Negative Edge Swimming Pool, Perimeter Edge Spa, and Runnel Connector

Cold Spring, NY

By Jamie Scott

A client had recently built a new weekend home in Upstate New York, with a distinctly modern style interior and exterior. Although there was an existing pool on the property, it had no relation to the new home. Even though the house overlooks the Hudson River, the existing pool actually managed to truncate the view. The homeowners wanted a watershape that would not only open the view to the Hudson River Valley but also fit their modern taste.

The final design consisted of a negative edge swimming pool and perimeter overflow spa with a multilevel runnel system connecting the two bodies of water. Within the main pool was a dividing wall that created a private sitting area in the shallow end. While these design features certainly met the clients' requirements, they added a level of complexity not seen very often in the industry. Building this watershape would require significant thought and preparation.

Swimming pools can be, and are, constructed from various materials. Examples would include vinyl over steel, fiberglass, concrete blocks, placed concrete, or shotcrete. Due to the demanding requirements of the design, shotcrete was determined to be the optimal choice for this project because of its versatility. The shotcrete process would allow for efficient creation of the repeating curves seen in the pool design, as well as the multiple shapes and elevation changes within the spa and runnel complex.

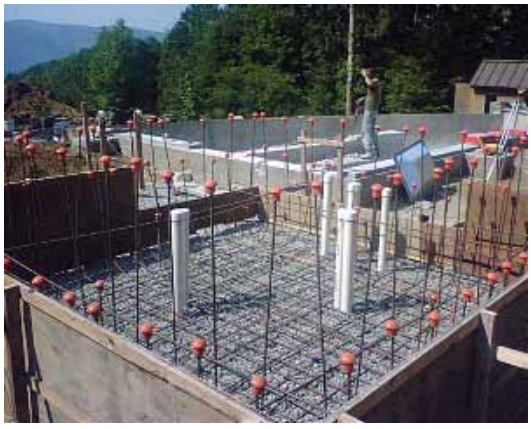
Negative edge pool—reinforcing steel being installed over the sloping floor profiles

A contractor was hired to supply and install the shotcrete, using the dry-method of shotcrete. The dry method proved particularly versatile during this project, as it allowed breaks in the shooting, thereby giving the crews shaping the details time to catch up. Strategies were discussed during advance meetings with the contractor; ultimately, it was decided to shoot the project in four phases.

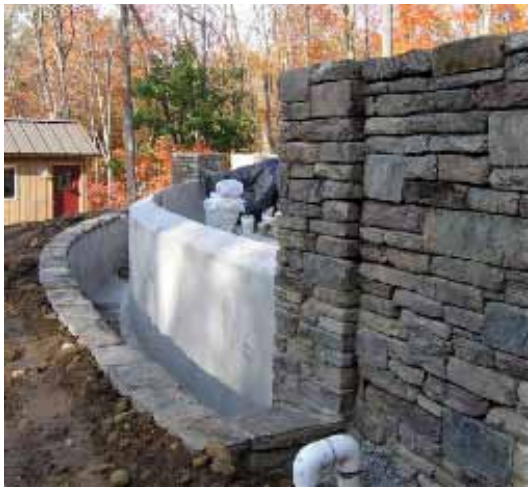
After demolition of the existing pool, focus was put on the construction of the new pool and its catch basin. The location of the undisturbed topography was determined through site analysis, which was of proper bearing capacity (1000 lb/ft^2 [4882 kg/m^2]), as required by the structural engineer. This information was used to calculate how far away from the house the pool should be located to give the desired effect of the negative edge. Placement of a negative edge pool is always critical to the success of how it relates to the downhill views and, therefore, how happy the clients will be! In this case, the pool needed to be placed out of ground and pushed toward the edge of the slope, which necessitated additional engineering.

Construction began with excavation and the stacking of crushed stone bags, which created the various floor profiles. Care was taken to ensure that the forms were properly braced to avoid vibration during the shotcrete application. Bracing points were spaced no more than 36 in. (910 mm) apart and many times closer. Wood forms were used instead of the more common expanded metal forming material to help achieve the needed rigidity. Later, proper consolidation of the shotcrete and encapsulation of reinforcing bar was shown to have been achieved during core tests of the pool shell. This pool, in particular, had an extraordinary amount of footage where all the wall and floor

Phase 1 of shotcrete. Note top of freestanding wall is cut to an angle, with dividing wall to the right



The base of the perimeter edge spa ready for Phase 3 of shotcrete



Catch basin for pool, with fieldstone veneer being applied

The multi-level runnel system around the spa that will carry overflow water to the pool

planes came together. Hand-shaping the coves in these areas was handled easily because of the shotcrete's one-sided forming ability. This detail would not have been possible had the concrete been placed.

The shotcrete was reinforced with No. 4 (13M) Grade 60 deformed steel reinforcing bar. Also, in addition to the obvious addition of tensile strength, reinforcing bar was installed within interior elements of the pool (steps, benches, and dividing wall) to aid the nozzleman in applying the shotcrete in a timely manner. Recirculation plumbing was rigid schedule 40 polyvinyl chloride (PVC) 1-1/2 to 4 in. (40 to 100 mm) in diameter. The plumbing lines were pressure tested for 24 hours prior to each shotcrete phase to confirm that there were no leaks, and pressure was kept on the lines during all shotcrete applications.

The first shotcrete phase began in August 2007. Using a 4:1 mixture, the contractor began by applying 80 yd^3 (61 m^3) of shotcrete to the pool shell. With care to throw out rebound and trimmed material, a tapered, clean joint was left between the negative edge wall and adjacent catch basin.

The second day was Phase 2, during which the hydration process of the pool began. After stripping the forms in the morning and cleaning and saturating the shotcrete joints to a saturated surface-dry (SSD) condition, the catch basin structure was shot using 23 yd^3 (18 m^3) of shotcrete. The next 7 days were spent soaking the structures to aid in hydration. The pool's structural shell was now complete.

The second half of the project focused on the perimeter overflow spa and multi-level runnel system leading into the pool. The first step was to form the bases of the spa and runnel system. Beneath the runnel, excavation went down 42 in. (1 m), and local 3/4 in. (20 mm) crushed stone was installed as engineered fill to protect against frost

heave. The plumbing trunk lines were brought into the base of the spa, and reinforcing bar splices were left projecting from the base—all of which would be picked up for completion during the final construction of the spa.

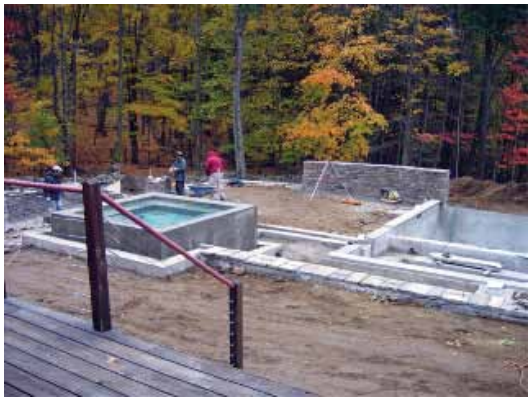
Phase 3 began at the beginning of October 2007, at which time the spa base and runnel were shot using 15 yd^3 (11 m^3) in total. After hydrating the base and stripping the forms, the next week and a half was spent creating the steel reinforcement for the spa itself and installing the rest of the plumbing. The fourth and final shotcrete phase came later that month, which entailed shooting the spa walls, benches, and steps, and took 12 yd^3 (9 m^3) of shotcrete.

Once the structures were in, the tie wire holes and any forming defects were patched with a nonshrinking grout. This grout also helped seal around all plumbing protrusions through the walls. The shells were now ready for installation of fittings and masonry finishes: ceramic and glass tile, aggregate plaster finishes, and custom precast red concrete panels on the spa. By this time, the outside temperature was dropping, and the winter winds were picking up, so the remainder of the finish work was put on hold until the following spring. The pool was finally ready for its first plunge by Memorial Day of 2008, and the spa followed a month later.

As was discovered early on, it was relatively easy to design these structures, but building them was quite a different story. The success of this watershape relied on moving water without loss, and shotcrete's abilities and characteristics enabled that success. Specifically, a good shotcrete application produces a dense structure that could be created in a noncontiguous manner, without having to use waterstops. The spa and surrounding runnel system contained so many angles, drops, and changes of direction that it would have increased costs and schedules significantly if the concrete had been placed.

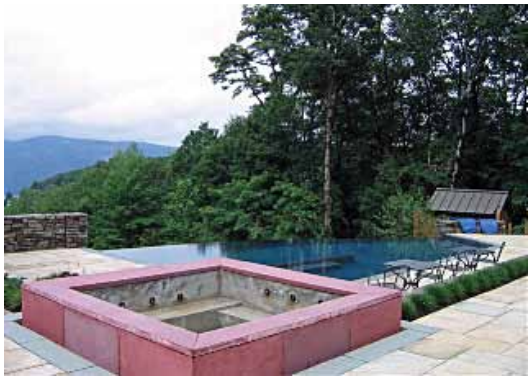
Although this project eventually included landscaping, masonry, and carpentry, there is no doubt that the focus of this property was to be the pool. The versatility of shotcrete allowed all phases to proceed with relative ease and allowed this unique pool setting to be created to the homeowner's satisfaction. Without the use of shotcrete, it would not have been possible to accomplish this multi-dimensional project.

Pool & Recreational Shotcrete Corner



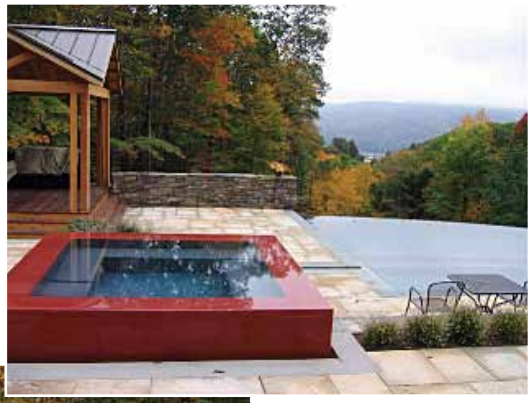
The pool and spa connected by the runnel system

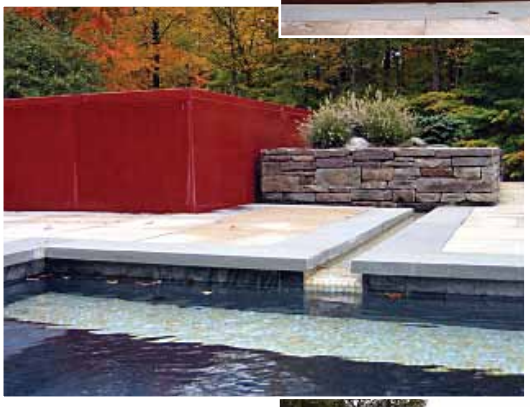
The dividing wall in the pool, along with benches. Coping and tile are being installed



The pool is complete, and the spa is nearing completion as it gets clad with red concrete panels

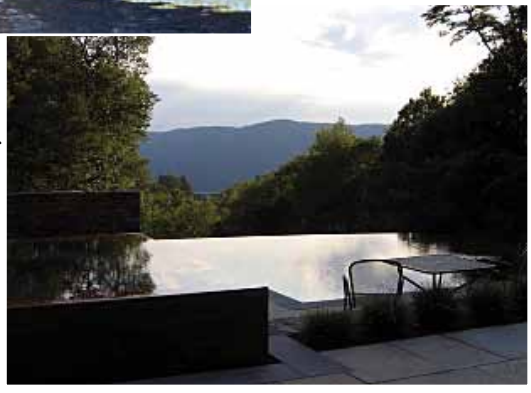
The perimeter overflow spa and pool in the fall of 2008





A view of the runnel leading back to the spa

The overflow nature of both the pool and the spa make for highly reflective surfaces



Acknowledgments

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***Tom Norman**, ASA member and Chair of ASA's Pool & Recreational Shotcrete Committee, wants your input. Your comments, suggestions, and the topics you'd like to see covered are welcome. Perhaps you'd like to become a contributing author to Pool & Recreational Shotcrete Corner. Norman and the ASA staff encourage you to contact ASA with your questions and comments at: info@shotcrete.org.*

***Jamie Scott** is a third-generation watershape designer and builder, who has worked in the industry for 37 years. He developed and managed the Sales, Design, and Construction Departments of his co-owned family business. In 1998, Scott started a new firm, Group Works LLC, based in Wilton, CT. Through Group Works LLC, he aligned himself with organizations that focus on continuing education and increasingly higher standards in the swimming pool industry. Scott is a Platinum Member of Genesis 3 and a certified member of the Society of Watershape Designers. He is also an APSP Certified Professional Builder, American Shotcrete Association member, and has trained with the Portland Cement Association. Scott is currently training to becoming a registered landscape architect as well.*