The 414,000-square-foot building sits on a 6.2-acre site with a 30-foot grade change from the rear of the building down to the front. With a relatively small site and a large building, including a three-story, below-grade parking structure, the remaining open space was heavily impacted by construction activities.

LIGHTWEIGHT AGGREGATE PROMOTES SUSTAINABILITY ON GA TECH CAMPUS

After nearly a decade, the unique properties of lightweight aggregate continue to be useful for plant growth and storm water management on the Georgia Tech campus near downtown Atlanta. "This is a project that I've watched over the years since installation," says Stephen Brooks principal of SOLIDAGO Design Solutions, Inc

"I have been impressed with the high survivability of the material as well as the significant growth rate, especially compared to areas that did not receive the engineered soil media. Given the long term success of this project, my firm uses this as a reference project to showcase the critical importance of regenerating a healthy soil condition post construction."

When construction on the Christopher W. Klaus Advanced Computing Building began nearly ten years ago, Georgia Tech and those involved in the site's development, set out to achieve a competitive environmental benchmark in storm water management. Today, the dense urban campus boasts a diverse ecological environment that preserves over 50% of the site as open space.
Brooks was vice-president of landscape architecture and urban planning firm Ecos Environmental Designs when this project was completed back in 2006. "It turned out to be a perfect fit," Brooks says. "We were able to achieve the needed infiltration rates while maintaining the right amount of moisture, combined with good organic content to support proper soil biology for ample plant life."

Brooks says the project presented an opportunity to use new solutions, embracing the university's challenge to replicate pre-development hydrology, preserve the site's native ecology, and emphasize open green space. "Through a collaborative effort with the Environmental Protection Agency Region 4 and the Georgia Department of Community Affairs, we partnered with ERTH Products to engineer a soil mix for a bioretention and landscape area.," says Brooks. "The goal was to capture and infiltrate or re-use storm water while minimizing run off on the site's dramatic grade change," he says.

Back in 2006, Georgia Tech's primary goal was to develop a retention system that would capture the first flush, or the first 1.2 inches, of each rain event and hold it on site as reclaimed irrigation water. The soil quality was ideal for building support, but lacked the necessary infiltration for adequate storm water management.

SOIL CONSIDERATIONS

The bioretention area of the site used 350 cubic yards of engineered soil, containing 40 percent clay topsoil, 20 percent sand, 20 percent ERTH food compost, and 20 percent expanded clay lightweight aggregate, manufactured through a rotary kiln process in which selectively mined clay is fired at 2000 degrees Fahrenheit.

"This process produces a consistent and predictable, high-quality ceramic aggregate that is structurally strong, physically stable, durable, environmentally inert, lightweight, and highly insulative," says Jeff Speck, of Arcosa Lightweight. "As a filter medium, lightweight aggregate increases surface area and allows fast, free drainage, helps remove or reduce toxins, and absorbs nutrients for long-term, sustainable water treatment."

For site developers and storm water management professionals, the product improves soil's functionality and service life, saving material, labor and transportation costs.

Lightweight aggregates support the physical requirements needed for developing engineered soil mix, according to Scott King of ERTH Products. "This design allows for good surface infiltration of storm water, along with high groundwater holding capacity, while not creating a continuously saturated soil, which would be detrimental to plant life," King says. "Lightweight accomplishes this and provides long-term soil structure with pore space for air, water and nutrient exchange in the soil profile."

Chemical and biological considerations included creating a living soil containing organic macro- and micro-nutrients and a diverse population of beneficial microbes. A living soil was essential given it requires fewer chemical inputs, breaks down contaminants, and provides movement within the soil, which increases infiltration, water holding capacity and the overall air and water exchange.

MANY PARTS CREATE A WHOLE

The storm water retention design aimed to accept the building's roof runoff and the site's first flush, absorbing storm water into the landscape and depositing the surplus into two underground concrete cisterns with a combined 174,149-gallon volume. After the cisterns were installed, A series of retaining walls were constructed, up to 25 feet long by 3 feet wide and 30 inches tall. Built from local, natural granite, the walls were set perpendicular to the flow within the bioretention area, and served as the conduit for roof runoff into the terraced bioretention area where the engineered soil mix filtered the stormwater before entering the cisterns below.

"The roof's downspouts were connected to the end of the walls to an interior channel, which has a series of openings on the downstream side," explains Brooks. "Roof runoff passes from the downspout to the walls' interior, turns 90 degrees, and exits to the landscape. The reinforced channel of the walls withstands the four stories of velocity from the roof, preventing soil erosion."

Four-foot deep cells were excavated between the retaining walls, with under-drain pipes surrounded by gravel and wrapped with filter fabric were connected to the underground cisterns. The engineered soil mix was then installed in a series of lifts, each watered down to ensure soil settlement until the design elevation was reached. The channels were lined with native river rock, broken up by large boulders salvaged during excavation of the building site. Cranes placed the boulders on graded aggregate to ensure that they did not move. The boulders were slightly elevated to absorb grade changes and encourage pooling behind them, maximizing infiltration time.

The bioretention area was then planted with a mix of native plant species to mimic a perennial stream and floodplain plant community in Georgia's Piedmont region, providing a drought-tolerant landscape. Any storm water that does not absorb by the soil or plant material is captured by the under-drain and sent to the cisterns, where irrigation pumps recycle it throughout the project site.

At the rear of the Klaus building is a large lawn space used for student gatherings and social functions. Under the sod, the same bioretention soil mix formulated with lightweight aggregate was used to capture storm water sheeting off hardscapes. The water is routed through a series of under-drains emptying into the cisterns.

MISSION ACCOMPLISHED

Georgia Tech's innovative storm water management system earned a coveted LEED Gold Certification from the U.S. Green Building Council for sustainable site development using environmental materials from local sources. The experience and its ultimate result not only achieved the university's goals for storm water retention, but set a new standard that's still being used for similar projects.

"The proper dynamics of compaction, nutrients and biological activity can only be achieved through special attention to the soil as a separate scope of work from the overall landscape planting," says Brooks. "Without this attention, plant material presents itself well at installation but experiences a dramatic decline as acclimating plant material encounters excessively compacted soils, poor oxygen & moisture ratios, and the unfavorable conditions leftover from intensive construction. The use of a quality engineered soil media that contains proper nutrients with good porosity creates a soil condition more aligned with native soils and is critical to ensure continued long term growth of the significant investment a client has made in the landscape."

SOLIDAGO is a partnership between Stephen Brooks and Alfred Vick, a former Ecos VP, consultant for the Klaus' plant communities and Associative Professor of Ecology at UGA's College of Environment + Design.