

A Natural Look, an Exact Science

By William T. Drakeley Jr.

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This project is located in Dutchess County, NY, an area defined by its horse and farm country. In particular, the region is full of weekend homes for affluent professionals who work in New York City but escape to the comfort of the countryside on weekends and vacations.

In this case, the clients were equestrian enthusiasts who wanted to make the most of their approximately 100 acre (41 hm²) property, which features all sorts of jumping gates and horse trails scattered throughout.

Drakeley Pool Company got involved at the suggestion of Eric Groft, a landscape architect with the firm Oehme Von Sweden (Washington, DC). Groft was working with John B. Murray Architects out of New York, who were both familiar with the company’s work and thought it would be a good fit for the project team. In addition to Groft and the architect, lighting designers, a sound designer, soils scientists, and a structural engineer were involved. That group also included Dave Peterson of Watershape Consulting (Escondido, CA), who took care of the hydraulic and system design.

Design

In many ways, the design is a terrific example of form meeting function.

The pool is big: 73 ft (22 m) long and 40 ft (12 m) wide with a 9 ft (3 m) deep end. It features a large step treatment on the side adjacent to a pool cabana that echoes the undulating lines of the pool’s overall shape. The steps are 2 ft (0.6 m) wide, large enough for entry and egress purposes as well as lounging, and are fitted with LED lights for safe use after dark.

The pool has a perimeter overflow detail that brings the water surface level with the deck, which augments the reflective qualities generated by the dark interior surface.

The original design called for 260 gpm (59 m³/h) over the edge to achieve complete coverage. The edge detail was so precise, however, that the flow rate was ultimately cut in half and still wet the entire edge. The 1/2 in. (13 mm) slot

is set back from the edge 14 in. (355 mm), creating a wet edge detail that visually blends the deck with the pool’s interior.

The gutter itself is relatively small—6 in. (150 mm) wide by 10 in. (250 mm) deep. Bather surge capacity is therefore handled by a large below-grade surge tank located downslope of the vessel. A continuous plumbing loop surrounding the pool is fed by gravity, which in turn flows into the surge tank. A secondary circulation system pulls water from the surge tank and pumps it back to the pool to run the edge.

Excavation and Forming

The pool area is on a gentle slope of mostly old fill—lots of rubble, sticks, and no competent soil. Because the material was completely unsuitable for use as a form for shotcrete placement, they had to over-excavate the site and build one-sided forms as if building an above-grade structure. The downslope side of the pool is defined architecturally by a retaining wall with the remainder of the structure entirely below grade.

The forming was tricky. It had to be flexible enough to create the curvature but sturdy enough to prevent the structure from moving during the plumbing and steel installation (not to mention the later shotcrete process). If they didn’t get it right, the wall could have been off by a couple inches (mm), which is never acceptable.

Because of the perimeter overflow system, the top of the walls had to be formed with two precise top-of-beam details to create the 6 in. (150 mm) wide gutter. In all, the gutter measures 36 in. (450 mm) wide in its entirety. That meant very precise box forms had to be used to hold the tolerance on the edge when we shot the shell.

Site Preparation

After we over-excavated the pool by approximately 10 ft (3 m) all the way around, they brought in soil, compacted it into place, and carved into it to create the pool shape (Fig. 1 and 2). To help keep everything in place, they then applied a sacrificial layer of concrete via the wet-mix shot-



Fig. 1: Beam profile and edge forming



Fig. 3: Plumbing system under shotcrete shell



Fig. 2: Application of sacrificial shotcrete layer for soil containment



Fig. 4: Steel reinforcement on radius steps

crete process (approximately 5 yd³ [4 m³]) to the vertical soil prior to reinforcing bar installation.

Although the water table is below the pool structure, the soil is very dense and retains moisture. Because the clients plan to add all sorts of plantings, there would be a large amount of water flowing around the structure that could be retained by the soil, which could create a hydrostatic imbalance when the pool is drained down the line for maintenance. They also wanted the hole to remain dry during construction (Fig. 3). For all these reasons, a layer of gravel and a system of 4 in. (102 mm) drainpipes were installed in the pool floor to dewater the pool every day from now until eternity. It's always good to have drainage around an in-ground concrete structure. While shells are built to be watertight, they are not meant to function as underground dams.

Shotcrete Installation

Drakeley employs a crew of eight men: two ACI Certified Shotcrete Nozzlemen, one pump operator, two tenders, and three finishers. All crew members are trained on proper safety procedures—not only in pumping mechanics but also in shotcrete applications based on ACI CP-60, “Craftsman Workbook for ACI Certification of Shotcrete Nozzlemen.” The shotcrete crew is also up-to-date on all current swimming pool shotcrete position statements from ASA.



Fig. 5: Floor shotcrete (placed in stages)



Fig. 6: Wall shotcrete and gutter detail

They installed 270 yd³ (200 m³) of concrete material using wet-mix shotcrete application (Fig. 4 through 6) for an average daily installation



Fig. 7: Curing process for maximum strength gain



Fig. 8: Finished structure suited to surrounding landscape



Fig. 9: Tight tolerances and advanced design features facilitated by the shotcrete process

of approximately 60 yd³ (46 m³). The mixture design included 750 lb (340 kg) of cement with 50 lb (23 kg) of fly ash and 8% batched entrained air, with a water-cementitious material ratio (*w/cm*) of 0.45. No additional water was added to the delivered concrete outside of or beyond the total allotted mix water from the plant.

Equipment included an Allentown PC 20 shotcrete pump with 4 in. (100 mm) pump discharge; an Ingersoll Rand 375 air compressor; 4 x 3 in. (100 x 75 mm) reducing bushing to 3 in. (75 mm) steel slick line run to pool's edge; 3 x 2 in. (75 x 50 mm) reducing bushing at pool edge connected to rubber 2 in. (50 mm) hose connected to 2 in. (50 mm) nozzle body; and miscellaneous shotcrete tools and aids.

The placed material was rough-screeded with finishing tools, allowing crews to keep uniform lines and still maintain an excellent bond plain for future plaster finish (Fig. 7).

The weather at the time of sprayed applications fell below 32°F (0°C) at night, so heat-retaining blankets were used to protect newly placed material from freeze damage during the hydration and strength-gain process.

The shotcrete process made this project both achievable and sustainable. The free-flowing pool design was a key feature for the client and was facilitated through the one-sided, non-restricted forming and installation inherent to the shotcrete process. They were able to install 6000 psi (40 MPa) watertight concrete to every angle and curve in the pool, with relatively low levels of labor and materials. By contrast, cast-in-place methodology would have required three sides of forming, considering the interior slot overflow/gutter design of the pool. The amount of materials, labor, and energy needed to complete the concrete installation via cast-in-place would have doubled in comparison to the shotcrete process.

Final Details

The edge detail was created with Roxbury Granite Stone, which is also used on the surrounding deck (refer to Fig. 8 and 9). Our masons did a great job of carefully honing the pieces, which range in length from approximately 1 to 4 ft (0.3 to 1.2 m), to create a precise edge with less than 1/8 in. (3.2 mm) tolerance. Each stone was selected, shaped, and marked to indicate its location. It was precision work using material that was a challenge to simply lift into place.

Inside the pool, the returns are all wall-mounted. To some, flow returns make the bottom of a pool look like it has a case of the measles. There are five 12 x 12 in. (300 x 300 mm) Pentair drain boxes in the floor. Three are for the organic

ozone, which does the vast majority of the sanitizing and oxidizing work, but a flow-through tablet feeder was also installed to add a tiny residual as a backup for bather-to-bather safety. Both the edge system and primary circulation system run with Pentair's Intelliflo variable speed drive pumps for maximum hydraulic efficiency. The VSD pump on the edge systems enabled us to dial in the minimum flow necessary to cover the edge.

The Outstanding Pool & Recreational Project

Project Name

Finch Farm

Project Location

Salem, NY

Shotcrete Contractor

Drakeley Pool Company*

General Contractor

Drakeley Pool Company*

Architect/Engineer

David Peterson

Material Suppliers/Manufacturers

Brewster Transit Mix,
Putzmeister Shotcrete Technology*

Project Owner

Finch Farms

*Corporate Member of the
American Shotcrete Association



William T. Drakeley Jr. is President of Drakeley Industries and W. Drakeley Swimming Pool Company. Drakeley Industries is a shotcrete consulting firm that is dedicated to the training and implementation of the shotcrete process in regards to building water-retaining structures, ground support, and underground shotcrete application. Drakeley Pool Company is a design-build construction and service firm specializing in in-ground, high-end commercial and residential pools. Drakeley is an active member of ACI Committee 506, Shotcreting. He is the first ACI Certified Shotcrete Examiner from the pool industry nationwide. Drakeley is also an ACI Certified Nozzlemaster, ASA Technical Advisor, Chair of the ASA Pool & Recreational Shotcrete Committee, and serves as Treasurer to the ASA Executive Committee. His writings have been published in national and international trade magazines, including Shotcrete, WaterShapes, Pool and Spa, and Luxury Pools. In addition, Drakeley is a Platinum Member of the Genesis 3 Group, a licensed member of the Society of Water Shape Designers, and a member of the Association of Pool and Spa Professionals (APSP). He is also the Concrete/Shotcrete Instructor at the Genesis 3 Pool Construction Schools and NESPA Region 1 Show in Atlantic City. As an instructor and trainer, Drakeley has given lectures on shotcrete applications for various pool trade shows and for World of Concrete. Drakeley is an expert witness regarding shotcrete applications for the swimming pool industry.