



Up to the Challenge

Precast concrete tanks are at the heart of a large-scale, complex septic system serving Raven Rock State Park's new campsites.

By Shari Held

Photos by Stacy Creech, Creech's Plumbing & Septic



Shoaf Precast manufactured the precast portions of the septic system for the Moccasin Branch campground at Raven Rock State Park in North Carolina.

Named for a massive bluff that rises 100 feet above Cape Fear River in North Carolina's Piedmont region, Raven Rock State Park is known for its unique 570-million-year-old bluffs, breathtaking river vistas and mature forests. The area, once home to the Siouan and Tuscarora tribes, was the perfect spot for camping, but it was missing one major component: campsites.

In a quest to provide more outdoor recreational opportunities statewide to residents, North Carolina adopted a campground model that includes up to 30 campsites – a combination of primitive sites, RV sites and cabins, with one handicapped-accessible site per campsite type – plus a bathhouse.

“It's the model that works for the state size-wise,” said Robert Graham, P.E., principal engineer at the time for George Finch/Boney and Associates, headquartered in Raleigh, N.C.

In September 2019, construction began on Raven Rock's new Moccasin Branch Campground, which includes nine RV sites with full water and sewer hook-ups, a bathhouse with restrooms and hot showers, 15 campsites for tents and trailers and six rustic

cabins. This park, which typically is packed from spring through fall, was one of the first campgrounds projects commissioned by the state for this initiative.

“Raven Rock State Park is between some fairly large municipal areas such as Raleigh-Durham, Greensboro and Fayetteville, so it made sense for the state to add the campgrounds there,” Graham said.

WEATHER PERMITTING

Before the project began, it faced several obstacles. One issue was that it was on a tight deadline during the busiest time of the season for local installers and many were booked for the season. In addition, the scope and complexity of the project was daunting. Ultimately, the septic system team consisted of the installer – Wilson, N.C.-based Creech's Plumbing & Septic – and the septic tank fabricator – Lexington, N.C.-based Shoaf Precast.

Everyone involved with the project knew upfront the weather would be a big challenge that they couldn't control. Work couldn't



The septic system at Raven Rock State Park was the largest project to date for Shoaf Precast and Creech Plumbing.

begin until early September, which coincided with the beginning of North Carolina's hurricane season. During that time, the area is pummeled by relentless rain and low-pressure systems.

"Once it got wet, it would take a couple of weeks before we could go back," said Stacy Creech, proprietor of Creech's Plumbing & Septic. "So, if it rained on and off again for four weeks, we'd be looking at two months before we could even go back to work."

That could be a death knell to a project with a firm deadline of 180 days from start to finish. Adding to the tight timeline woes, work crews had to comply with the park's hours of operation, which limited the hours they could work on-site.

PRECAST: THE MATERIAL OF CHOICE

This was the largest state park project that Creech's Plumbing and Shoaf Precast had worked on to date.

The septic system is sized to handle 2,655 gallons per day. It includes two 8,000-gallon tanks – a dual-compartment septic tank with a 6-inch PL-625 effluent filter and a dose tank with dual

dedicated 2 HP Hydromatic SKHS-150 sewage pumps.

Park officials requested precast concrete septic tanks.

"Precast has been their material of choice," Graham said. "They have had good experience with precast in the past, and I don't think they wanted to consider any other options. Durability and longevity of use were the primary factors for choosing precast."

ADDITIONAL CHALLENGES ALONG THE WAY

According to Graham, the rocky soil composition was the most unexpected challenge, requiring a much larger excavation for the bathroom foundation than anticipated.

"I've worked on other parks in North Carolina, and I've never seen that kind of rocky soil before," Graham said. "It made things a little more interesting, for sure."

For Creech's Plumbing, the logistics were a nightmare.

To stay within budget, park official initially requested a conventional septic system with gravel and pipe drain fields. But this type of drain field has a large footprint. More importantly,

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there wasn't enough cleared space to store the massive quantity of gravel the drain fields would require.

Creech successfully negotiated replacing the gravel and pipe drain field with one that used infiltrator chambers. They could easily be transported to the job site on one truck, requiring much less space in the staging area.

Still, logistics remained an issue.

Access to the job site was via a narrow park ranger road, cut through the forest. Once Goldsboro, N.C.-based Allen Grading Co., the general contractor, cleared the trees and flagged the drain field perimeters, workers, project materials and machinery had to stay within those boundaries. They couldn't set foot in the forest, nor could they block the ranger road at any time.

"It took a lot of planning and logistics to make sure everything was on-site to work with," Creech said.



It took just shy of four hours to assemble the tanks with the help of a 110-ton crane.

LARGE SCALE BUT ROUTINE

The 8,000-gallon commercial tanks were huge, but fabricating them wasn't anything unusual for Shoaf Precast.

"We manufacture a lot of these bigger tanks," said Phillip Shoaf, vice president of Shoaf Precast. "That's what we're set up to do. As far as the design of the project and the materials used, it was all fairly standard."

The tanks were fabricated using a 5,000 psi minimum concrete mix and were heavily reinforced with a mix of No. 4, No. 5 and No. 6 rebar. On average, the precast concrete gained full-strength capacity in 28 days. Each tank consists of three sections. The top and bottom sections weigh 21,000 pounds apiece, and the middle riser section weighs about 14,000 pounds. Shoaf Precast used a 10-foot-by-20-foot (inside dimensions) steel mold for the tanks. The company manufactured all six sections within two weeks.

"You have to make sure you pay attention to the details when you're working with such large structures," Shoaf said.

The biggest challenge from Shoaf's point of view was transporting the finished sections to the job site. Plant workers used a rough terrain crane to load the precast sections onto six wide-load trailer tractors.

"There's always some careful consideration taken when you go down the road with a piece that's 11-foot-4-inches wide and the project is 2 1/2 hours from the plant," Shoaf said.

Thankfully, they encountered no problems in transport, and the precast tank sections arrived safely.

PUTTING IT ALL TOGETHER

The septic system was installed in stages, starting with the drain fields. Rather than using a laser to mark the trenches, Creech imported the surveyor's DWG file – which had the



Each tank consisted of three sections, with the top and bottom sections weighing 21,000 pounds a piece and the middle 14,000 pounds.



drain lines already marked – into his data collector. This enabled him to lay the lines for both drain fields in one day.

“That process basically shaved two days off the project,” Creech said.

Both fields, which are 100 yards apart, consist of 14, 120-foot-long trenches on 9-foot centers. Field 1 is 1,292 feet from the septic tank, while Field 2 is 1,250 feet from the septic tank. Each field has a 3% slope, which allows effluent to gravity-flow to the chambers. Creech’s Plumbing began installing Field 1 on Oct. 2. Before starting work on Field 2, workers inspected, then covered Field 1.

“It was too large a project to leave it all open and inspect it all at one time,” Creech said. “We didn’t want to deal with any rain, settling or erosion in the trenches if we left them open.”





The project site was on a narrow ranger road and more than two hours from the Shoaf Precast plant, requiring careful planning for transportation.

After both drain fields were installed, the tanks were set on Oct. 15.

It took just shy of four hours, using a 110-ton Grove TMS 9000e crane provided by Edwards Crane of Spring Hope, N.C., to assemble the tanks. Staying within the four-hour timeframe was a priority for Creech Plumbing because crane time was purchased in increments of four hours.

“Creech’s Plumbing put all the pieces of the puzzle together, basically,” Shoaf said.

Finally, the force main – the pipelines that convey wastewater under pressure from the pump to the drain fields – was installed. The Shoaf crew tested the tanks for structural integrity and vacuum-tested them, and Creech’s Plumbing pressure-tested the pipe system using a generator for power. Once satisfied, they began covering them.

ALL’S WELL THAT ENDS WELL

It took Creech 14 workdays stretched over three months to complete the job. But the project met its deadline, finishing in December 2021. Great teamwork, coordination and communication played a big role in the project’s success.

“It was a very smooth process, smooth project,” Shoaf said. “The engineer did a great job. Creech’s Plumbing did a great job. And we had everything ready to go when he was ready. In the end, everything went as planned.”

Even the weather was on their side.

“The day after the install, a low-pressure system came through, and it rained off and on over the next four weeks,” Creech said. “If we hadn’t finished on time, it would have been the middle of the following spring before we would have concluded the job.” **PS**

Shari Held is an Indianapolis-based freelance writer who has covered the construction industry for more than 10 years.