

## Flexibility of Shotcrete— Pools, Spas, and Waterfalls

By Jamie Scott

Shotcrete is often used on large industrial or municipal projects, such as concrete domes, bridge restoration, and tunnel work. Due to shotcrete's inherent flexibility and the creativity it gives a designer, it is the preferred method for building residential watershape projects, such as pools, spas, and waterfalls.

In spring 2008, a homeowner who was interested in creating a waterfall in her small hidden backyard was interviewed. The rear of the property presented some distinct challenges for construction access, as half of the Greenwich, CT, property was massed with a wall of ledge rock approximately 20 ft (6 m) tall. With its aged appearance and craginess, however, it was also well situated for integration with moving water. Previously, others had attempted to create some sort of waterfall using a masonry basin and recirculating hose. After this initial attempt at creating a waterfall failed, the homeowner sought out a more serious, permanent approach to the project.

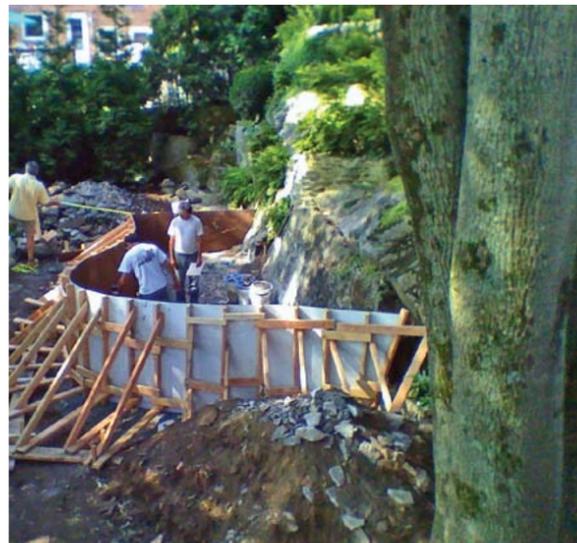
Not only did the homeowner want to enjoy the sound and sight of water falling down the ledge, she also needed a therapeutic function for a disabling injury, which the warm water and action

of a heated spa could provide. The final design consisted of a waterfall cascading down over the ledge rock approximately 10 ft (3 m) into an integrated waterfall basin surrounded by the separate waters of the therapeutic spa.

In designing these watershapes, the following key factors were taken into consideration:

- The ledge rock;
- The severe space limitations of the backyard; and
- The need to build a tightly curved, structurally sound watershape that met the homeowner's needs.

The ledge rock was the first, obvious, and somewhat overwhelming issue. Watershapers strive to get the structures "into the ground" for aesthetic and functional reasons. This site, however, did not allow this. This particular part of the state is known for its very dense rock, and the homeowner's budget did not allow for much ledge-rock removal. The site also only allowed a narrow walkway into the backyard with virtually no room for machinery access. Pneumatic drills with "feather and wedge" tools allowed for a small thickness of rock to be taken out—not a lot, but enough for the structure to be anchored into the rock beneath.



Rigid forming to remove vibration during shotcrete



Shotcrete waterfall basin and spa ready for plaster



Waterfall running over ledge rock into waterfall basin



Waterfall and shotcreted spa working together

Essentially, the spa and catch basin structure was built out of ground. The structure was rigidly formed using No. 4 steel reinforcement. In the spa business, steel reinforcement is often oversized to create a rigid steel cage that does not sag under the weight of workers and provides a more stable cage for supporting plumbing.

Limited space was also a significant obstacle. As previously mentioned, the backyard was narrow with no real access. Also, the existing landscape and tree roots were to remain untouched. It became clear as the project progressed that the shotcrete process was a key advantage in working in this small and limited space. The concrete was delivered to the backyard through the hose, and the tightly curved shapes were easily handled by the versatility of shotcreting.

A significant side note involves the recirculation systems. In 2007, there was a nationally publicized case emanating from this town about a young child who lost his life in a swimming pool due to entrapment. The builder was charged with criminal acts, including manslaughter. The town's reaction was to go back several years to review all swimming pool drain installations to ensure that they were properly installed and, of course, to scrutinize any future installations.

The waterfall basin and spa were built to provide two entirely separate recirculating bodies of water. With the basin only 2.5 x 4.5 ft (0.76 x 1.37 m) in size, it was a challenge to place the suction fittings so that they would draw properly and still meet building code specifications. Plumbing in the 8 x 5 ft (29 x 18.5 m) spa was slightly less of a challenge, but it still called for ingenuity in design and installation due to the limited surface space.

The dry-mix shotcrete method was used, with a 4:1 mixture (sand:cement) proportion. Following the 1-day shoot, the shotcrete shells were moist-cured for 7 days using soaker hoses. The structure was completed with a masonry façade and a dark gray aggregate interior finish. Finally, several large stones were worked into the upper ledge along the waterfall route to help direct and contain the flow.

The end result was a beautiful waterfall that met the homeowner's aesthetic and functional needs. Using shotcrete presented the opportunity to be creative and integrate the new structures into the challenging site.



**Jamie Scott** is a third-generation watershape designer and builder who has worked in the swimming pool and landscape industries for 39 years. He received his BS in business and accounting from Southern Methodist University, Dallas, TX. Scott co-owned a high-end pool and landscape firm until 1998, when he divested to found a new firm, Group Works LLC, based in Wilton, CT. Through Group Works LLC, Scott has aligned himself with Genesis 3 and other organizations that focus on continuing education and increasingly higher standards in the watershape industry. He is a Platinum Member of Genesis 3 and a certified member of the Society of Watershape Designers. Scott is also an APSP Certified Professional Builder and an ASA member and has trained with the Portland Cement Association. Additionally, he is on track to become a registered landscape architect. Scott and Group Works LLC have been featured in regional and national publications.