2019 Honorable Mention

The Making of Swamp Thing

By Ryan Oakes

It was early November and I was on top of a mountain, at the halfway point of a project that would take 18 months to complete. This is the moment I got a call to help build a swamp, indoors, for a movie set on the coast. We get all sorts of odd requests, but this was a different kind of strange. Without further ado, I said, "Sure, sounds great, when do you need it?" The studio replied, "By Thanksgiving," as filming was starting the following week. This sort of answer required a little more digging.

The quick path to how we get there is this… The studio had just been given the green light for the upcoming series. They had strict deadlines to meet and if we wanted the job, we had to help them meet the deadlines. I questioned the practical nature of getting so much done in such little time, but this is the way the studio works, and we were soon to be their students and their heroes. They had artistic models underway, a plan in place, but no shortage of obstacles.

For starters, they wanted approximately 18,000 ft^2 (1700 m^2) of "swamp" to hold water approximately 4 ft (1.2 m) deep (Fig. 1). It was located indoors and all of the exposed surfaces had to be hand-carved to look like a muddy swamp bank (Fig. 2). With hundreds of feet of continuous carved concrete shoreline—it was the perfect job for shotcrete. The studio recognized this, and they called us.

What the studio didn't know was that using the shotcrete process, we could create a watertight concrete shell. They had already started construction of a stainless steel cofferdam around the project (Fig. 3) to help ensure that the lagoon would hold water for several seasons of filming. To complicate matters, they needed to demolish the structure after filming, so minimal to no reinforcing steel was desired. Finally, they wanted to color the exposed concrete surfaces to reduce artistic and post-production work, given the tight deadlines.

We had answers but not enough construction staff to get them over the finish line. We could shoot and carve it, but the studio would need to have all preparations, including any

Fig. 1: Finished Swamp Thing set

Fig. 2: Carved "mud" slopes

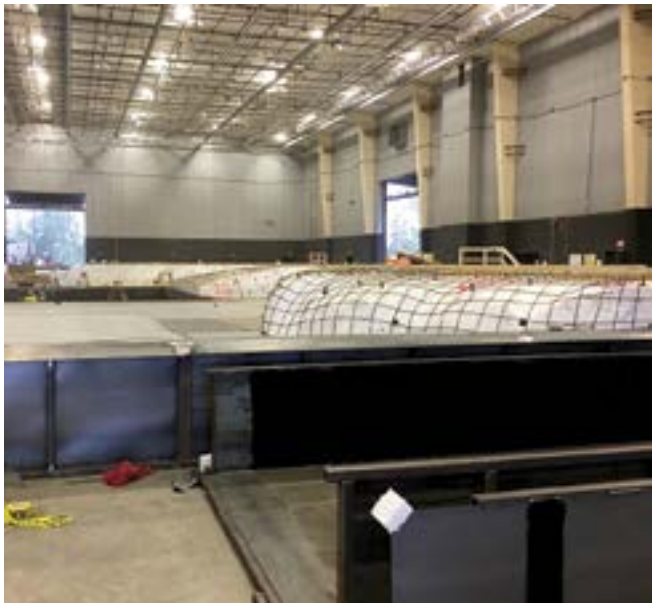

Fig. 3: Stainless steel cofferdam around set

formwork, ready for us when we arrived, as the project was on short notice with a very tight deadline.

To successfully complete this project, we needed to:

- Mobilize no earlier than November 12;
- Create a watertight shell;
- Carve muddy swamp banks with brown colored concrete;
- Create a black floor to disappear and create the illusion of depth with added reflection;
- Minimize or eliminate reinforcing bars to facilitate demolition;
- Connect to an existing deep well in the studio where divers could drop cars and swim with cameras; and
- Finish all work by November 21 (day before Thanksgiving) without fail.

PLASTIC SHRINKAGE

Sometimes it seems the stars line up perfectly—at least if you are prepared. It so happened that in the past year we produced three projects of incrementally larger size with varying shotcreted sections from 1 to 9 in. (25 to 225 mm) thick with no reinforcing steel.

We started with a small project of about 1200 ft^2 (110 m^2), then a 4100 ft^2 (380 m^2) commercial pool renovation, followed by the project we were working on at that time, which required so much rock carving that it would take a whole team of artists and rock climbers months to shoot and carve.

To help control plastic shrinkage without any steel, we placed concrete using natural fibers (hemp and jute). We had experimented with hemp fibers but couldn't procure enough in time for this project. So, I reached out to colleagues and found an answer in jute fibers (Fig. 4). These fibers came in various lengths and without having the research to determine which length would be best for us, we tried two different options on the Swamp project. Thankfully, we had the flexibility to do so. Throughout our 22 years of involvement

Fig. 4: Natural jute fibers in hopper

in various forms of construction, we have been able to experiment like this on several projects.

Why would control of early-age plastic shrinkage cracking be so important? In short, we needed a watertight shell. Any severe shrinkage cracking could create a path for water to flow through the section. Primarily, we shoot swimming pool shells, which also need to be watertight. It is common to see varied steel schedules in swimming pools or fountains, some of which are adequate and some that are not. The industry struggles with how to shoot a watertight shell with inadequate reinforcing steel. To that end, our company has been experimenting with natural fibers which are hydrophilic and help provide internal curing for the concrete. With the use of natural fibers, we have seen a substantial reduction in shrinkage cracks, regardless of span or lack of steel. With this result in mind, we explained to the studio that there were no guarantees, but that this addition to the mixture design should help achieve their goals.

In the end, we reduced the reinforcing bar in all of the vertical structures to a very light schedule and eliminated the reinforcing steel in the floor altogether.

ARTISTRY

How does one carve mud? The stars seemed to be aligned for us on this aspect, too. As swimming pool shotcrete finishers, we carve concrete every day, but those are straight walls, horizontal floors and benches, and even curved walls. We carve rockwork less often but mud, never. We even try to avoid it.. From time to time, however, we take on a man-made rock project and draw on talent from within our company, as well as outside. We use resources from our experiences and relationships that have developed over the decades. We know a wide variety of shotcrete artisans creating man-made rock. Most recently, we had hired a consulting firm, Ocean Rock Industries, out of British Columbia, that specializes in freehand carving and coloring for rock-like appearance using shotcrete placement. We had a group of experienced individuals, mostly rock climbers, who make a living as artists and whom I have climbed with and worked with for the last 25 years, but I felt we needed some enhanced skills. Thus, we hired Ocean Rock to introduce us to new techniques for creating shotcreted reproductions of natural rock. In this case, we were tasked to carve mud. We took on the challenge of the swamp project with professional artists Peter Glenn Oakley and Anne Rogers. Growing up in North Carolina and being familiar with the scene and applying simple techniques, we created the effects of muddy banks. We knew the studio would send in their artists on our heels, but we wanted to get them as close as possible during the shotcrete placement, given their limited time before filming.

We were shown where actors would be entering and exiting the water for various shoots, as well as where boats would be filmed, safety and camera divers would be, and how various action scenes would take place. It seems simple, but when you are tasked with making a path out of a concrete "swamp" for an actor to look like they are casually walking out of a muddy swamp rather than up a set of stairs, it takes a bit of thought and practice. Through understanding the buoyancy of an actor's body in water, tread depth, and riser heights from shooting pools every day, and a general sense of artistry, we were able to create seamless transitions for the actors that didn't look like stairs.

MONOLITHIC SHELL

One of the requirements of the project was that the concrete shell must hold water. We shot this shell over nine days

with numerous construction joints (Fig. 5) throughout any given day and from the day before. Because the production schedule didn't allow for shooting breaks during the day, we had to move our shotcrete placement around a lot because we could only perform the artistic finishing component so fast.

To achieve a monolithic, watertight shell with many construction joints, we roughened the surface of the joints to achieve an International Concrete Repair Institute (ICRI) Concrete Surface Profile of 6 or higher. We typically use a grass cutting rake to achieve a rough surface. Once any of the surfaces were hardened, we water-cured all surfaces continuously with a garden hose. The curing water flowed off of the concrete into the diving well we shot on the first day (Fig. 6) and carried much of the rebound with it. At the end of the project, we vacuumed out all rebound slurry from the bottom of the diving well with a vacuum excavator truck.

The next step in shotcreting a monolithic shell with no cold joints requires cleaning the existing roughened surface, bringing the surface to a saturated surface dry (SSD) condition, and then properly shooting new shotcrete against the joint surface. To clean it, we either used a pressure washer, or simply shut down the material flow from the dry-mix nozzle and used the high-volume air flow with water to clean the surface. Using the dry-mix nozzle with only water and air also works well for cleanup. While shooting in congested or complex sections, it's important to use an air lance (Fig. 7), also referred to as a blowpipe, to keep the receiving surface clean and free from overspray or rebound.

Using these techniques allowed for hundreds of construction joints in over 18,000 ft^2 of watertight surface area. Though the studio had installed the steel coffer dam to ensure no water entered the rest of the building, they called us a week after the install and were happy to report that no water had yet to enter the space between the concrete shell and the coffer dam. Even months later on a site visit there was no evidence of leakage.

TIMING

Hurricane Florence had just wiped out the coastal region of North Carolina, wreaking havoc up and down the coast. But,

Fig. 5: Various shooting locations around the swamp

Fig. 6: Deeper diving well

Fig. 7: Dry-mix shotcreting with air lance

Fig. 8: Final view of set with trees and ground debris

through an abundance of phone calls and plentiful preparation, we were able to organize this operation on time. Our aggregate pits were flooded, so we had to truck in aggregate from much further away. Gratefully, our satellite batching facility, which was only a few miles away from the studio, was large enough to store material for the job.

Though the local hotels were all booked due to the hurricane cleanup efforts, we were able to reserve enough rooms for our staff because we were regular hotel customers and had established good relationships in the area.

The jute fibers came air freighted from Korea and landed within days of our order, replete with enough of the two colors needed to integrate into our concrete mixture design for the job, thanks to a local color batching company and running our own flatbed truck.

Finally, nothing ever goes according to plan, so of course, we experienced a compressor failure. Thankfully, we had a backup and were able to supplement the backup with the only 950 ft^3/min. (27 m^3/min.) compressor rental within 300 miles (480 km).

One of the great things we learned about working with a studio is that they have an answer for everything. Minor cut? No problem, send a doctor over and get them back to work. Need a compressor? No problem, send one over. Remove rebound? No problem, they had bags, overhead cranes, and forklifts available all day. It was an amazing experience and they were essential to allowing us to complete the job in time (Fig. 8).

In 9 days, we placed over 18,000 ft^2 of colored and hand-carved concrete and finished just in time for everyone to make it home for Thanksgiving dinner. That's a wrap!

2019 HONORABLE MENTION

Project Name
The Making of Swamp Thing

Location
Wilmington, NC

Shotcrete Contractor
Revolution Gunite*

Architect/Engineer
Palladin Productions, LLC and Clearwater Construction Group

Materials Supplier
Natural Reinforce Fibers & Co.

Equipment Manufacturer
Gunite Supply & Equipment*

General Contractor
Studio Gems

Project Owner
Palladin Productions, LLC

*Corporate Member of the American Shotcrete Association

Ryan Oakes *is a Professional Watershape Designer and President of Clearwater Construction Group, Inc., Revolution Gunite, and Revolution Pool Finishes, all of which are award-winning firms in their respective trade. Oakes is a faculty member at Watershape University, where he continually aims to raise the bar in the swimming pool and the watershape construction industry. As a member of the leadership team for the International Watershape Institute (IWI) and through educational outreach to a vast pool builder network throughout the United States, he aims to improve the building techniques and methods of constructing swimming pools. Oakes is a member of ACI Committee 506, Shotcreting, and ACI Subcommittee 506-H, Shotcreting Pools. He serves on the ASA Board of Directors and also serves as Vice Chair of both the ASA Pool & Recreational Shotcrete Committee and the ASA Contractor Qualification Committee.*