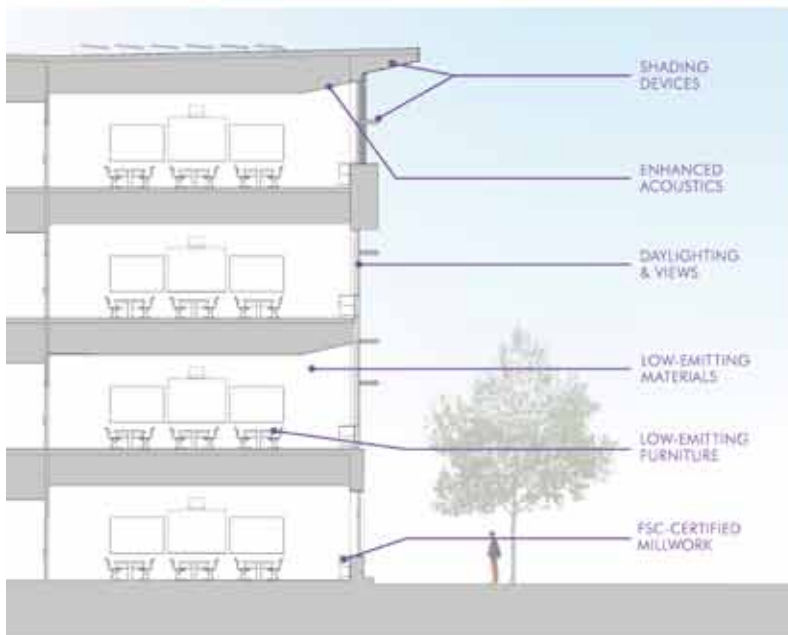


Insulation and wall detail of Dunbar



# INTERIOR

Low-emitting, recycled and regional materials, green housekeeping, and pervasive daylighting and views enhance the quality of the interior environment.



## DID YOU KNOW THAT...

- Natural light is provided to over 90% of the classrooms.
- Natural daylighting has been directly linked to enhanced achievement in the classroom.

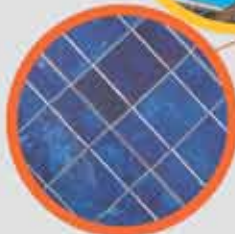


# SOLAR

Solar panels, also known as photovoltaic (PV) panels, convert natural energy from the sun into clean, reliable electricity.

The new Dunbar will have these three different types of solar panels on the roof. Solar panels must be oriented south to maximize efficiency.

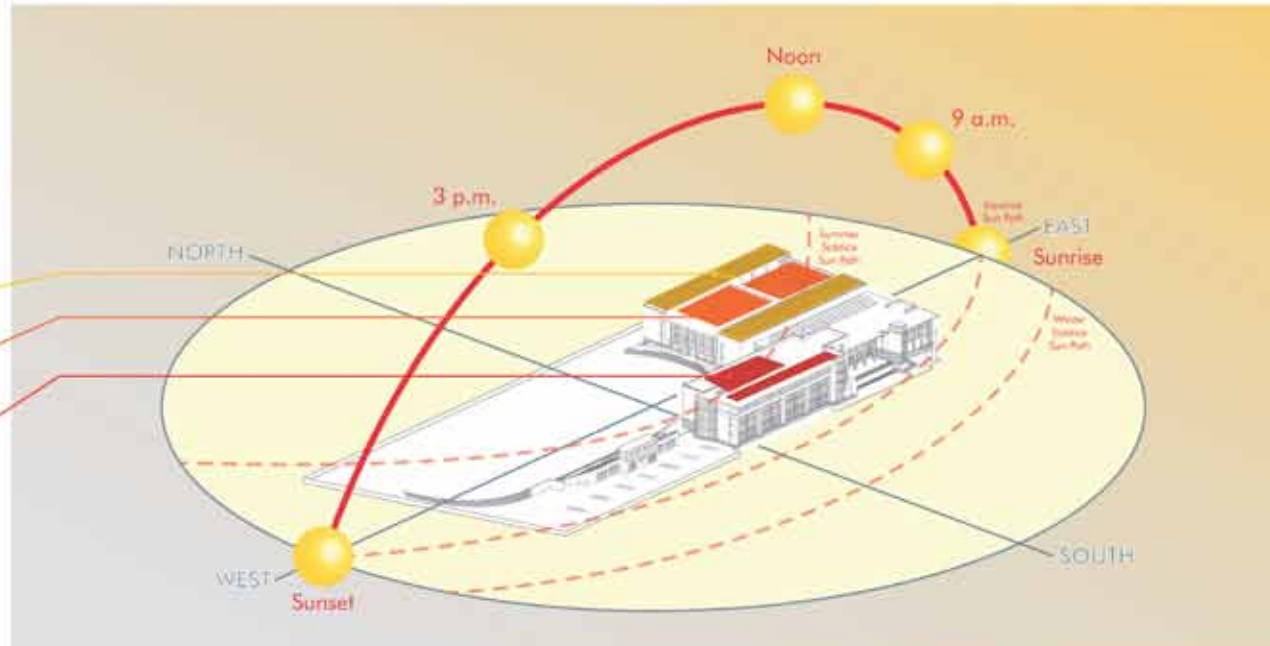
trellis mounted  
south facing 5° slope



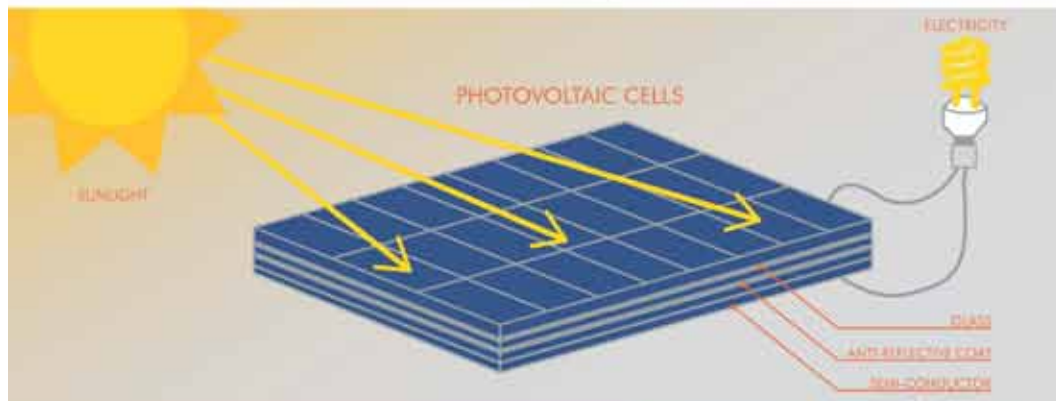
thin film  
0° slope



roof ballasted  
south facing 5° slope



The sun's path changes with the seasons. The building is oriented on the east-west axis, with the longer sides facing north and south, to capture natural light throughout the day. In winter, the low sun warms the building, reducing load on the heating system. In summer, the high sun is blocked by overhangs and other shading devices.



## DID YOU KNOW THAT...

- ☀ On-site power generation accounts for 14% electricity savings.
- ☀ On average, DC has 202 sunny days per year, 4.2 hours of sun per day.
- ☀ Solar power gathered on a sunny summer day is strong enough to light all 56 classrooms and a surplus of 4 classrooms for 8 hours!

1 kW = amount of electricity to light one classroom for one hour

480 kW = total PV generation



56 total classrooms at Dunbar



# WATER

Rainwater collection and water efficient fixtures reduce demand for fresh water and help retain storm water runoff.



## DID YOU KNOW THAT...

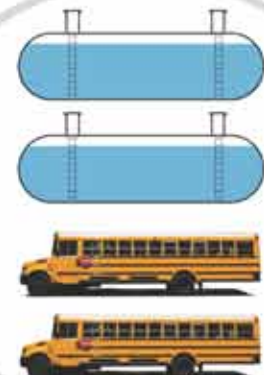
- Water reduction measures decrease water usage by 50%.
- Saving 1,400,000 gallons per year compared to a typical high school.
- Approximately 486 million gallons of water is used daily in the Washington DC area. Each person uses about 80-100 gallons per day.

### Where Does the Water Go?

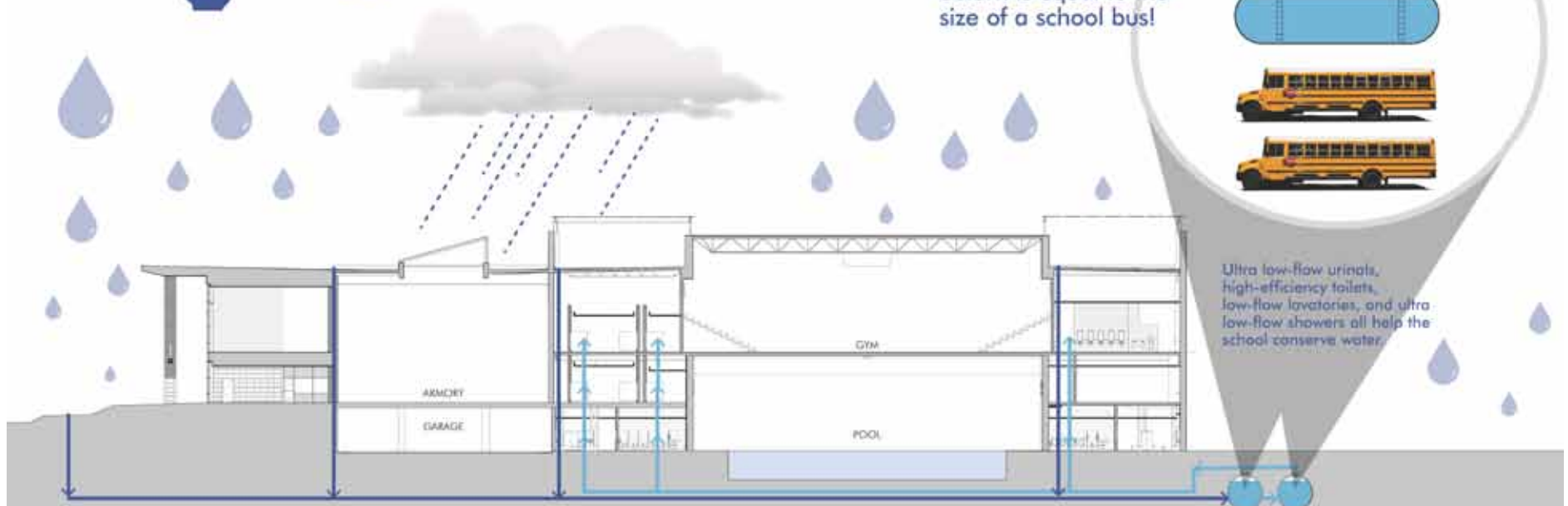
Dunbar High School is situated within the Anacostia River watershed. The Anacostia is one of the most polluted rivers in the country. To help improve the quality of the river, new developments in the city must capture and treat storm water so that it does not rush into the river, carrying dirt and pollutants. By collecting and reusing rain water, the school will minimize the impact of runoff on the Anacostia and beyond.



There are two 20,000 gallon cisterns adjacent to the building. Each cistern is equal to the size of a school bus!



Ultra low-flow urinals, high-efficiency toilets, low-flow lavatories, and ultra low-flow showers all help the school conserve water.



Rainwater harvested from the roof and site will be stored in the cisterns to be filtered and reused for flushing toilets throughout the building.



## **NORTH AMERICA**

BOSTON, MA  
CHARLOTTE, NC  
CHICAGO, IL  
NEW YORK, NY  
PITTSBURGH, PA  
SAN FRANCISCO, CA  
STAMFORD, CT  
TORONTO, ON  
WASHINGTON, DC

## **SOUTH AMERICA**

GUAYAQUIL, ECU

## **ASIA**

MUMBAI, IND  
SHANGHAI, PRC

## **MIDDLE EAST**

DUBAI, UAE

## **K-12 EDUCATION EXPERTISE**

Perkins Eastman views every school project as an opportunity to understand the present and envision the future, each time challenging ourselves to create relevant and inspiring learning environments that propel students to identify their potential to grow. We believe that schools should function as the centers of their communities. Our passion is to improve school facilities for our national and international school clients by incorporating each institution's unique core values, goals, and mission. Working closely with constituents, we ensure that curriculum and program drive solutions. By merging the practice with EE&K's 50-year legacy of school planning and design, we have enhanced our capacity to create private and public school environments that are bright and inviting, scaled to the child, and provide an effective, welcoming environment for teaching and learning both inside the classroom and out.

# Perkins Eastman

[www.perkinseastman.com](http://www.perkinseastman.com)

2121 WARD COURT, NW, FLOOR 6  
WASHINGTON, DC 20037

T. 202.861.1325

F. 202.861.1326