GREENVILLE, S.C. – A five-gallon plastic bucket filled with washed stone and a pair of gallon-sized water jugs helped city engineers in Greenville, South Carolina decide what kind of drainage system to install on a fast-growing hospital campus.

The project engineers and contractors claimed that the voids between stone – specifically, a foot of #5 grade stone above and below a corrugated high-density polyethylene (HDPE) drainage pipe – could utilize at least 40 percent of that space for water retention. The innovative project would make unnecessary a retention pond, allowing for safe, maximum use of the property.

When the team proved it by pouring more than two gallons of water into the stone-filled bucket, the decision was made, and the system has been working successfully since it was completed in 2004.

“That demonstration convinced the hospital and the city that this system was the one to use,” said Robert Norris, the project manager at the time for Greenville-based Strange Bros. Contractors.

The Patewood Medical Campus of Greenville Hospital System was growing rapidly and in need of more parking. At the time, it had approximately 1,000 physicians, more than 7,500 employees and 1,146 licensed beds spread among five campuses.

With that kind of demand for parking, it was easy to understand why the owner wanted to utilize the valuable space that would have been taken up by a retention pond.

Using HDPE pipe to construct a storm water drainage system was done with a minimal crew and saved valuable parking space that would have been lost if a retention pond was built at the Patewood Medical Campus.

The corrugated HDPE pipe system was the only solution that could provide the nearly 100,000 cubic feet of water storage capacity required in such a small footprint of just 100 x 420 feet.

The system is made up of 4,900 feet of 48-inch Advanced Drainage Systems (ADS) N-12® HDPE pipe with one foot of stone above and below it. The pipe was perforated with 3/8 inch holes all around using a standard pattern and wrapped in 6 oz., non-woven geo-textile fabric as is the entire system.

Wrapping each pipe prevents sediment from lodging in the stone voids. Enclosing the entire system in fabric prevents the migration of fines from the native soil into the select backfill material.

“Using voids in the stone allows you to reduce the footage and/or the diameter of the pipe with the
ultimate goal to achieve more volume for less money,” said Norris.

In a heavy rain event, the perforations in the pipe allow the collected storm water to leach into the stone layers where it is held before slowly draining back into the corrugated HDPE pipe that makes up the retention unit via smaller drain pipes in the bottom native soil backfill.

Because HDPE pipe will maintain its structural integrity and its surface will not be damaged when the perforation holes are drilled, it is the ideal product. Steel pipe has a coating which would be compromised when drilled, leading to a more rapid corrosion of the pipe, and it is not practical to drill concrete pipe.

“There are solutions to underground storage systems that can only be accomplished due to the versatility of HDPE pipe and the creativity of those in our industry,” said Tony Radoszewski, executive director of the Plastics Pipe Institute (PPI).

The Plastics Pipe Institute is the major trade association representing all segments of the plastic piping industry. ADS is a member of the PPI.

“The Patewood project is an example of the creative solution driven by both engineering and economics,” Radoszewski stated. “And environmental reasons can be added to that list.”

Perforated pipe is typically used in retention systems so that the stored storm water runoff can recharge groundwater. A discharge outlet is designed into the system to limit the flow rate into the receiving sewers or channels.

“Specifications at the time required the first inch of runoff in any storm to be held and allowed to recharge the groundwater, and this system is designed for that,” said R. Michael Batie, P.E., CFM, technical and engineering manager for the PPI.

According to Batie, this
innovative solution could become commonplace nationwide as open land becomes scarcer and land use becomes more dense.

“A system like this returns more water into the ground than any other storm water system that could be installed,” Batie explained. “That’s not something that people think much about when population growth keeps pushing more and more into our former undeveloped open lands, but it’s very important.”

Radoszewski explained that because components for systems like the one installed at Patewood are engineered for retention, they easily fit together. The pipe and components are lightweight to help speed handling and placement. Joints are easy-to-assemble standard designs, making installation a rapid process. Contractors spend their time completing the system, not making field modifications to the product.

“The ability to design and manufacture a system with the exact pipe segments and fittings ahead of excavation makes installation a snap,” Radoszewski emphasized.

The bulk of the work was completed in just a three-week span, according to Strange Bros. Project Superintendent Jay Clark.

“We were able to do this job with minimal labor and minimal equipment,” said Clark, who installed the pipe system in less than two weeks and had the entire job completed (excavation, stone bedding, and backfilling) in about a month. “With just myself, two other men, a loader and a trackhoe, our best day was putting down 720 feet of pipe. On average, we would do between 400 and 600 feet a day.”

“For this application and situation, HDPE pipe was the only kind we could have used,” Clark said. “The pipe holds water, the stone holds water and putting it underground saves the valuable property space. Making this choice had a lot to do with downstream capacity capabilities.

The storm water drainage system for the Patewood Medical Campus here consisted of ADS N-12 HDPE pipe that was perforated and surrounded by stone to allow water to slowly drain into the collection unit. Installation of nearly 5,000 feet of 48-inch diameter HDPE pipe was done in less than two weeks.
and our need to have a system that would gradually let the water out and still have enough capacity to handle a flash flood situation.”

David Elliott of Design Strategies and the lead engineer on the project said there were three main obstacles to overcome and convince the city to approve this system: the holding capacity of the stone, the potential for fines to contaminate those voids and “…of all things, the light pole installation. With the water capacity issue well covered, the light issue, however, was an easy one.”

To install large light poles for the parking lots, 8-foot to 10-foot deep cylindrical foundations are typically used to anchor the structures. But since that would compromise the geotextile wrap, not to mention the HDPE pipe system itself, Elliott recommended spread footings to support the light poles.

“I would call what was done at Patewood a new use of established technology,” Elliott said. “In this area, it’s still the exception, not the rule. But we’re seeing changes in the way reviewing agencies feel about retention ponds. They used to see them as a very good thing, but that’s starting to change. Ponds take up too much valuable land with no other usable purpose. At Patewood, HDPE pipe was the solution.”

PPI is the major trade association representing all segments of the plastics piping industry. Member companies share a common interest in broadening market opportunities that make effective use of plastic piping for water and gas distribution, sewer and wastewater, oil and gas production, industrial and mining uses, power and communications duct and irrigation. More information is available online at www.plasticpipe.org.

---

**CORRUGATED POLYETHYLENE PIPE – The Drainage Solution – STRONG, RELIABLE, COST-EFFECTIVE**

It is a fact: the next century of storm water technology and solutions is not written in concrete.

During the past several years the specification and use of dual wall HDPE corrugated pipe for storm water systems have increased dramatically based on factors such as the pipe’s strength, durability, joint integrity and long-term cost-effectiveness.

Results show that forward-thinking municipalities are realizing the future of storm water management relies on the best technology. HDPE corrugated pipe is manufactured from the highest quality materials and is the most technologically advanced product available to move storm water and wastewater.

HDPE corrugated pipe is the proven, reliable, cost-effective and safe solution for your long-term drainage needs.

**Structural Design**

**Strength**

HDPE corrugated pipe is a flexible pipe system that performs well in both high cover and low cover applications. Its unique ability to support and distribute live and dead load enables it to meet almost every installation condition.

**Durability**

**Chemical Inertness**

High-density polyethylene is one of the most chemically inert of all plastics and therefore is extremely chemical and corrosion resistant.

**Abrasion Resistance**

HDPE is very resistant to abrasion. These two characteristics give corrugated polyethylene pipe a significant long-term advantage over concrete and metal pipe.

**Reliability and Security**

**Joints**

Silt tight and water tight joints mean that what’s inside the pipe stays inside the pipe, and what’s outside stays outside. This ensures that communities, citizens, ground water supplies and wildlife are safer and more secure in their environment. These integral joints meet the stringent standards mandated by the EPA and comply with ASTM and AASHTO specifications.

**Tolerances**

Tight control of production and use of uniform, specified raw materials ensure that HDPE pipe is manufactured to the tightest tolerances. Silt tight and water tight joints continue to perform under moderate deflections.

**Quality**

The Plastics Pipe Institute has initiated a tough third-party certification program for manufacturers of corrugated HDPE pipe and resin. The certification program tests for the material, dimensional, and physical performance properties as specified in AASHTO M294/MP7.

**Economic Advantages**

**Installation**

HDPE pipe is light, tough and is manufactured in long lengths. This adds up to significant potential for installation cost savings.

**Life Cycle Cost**

Because of HDPE’s resistance to abrasion and to chemicals, polyethylene’s pipe’s life-cycle savings over alternative drainage systems are significant. Users can expect a minimum service life of 100 years in many typical drainage applications.