Inside: Jim McNicol Returns to Things Electric

WaterShapes

Design • Engineering • Construction

Volume 3
Number 1
January/February 2001
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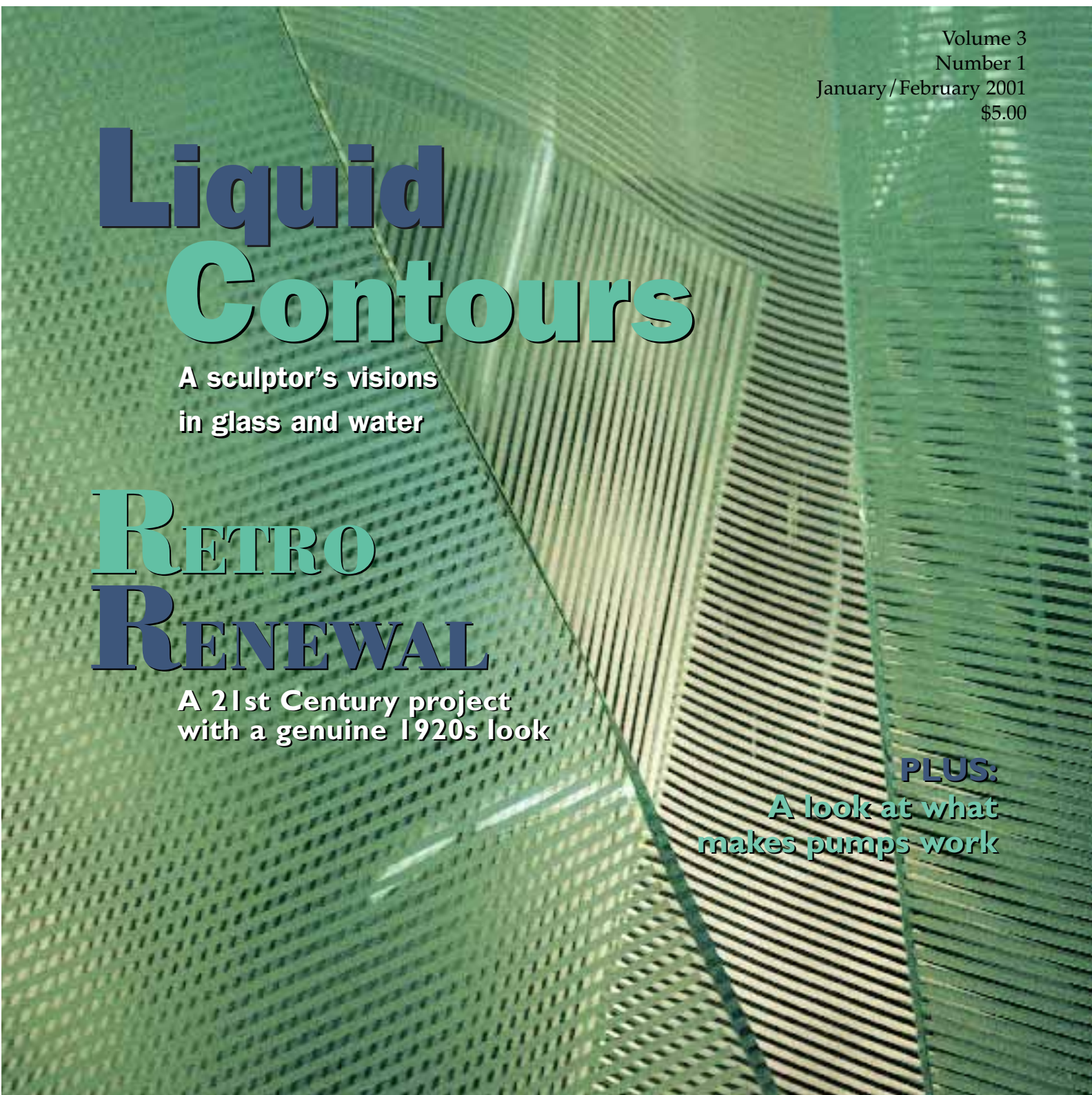

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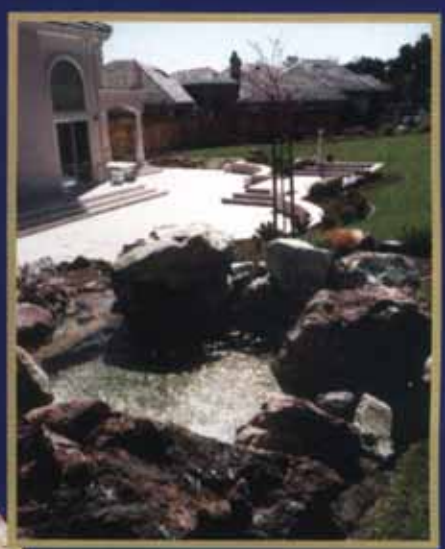

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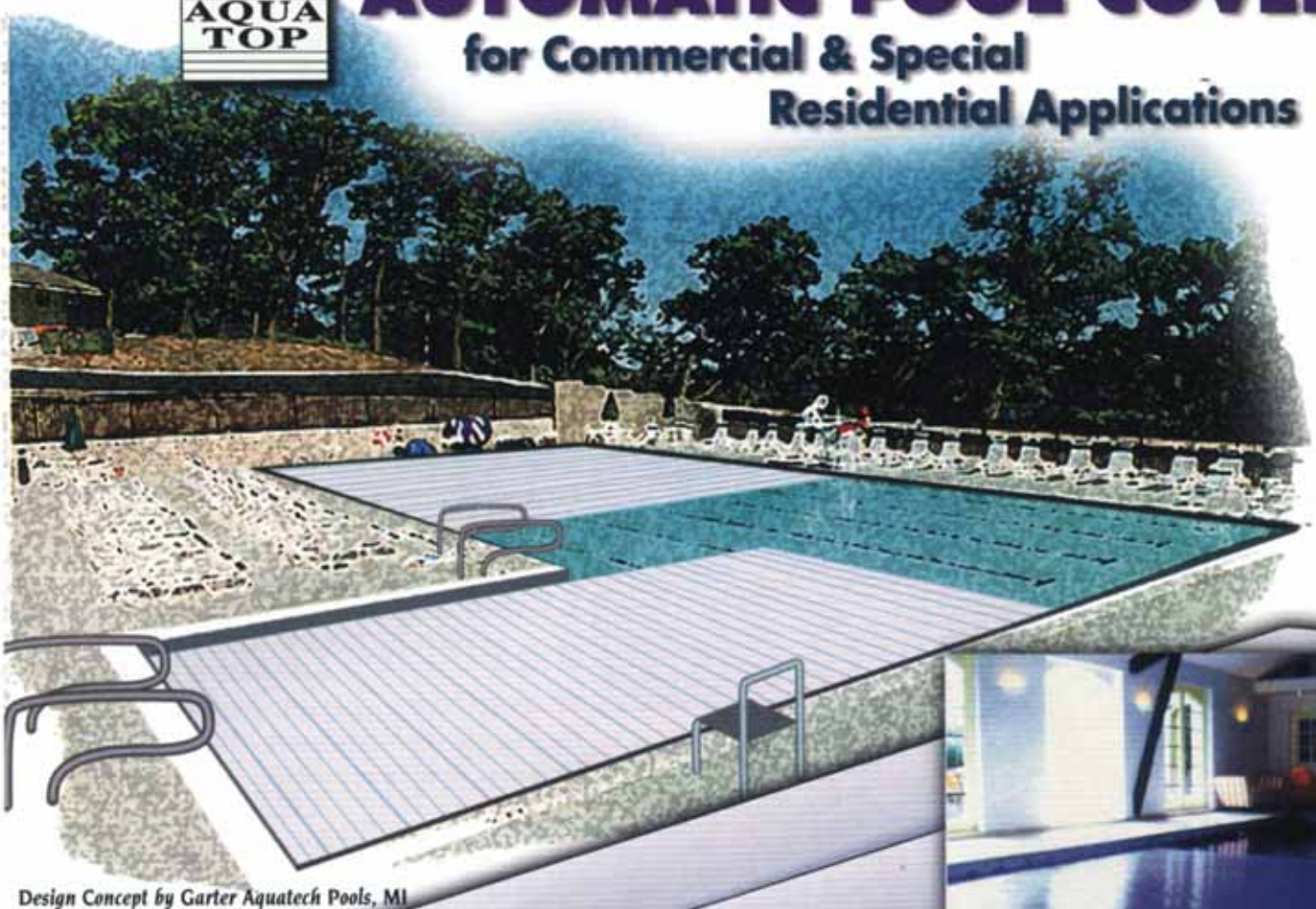

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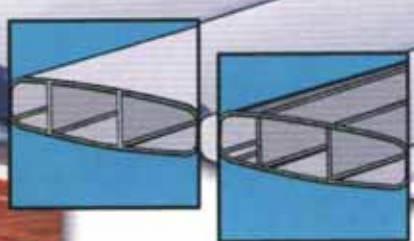

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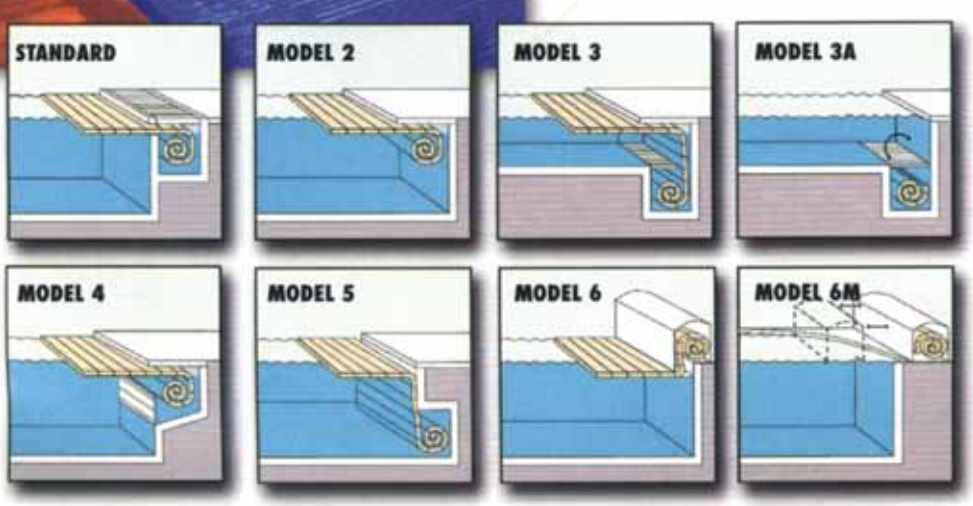

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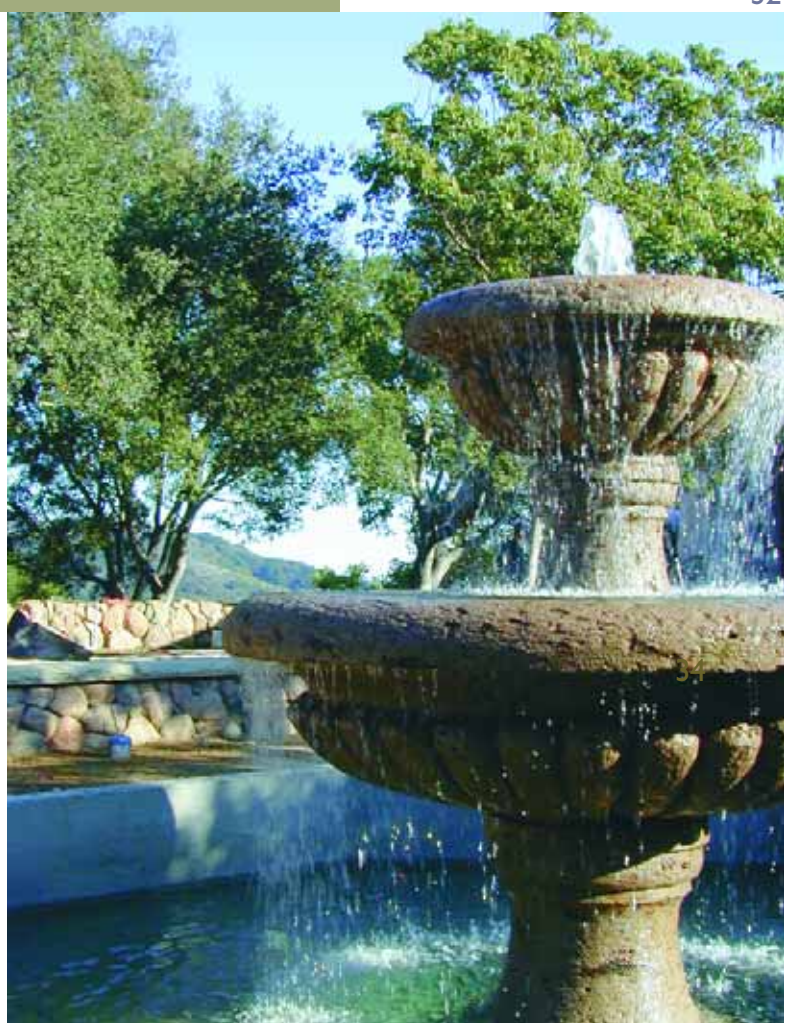

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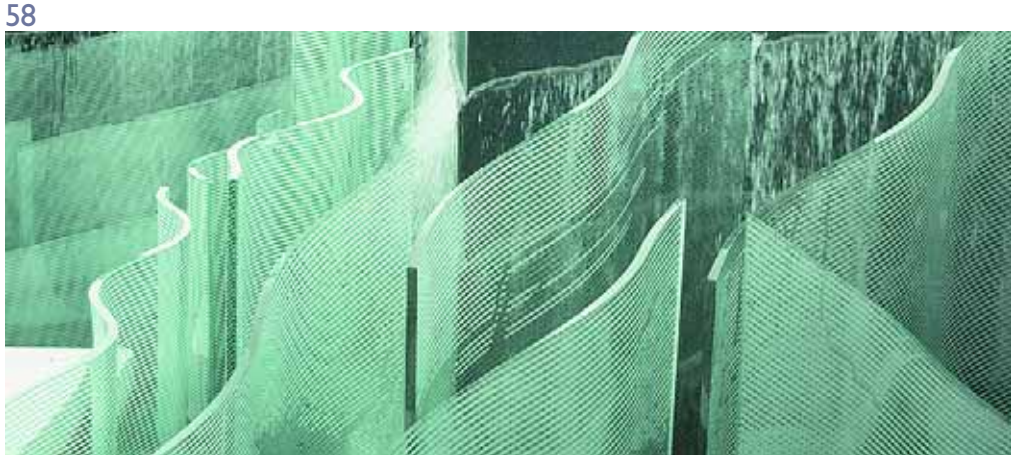

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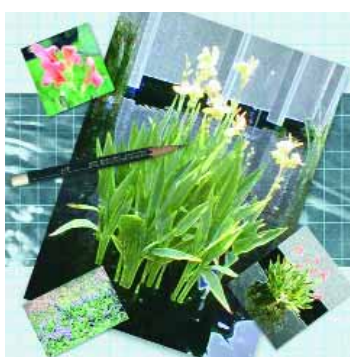

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DEPARTMENTS

On the cover:
Photo by John Leubtow

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By Eric Herman

Core Values

It's disappointing when we discover that something beautiful on the surface is devoid of substance at its core. Our world is full of far too many examples: The childish pro athelete, the sleek sports car that routinely breaks down, the boring novel with the snappy cover. Unfortunately, the watershaping trade also has its own tradition of thin facades masking poor quality, poor performance and worse.

Years ago, I spent a day riding along with a service technician who was writing up estimates for repair work on a variety of residential and commercial pools in the area just north of Los Angeles. Time and time again, I watched as he inspected pools that all looked good but that had serious problems in one way or another.

At one stop, for example, he was asked to figure out why a pool – a beautiful vessel installed on the roof of a parking garage at an upscale condominium complex – was afflicted by not one, but more than a dozen apparent leaks.

We were able to walk underneath the pool and inspect the plumbing; check out the structural components and get a pretty good idea of the quality of workmanship. Up above, the project was an award winner; down below, even a cursory inspection of the technical aspects of the installation revealed less-than-admirable engineering and questionable construction practices front to back.

Throughout the day, this same pattern of good looks masking poor construction was repeated again and again. In some cases, the equipment pads were twisted monstrosities; in others, skimmers leaked or tile was peeling off the walls or oversized pumps howled as they fought to shove water through undersized plumbing. It was testimonial to certain contractors who, at the time, seemed dedicated to the idea that style mattered much more than substance.

The pages of *WaterShapes* are filled with the work of contributors who spend a lot of time making their watershapes as beautiful as possible. And make no mistake: that's a big part of the art of watershaping. But without real quality at the core – without sound structural engineering, top-notch hydraulics and quality workmanship – all that beauty serves merely to conceal a lack of substance within.

That's why we keep coming back to these issues of quality that is much more than skin deep in our publication. That's why, in this issue on page 50, hydraulics specialist (and former service technician) Steve Gutai dives into the decidedly unlovely topic of pump hydraulics and performance characteristics.

Although you won't find any pretty pictures in this article or further exploration of design philosophy, the information in Gutai's discussion is as critical to the true beauty of a watershape as any other feature, detail or fine finish. Fact is, if a system that is designed to move water does not do so efficiently, reliably and quietly, everything else in the project is little more than unrealized potential.

Look at it this way: Many of the world's greatest and most enduring landmarks are triumphs of technical ingenuity as well as aesthetic vision. From the Great Wall of China to the fountains at Versailles, from Stonehenge to the Golden Gate Bridge, striking visual forms are possible only by way of solid engineering and technical execution.

Today's watershapes are not like ice sculpture or sand painting; these look good for a time but are destined to melt or blow away. Rather, watershapes and all the beauty they embody should always be built to last and function as advertised.

WATERSHAPES

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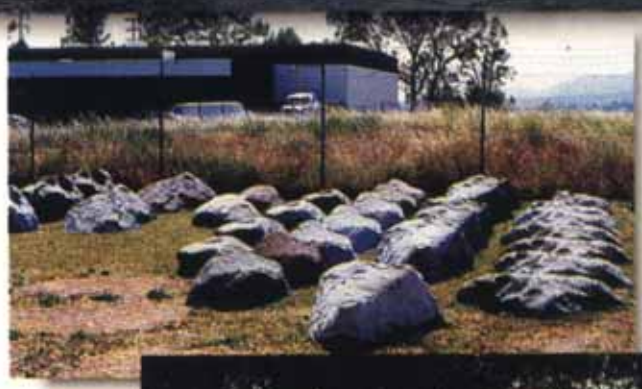

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IN THIS ISSUE

JANUARY/FEBRUARY'S WRITERS

GUTAI

Mark Holden owns Earth Patterns in Long Beach, Calif. A landscape architect and licensed contractor, he has been designing and building watershapes for more than 15 years, specializing in creating dynamic spaces that use water as a primary feature. While his own business combines his roles as designer and builder, he believes firmly that it is important to reach past his own resources and make contact with (and consult for) other architects and builders as a means of elevating standards in both trades. That thought in mind, he is an instructor in art and architectural history for the Genesis 3 Design Schools and also teaches senior landscape-architecture students at Cal Poly-Pomona.

Kevin Fleming is swimming pool manager for Lipinski Pools, an offshoot of Lipinski Landscaping of Mt. Laurel, N.J. Shortly after graduating from West Virginia University in 1992 with a degree in landscape architecture, Fleming went to work for Lipinski Landscaping as a draftsman. He quickly moved into design, engineering and management roles, overseeing many of the firm's most elaborate projects. He assumed his current post three years ago, stepping away from his work in traditional landscape design to spearhead the company's move into swimming pool design and installation.

Interested in writing for WaterShapes *on design, engineering or construction topics? Contact Eric Herman at (714) 449-1996!*

Steve Gutai is a territory sales manager for Laars and Jandy Pool Products, a division of Waterpik Technologies based in Petaluma, Calif. Gutai is a veteran of the swimming pool industry, having spent more than 13 years as an independent service and repair technician in the Los Angeles area and three more as a technical service representative for Waterway Plastics in Oxnard, Calif. He joined Laars and Jandy a year ago and now works directly with contractors and engineers in designing circulation systems for pools, spas and other watershapes.

John Gilbert Luebtow is a modernist sculptor based in Chatsworth, Calif., and has been designing and constructing massive glass sculptures in architectural settings for nearly 30 years. He holds advanced degrees in ceramics, glass and fine art from the University of California at Los Angeles and California Lutheran University. His portfolio includes elaborate commissions for commercial clients including Atlantic Richfield, MCI, the Supreme Court of Nevada and the Yokohama Royal Park Hotel in Nikko, Japan, among many others. Among his most striking works are those that include the use of water as a design component.

McNicol

James R. McNicol is a technical consultant to the swimming pool, jetted bath and spa indus-

TISHERMAN

ROSE

tries from his base in Tustin, Calif. Before joining the pool and spa industry, he spent 16 years in the aerospace industry, mainly on development of large-scale telecommunications systems. He started in the pool industry as a retail/service manager, moving on to become director of engineering for a leading pool-equipment manufacturer. In 1982, he co-founded Brett Aqualine, a supplier of electromechanical equipment for spas. In 1984, McNicol became a charter member of Underwriters Laboratories' Industry Advisory Group on Standards for Safety of Electric Spas, Equipment Assemblies and Associated Equipment (UL 1563) and has been a member of the Industry Advisory Group for UL 1081 on Swimming Pool Pumps, Filters and Chlorinators. From 1979 to 1996, he represented the National Spa & Pool Institute as a member of the panel responsible for all aspects of Article 680 of the National Electrical Code governing swimming pools, fountains and similar installations. He was the 1987 recipient of NSPI's John Holcomb Silver Award in recognition of his technical contributions to the industry; in 1994, McNicol received NSPI's Eagle Award for his overall contributions to the industry – the only person to have been honored with both of these awards.

David Tisherman owns and operates David Tisherman's Visuals in Manhattan Beach, Calif. A designer and builder of high-end custom swimming pools since 1979, he is widely known in the pool and spa industry as an advocate for the highest possible standards of design, engineering and construction. He has degrees and credentials in industrial design, scientific illustration and architectural drawing from Harvard University and Art Center School of Design and has taught architectural rendering and presentation at

UCLA. An award-winning designer, he serves as an industry expert for California's Contractor State License Board and has been a member of NSPI's Builders Council since 1994. Tisherman is a co-founder of and principal instructor for the Genesis 3 Design Group

Stephanie Rose runs Stephanie Rose Landscape Design in Encino, Calif. A former New York securities analyst, she gave up Wall Street ten years ago to pursue a career in landscape design – and has never looked back. Her firm specializes in residential gardens for upscale clients in the Los Angeles area, where the lengthy planting season and mild climate provide tremendous creative freedom and year-round work. Her projects frequently include collaboration with custom pool builders, a cross-disciplinary blending of perspectives and skills she sees as having profound potential for professionals on both sides of the relationship. Rose can be seen this season in four episodes of "The Surprise Gardener," airing Tuesday evenings on HGTV.

Brian Van Bower is a partner in the pool-construction firm of Van Bower & Wiren in Miami, where he also runs Aquatic Consultants. With more than 30 years' experience in the swimming pool and spa industry, he now specializes in the design and construction of swimming pools, recreational areas and hydrotherapy clinics. As a consultant, he also conducts training and inspections and serves as an expert witness and in insurance investigations. From his start with pools in 1967, he's been a pool manager, service technician and contractor, operating Van Bower Pool, Patio & Spas from 1971 until 1991. He began consulting in 1989 and co-founded Van Bower & Wiren in 1995 to specialize in high-end pool-construction projects. He's been active in the National Spa & Pool Institute throughout his career at the local, regional and national levels, has won numerous design awards and has been inducted into the Swimming Pool Hall of Fame. Bower is also a co-founder of the Genesis 3 Design Group.

BOWER

Made in the Shade

By Brian Van Bower

In recent years, I've noticed a tremendous increase in the demand for shade structures – so much so that it would seem the era of slathering on suntan oil and basking in the sun in search of a savage tan might be gone forever.

It's an exciting trend that really expands the creative possibilities for watershapers working across a broad range of styles and pricing levels.

And no one could be happier about that than me: For one thing, I'm fair skinned and burn easily; for another, adding the element of shade is an exciting, interesting and increasingly profitable way to create complete watershape environments that meet a variety of needs – including our clients' fundamental desire to be comfortable.

Shelter from the Norm

By giving our clients shady places to lounge, entertain and daydream, we give them the power to choose the elements to which they expose themselves. Better still, we increase the functionality and the value of the designs we create.

As I prepared to write this column, I began by thinking about all of the different types of sheltering structures we can provide. It's an extremely impressive array, so vast you'll never have to repeat yourself unless you and your clients want it that way. Shade structures can be fun and casual or formal and architectural. They can be small or large, and they can be made from a huge range of materials.

In addition, they do much more than shield users from the sun. They can serve as a place for napping or meditating or cooking or dining, for example. They can be solid structures that provide dry shelter from wet weather, or they can be permeable coverings that only partially block sun and weather.

They're also platforms for other outdoor features. They'll support plant life, for instance, and can encompass lighting, fans and fog/mist systems (an increasingly popular choice) as well as vertically oriented waterfeatures. They can be used to block undesirable views – or offer a stage from which to enjoy near and distant vistas.

By giving our clients shady places to lounge, entertain and daydream, we give them the power to choose the elements to which they expose themselves.

The options stretch from the simple to the sublime, and when you step back and consider the possibilities, you're sure to find design features that enable you to customize your work to closely meet the clients' lifestyles and visually blend with their homes, watershapes and landscapes.

Just listing the types of structures available to you tells a lot about the range of options: You can start by talking about umbrellas, awnings and patio covers, and then move on to trellises, Chickee huts, gazebos, pergolas and (my favorite) bowers.

As with just about every other component of watershape design, your treatment of shade begins with an exploration of the customers' needs and desires.

Very early on in my own design process, I always ask my clients what they have in mind in terms of shade. Many of them have very specific ideas in mind from the get-go, but others haven't given it a thought. Either way, when it comes to the question of whether or not they want something, the

vast majority will say yes.

From that point, it becomes a question of determining what it is they want to do in the shaded area and what style of structure best suits those needs while fitting the budget.

Rag Tops

When it comes to budget-friendly options, there's nothing for shade like a good umbrella.

Personally, I've really grown to love umbrellas through the years. They are comfortable and inviting and convey feelings of fun and conviviality. (Think sidewalk cafes and afternoon breezes.) Best of all, they can be used in a number of ways around watershapes.

Lately, for instance, I'm finding that many of my clients are choosing umbrellas when they want shade in the water itself. In terms of design or construction, nothing could be easier: Just set a sleeve for a post near the water's edge or in a beach entry.

This is an extremely inexpensive way to enhance the watershape experience, encourage lounging in the water and add a dash of color to a design scheme. I've often used umbrellas in conjunction with swim-up bars and seating, too. And the neat thing is that the umbrellas can be taken down as the situation dictates.

Awnings are another category of shade structure that offers many of the same advantages as umbrellas. They're relatively inexpensive and can be put up or taken down whenever it suits a client's fancy.

A long way back, I visited a pool I had built and found that the owner had set up his own awning system by stringing a series of stainless steel wires high over the pool. The customer used these to support a canvas panel that stretched over the entire pool or could be pulled part of the way for partial shading. The covering didn't draw high marks for aesthetics, but it did the job and the owner seemed completely satisfied.

The nice things about these rag-top options is that prospects get the idea without much explanation. That's not always the case with other options, where I find myself painting word pictures to help prospects visualize the scene.

Sometimes that's easy. I work with many waterfront properties, for example, and will describe a beautiful evening beneath a thatched roof with beautiful landscaping all around. There's a fan overhead and a table set, dinner for two, with gentle sounds of water splashing in the background as the couple looks out over a vanishing edge to the waterway beyond. Or if I have a different sense of what these clients are after, I'll describe calm Sunday mornings with a great cup of coffee and the newspaper or the joys of sitting outside, sheltered from a warm summer rain.

I set these scenes because I want my clients to project themselves into the watershape environment. With shade structures from the simple to the elaborate, I'm able to tell a story about all the

Used appropriately, even a simple trellis can be used to provide shade and cast an ever-changing variety of shadows in the space around a watershape.

things they can do around a pool or spa or waterfeature without getting wet.

Here and There

As I've moved further and further into the art and science of exterior design, one of the things I've learned is that by adding "destinations" within an environment, you create places for the clients and their friends and families to do different things at different times. This involves creating various focal points as well as opportunities to travel within the space via pathways.

Sometimes these spaces are compact and the destinations are modest – as in the case of the umbrella in one corner of the pool or perhaps a small arbor with some vines growing overhead. In other situations, however, the destinations are extremely elaborate and make big statements on their own.

A few issues back, I wrote a column about *feng shui* and mentioned a project that featured a wooden gazebo in which

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This structure interrupts a great view, but it provides some much-needed shade – and its tile-mosaic back wall offers a focal point that makes up for the intrusion.

my client would practice her yoga. What I didn't mention at the time was that the gazebo was connected to another shady area suitable for dining.

In this environment, the customer can travel from one distinct area and its activity to another via a small path. In terms of space, the area really isn't that large, but these two destinations serve two distinct functions and offer opportunities to relax and enjoy life in very different ways.

A step beyond these simple applications, the possibility exists to blur the distinctions between indoor and outdoor spaces and functions. I've worked on projects where entire kitchen facilities have been placed outside beneath some form of shade structure, complete with wet bars, refrigerators, ovens and cooktops.

I've also worked with clients who wanted complete living rooms outside, with televisions, couches and fireplaces. In these cases, the clients view the shade areas as literal extensions of their

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homes, effectively expanding interior functions into outside spaces.

I recently worked on a project on beautiful Biscayne Bay that features a solid-roofed shade structure tucked in a corner of the property. The triangular area includes a bar and a full-scale kitchen; there's even a bathroom tucked behind the solid back wall. Although the structure blocks a small portion of the view across the property, the back wall is covered with a large tile mosaic depicting nautical images – and in itself became a beautiful focal point.

Many of these designs become so involved they cross the line into what is literally interior design. Large, structural cabanas, for example, often become outdoor/indoor guesthouses with full sleeping and bathing facilities. I recently bid a project in Miami Beach that included a massive cabana with a kitchen, a separate bedroom and a living area that opened out into the pool. It will be a great place to entertain and a perfect place to stash a guest or two when the party's over.

Conveying Style

With so much going on with shade structures, it's easy to find opportunities to accentuate and articulate the stylistic decisions you and the customer have made.

Perhaps you're building a lagoon pool and want to blend it with a covered area. Here, a grotto of some type becomes a logical possibility. Or you may want to go with an open structure with a thatched roof to suggest a tropical or jungle environment.

In my area, you see many structures known as Chickee huts. These are open-sided buildings made of cypress logs and interwoven scrub-palm leaves and have become extremely popular for a variety

South Florida's classic Chickee huts bring a tropical touch to outdoor relaxation – and lend much needed shade to what can be a blistering setting.

of reasons. For starters, they are visually striking, with the chiseled patterns on the structural logs providing a distinctive detail. And the woven patterns of palm fronds and stalks that make up the roof system are truly fascinating.

Better still, Chickee huts are waterproof and provide a fair amount of insulation, offering the visitor a cool place to retreat from the pounding Florida sun. It's a fun, casual look – one that really invites you to enjoy a slushy cold drink (the kind with the little bamboo umbrella inside).

On the other end of the spectrum are shade structures that provide much more architectural and modern looks. On another Biscayne Bay project, the entire pool has a series of concrete beams overhead that provide partial shade. It's a formal look that creates a very modern, architectural feel – but it's intimate, too, with the shade lines adding a softer, embracing visual element to the design.

In my last column, I mentioned an extremely high-end job with a 70-foot vanishing-edge design. This project also includes a spectacular patio area that's raised above the pool with a view of the bay. The location was chosen deliberately to create the perfect destina-

tion from which to enjoy the pool and the ocean view. In fact, the setting enhances the impact of both views.

On yet another project, we set a wooden roof over a spa to establish a dramatic triangular geometry. Because the spa is located on a lower portion of the property, the roof's angles are visible from several points inside and outside the home and make their own creative statement.

Cool Creations

As you can tell, I like working with these shade structures and make a point of trying to include one or more on each of my projects. As I said up front, I see them as a way to add great value within the limits of just about any budget.

I also see them as a key design component because shade structures provide visually interesting points of transition. Trellises, for example, often support vines and other plants growing within their latticework. This can provide a very natural transition or demarcation point between structural elements of a home and the landscaped areas beyond. In addition, trellises offer the advantage of providing broken shade areas and a compelling play of light as the sun shifts positions throughout the day.

And I'll come back one last time to the use of shade structures as destinations: They invite clients and their guests to move from indoors to outdoors and, properly outfitted, allow them to enjoy the best of both indoor and outdoor living. And if you set them up with good lighting (both interior and exterior) and perhaps a good sound system, they'll serve their destination functions at any time of the day or night.

One last thing: Don't forget trees, the most natural shade structures of all. I've worked on projects where large existing trees have been rigged with lights and harbor beautiful decks below. I recall more than one job where a large tree with a wooden deck beneath it became everyone's favorite destination – beautiful and comfortable places to be.

The beauty of shade is that there is virtually no limit to what you can do with it. From small projects to large, it's a factor every watershaper should consider adding to their designs.

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Designing With Water Plants

By Stephanie Rose

Water Cannas photos courtesy The Crownsville Nursery, Crownsville, MD

I feel like I'm working backward: First, I told you about a gargantuan water lily and its very specific requirements, then I offered a more general look at water lilies that will thrive in almost any pond. Now I'm going to give you some ideas and tips for designing with all types of water plants.

It might have been more logical to approach things the other way around, but the important thing is that we're ready to complete the package and talk about ways of incorporating lilies and water plants of other sorts into beautiful, overall planting designs.

As always, I will avoid getting too specific with recommendations. Instead, I'll stick to basic design principles you can apply using your own tastes, local plant options and familiarity with your clients' desires. (I also want to hear from you: If you have a different perspective or simply disagree with one or all of the design elements I isolate here, please let me know!)

Getting Started

Let's start with a given: Unless you're working with a very contemporary or highly structured formal design, water plants will always be at home in your ponds. (This is no slap at contemporary or formal designs. The simple fact is that many of these watershapes are meant to be plantless.)

Another given is that the main difference between planting in soil and planting in water is the grade. With a watershape – and even with watershapes featuring more than one pond or level – you're always placing plants on a horizontal plane. You don't want to end up with a "flat" look, so bringing dimension and depth to your design with the plants themselves is very important.

For that reason, I'll be illustrating this discussion with water lilies, water cannas, and water hyacinths: Each has a different height, color (primarily in their flowers), texture, and shape.

The differences in these characteristics are important. Even if you and/or your clients love water lilies above all other flora, a pond planted *exclusively* with water lilies, no matter how many different varieties or colors you assemble, will all lay at about the same height relative to the water's surface. Even their flowers typically will bloom at about the same level. Unless you're looking for a flat, even design, you will probably want to mix in plants of other species to give your design more depth and dimension.

You could, for instance, add water cannas, which are tall, thin plants with strappy leaves and vibrant flowers. You might also want to mix in some water hyacinths to add some plants at a lower height. And of course, in designs where variety is the goal, you have many more choices available to you than lilies, cannas and hyacinths. As always, I recommend that you check with your local suppliers to find good choices for your area.

The idea is that you want to create a cohesive and interesting design by varying heights, colors, textures and shapes within the specific context of the size, shape, location and exposure of your pond.

❑ **Height.** As I've already mentioned, using plants of all the same type can give you a flat look, no matter whether you're using water lilies

Continued on page 24

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Continued from page 22

or tall grasses. If you vary the height of the plants, you will create more interest in your design.

It's important to start by determining which plant (or plants) will serve as the cornerstone of your design. If you decide to use water lilies as the focus, for example, you should probably think about adding in tall grasses or another vertical element that proportionally fits the pond.

That proportionality is important. If you have a 5-by-5-foot pond, you might want to think twice before inserting a plant that grows up to 10 feet high. It will simply be too big for a pond of that size. A better thought would be to put in some smaller plants with graduated sizes to fill in the gap between the grasses and the water lilies.

When determining how many plants to use and what their sizes should be, you also need to consider the surrounding landscape. Remember: The pond doesn't exist in a vacuum (even though evaporation might lead you to believe it does)! In fact, trees and shrubs just outside the pond might lend the height or depth you need to complete your design. Also, the margins (or borders or edges) of your pond might contain plants that look as though they blend with the pond – or may actually dip into the pond and blur the edges.

❑ **Color.** I'm not just talking about flowers when I refer to color. You don't need to look very closely to perceive that there are more shades of green in plants than you can count.

Although you do want to select flowers with colors your client likes, you can add lots of variety to your color palette by choosing plants of varying shades of green. There are also many water plants that come in shades of burgundy and black.

Watch the surroundings as well: If you pick up color elements that already exist in the area beyond the pond or that are planned for future construction, you'll have gone a long way toward tying the whole backyard environment together when the project is complete.

❑ **Texture.** Plants generally fall into one of three texture categories: *fine* (those with a feathery appearance that tend to have small or thin leaves), *coarse* (which have a more dominant appearance and tend to have large leaves) and *medium* (plants that make up the huge category between fine and coarse).

Your design will look flat if you choose all of your plants from just one of these categories, just as would be the case if you used plants that were all the same height. Variety will keep things interesting and make your pond more visually attractive.

❑ **Shape.** I'm beginning to sound a bit like a broken record here, but one last time: Vary the shapes (or *forms*) of the plants you use to keep things interesting. Water lilies have a flat shape, while water cannas have a tall, narrow shape and wa-

Continued on page 26

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Continued from page 24

ter hyacinths have a low, rounded shape.

Used as a mass, any single plant type will look flat, and *variety* is once again the key. By varying the shape of your plants, you lend interest not only to the plants in your pond, but to the pond itself, the surrounding garden and even the spaces beyond.

❑ **Placement.** There are two issues involved in placing plants in a pond: *where* you place the plants relative to each other and the main viewpoint for the pond; and *how* you manipulate the size of containers and heights of a plant to get more (or less) from those plants.

First, let's address the view of the pond. As with other elements of a landscape design, you need first to determine the direction from which people will be viewing the pond as well as how much of the pond you want them to see from that vantage point. This generally will lead you to place lower plants in front, with larger ones in back to draw the observer's eye across the pond and up, most likely leading to other plantings or architectural features behind the pond.

The other important feature of water-plant design involves playing with the flat surface you've been given by placing plants at different levels inside the pond. When most people look at a pond with water plants in it, they see only what is above the surface. Use that to your advantage and play visual tricks that hide your secrets.

Below the waterline, you can use bricks, concrete block, upside-down pots and a variety of other "elevators" to place plants at different heights. You might even want to design shelves into your pond to accommodate plants at different locations throughout the pond; this, of course, requires careful planning to make sure you put your shelves in places you want plants. Or you can set up the pond with sharply vertical sides, which allows you to place plants right at the margins – something you can't easily do with gently sloping sides.

▼▼▼

My fear in offering this quick review of principles for water-plant design is that it's too much information for easy absorption at one time – and that it is simultaneously too little information to offer a truly practical guide. That in mind, please use this as a point of departure that leads you to the right questions as you think about plants and your own ponds.

There's also much more to be shared on this topic – on water treatment, on the potting of water plants, on using different plants to balance a pond's ecosystem and much more. I'll get to some of these key topics in future columns; in the meantime, if you have specific questions on how to design with water plants or want to share your own design ideas, please enlighten me: I love learning new things!

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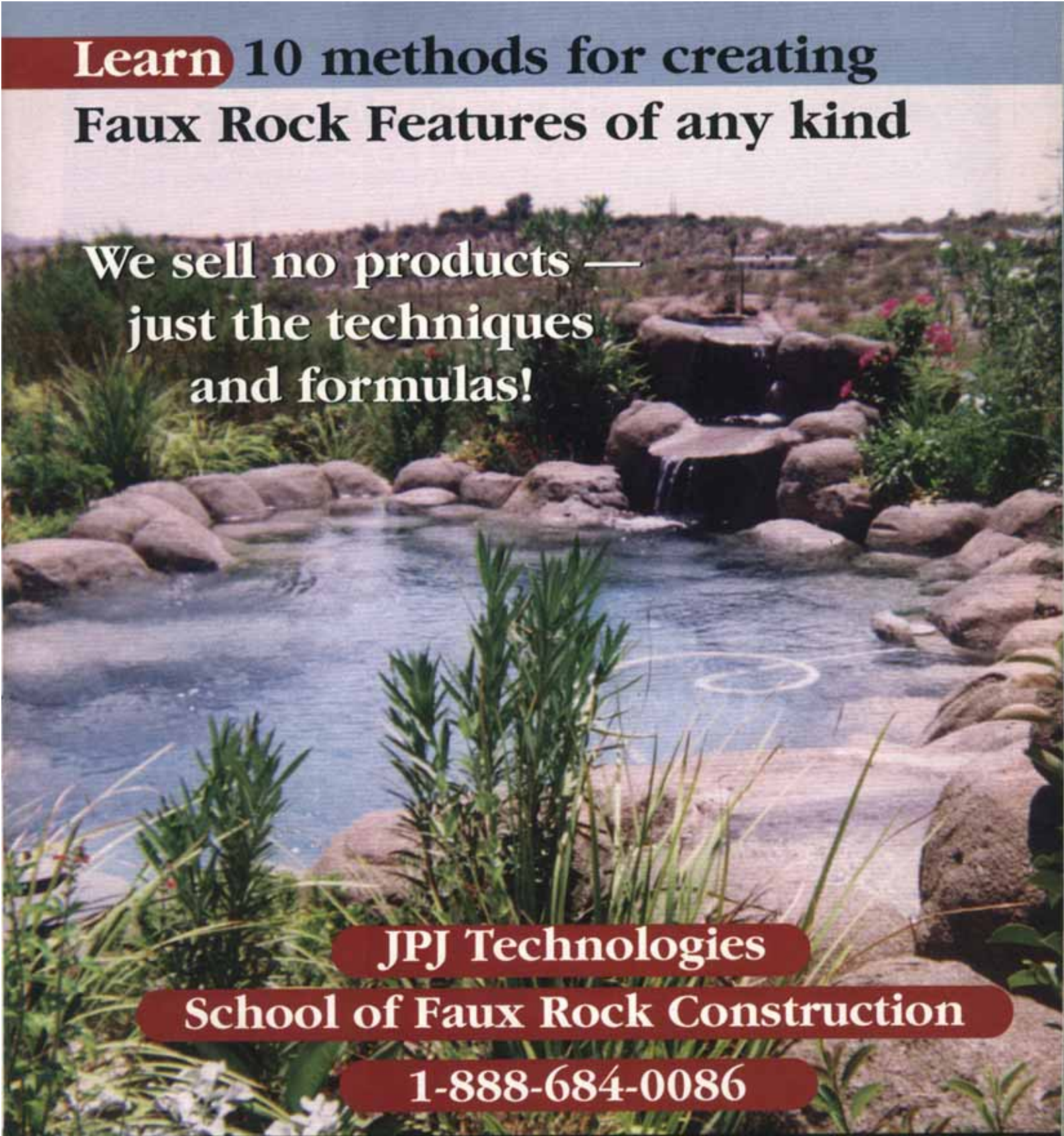

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Drains with a Difference

By David Tisherman

You'd think that having lousy-looking deck drains was inescapable, given that about 99.9% of them look like a thing you'd find in your shower.

Whether you're using PVC or brass grates, they disrupt the surface of any decking material and to my way of thinking are an unnecessary eyesore – nearly criminal when they interrupt the look and texture of a beautiful expanse of stone. It just doesn't make any sense to draw that much attention to the drains.

That's why I decided to develop a deck-drain detail that doesn't break up the visual lines of the deck. It's extremely simple – and it's something you can use in place of intrusive skimmer lids as well.

In a nutshell, the idea is to drill holes in a piece of decking material to create a removable drain grate that blends in with the rest of the stones on the deck. As with any drain, of course, the key to success is proper grading and drain placement. If the surface of the deck directs the water toward the drain, you won't have any problems.

Down to Details

I start by stubbing up with either 4- or 6-inch plumbing. The number of stubs I use is determined by the width and length of the deck: Too few or too many create a roller-coaster effect with the deck surface, while the proper number gives a visually level deck.

When we pour the concrete sub-base, a cone-shaped area is gouged out of wet concrete, creating a funnel effect toward the drain line (below at left). The idea here is that the water is to be collected over a wide area, approximately 12 inches across. I use three coats of Thoroseal to seal the funnel and Waterplug (which adheres to PVC – something the Thoroseal cannot do) to seal the interface with the plumbing.

When the deck goes in, we select a strategic piece of stone and leave a space for it. We bore 1/8-inch pilot holes using a stone masonry bit, then enlarge the holes to 3/4 or 5/8 inch – six or eight holes in all (below at right).

To blend the grate stone in with the rest of the deck, we grout against the stationary stones but leave about a 1/4-inch gap

Continued on page 30

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Continued from page 28

around the moveable stone. As water flows toward the drain, some of it flows into this perimeter space while the rest falls through the holes. (If the drain lines should become clogged, there's a clean out in a perimeter location.)

Once this work is finished, the stone rests on the sub-base and is only occasionally lifted for cleaning by a service technician or the homeowner. As mentioned above, this same treatment can be used for skimmer lids – the only added step being to make sure you line up the grout lines over the top of the skimmer (as seen below right).

This detail is expensive – as much as ten times as costly the best PVC or brass drain heads – so this isn't a detail for low-end projects. But for quality work with beautiful stone decking, I won't accept anything else.

I believe it's time pool builders take a look at their work and decide if they are truly building quality – with quality details such as this one – or are just *talking* about quality and really only building to the norm.

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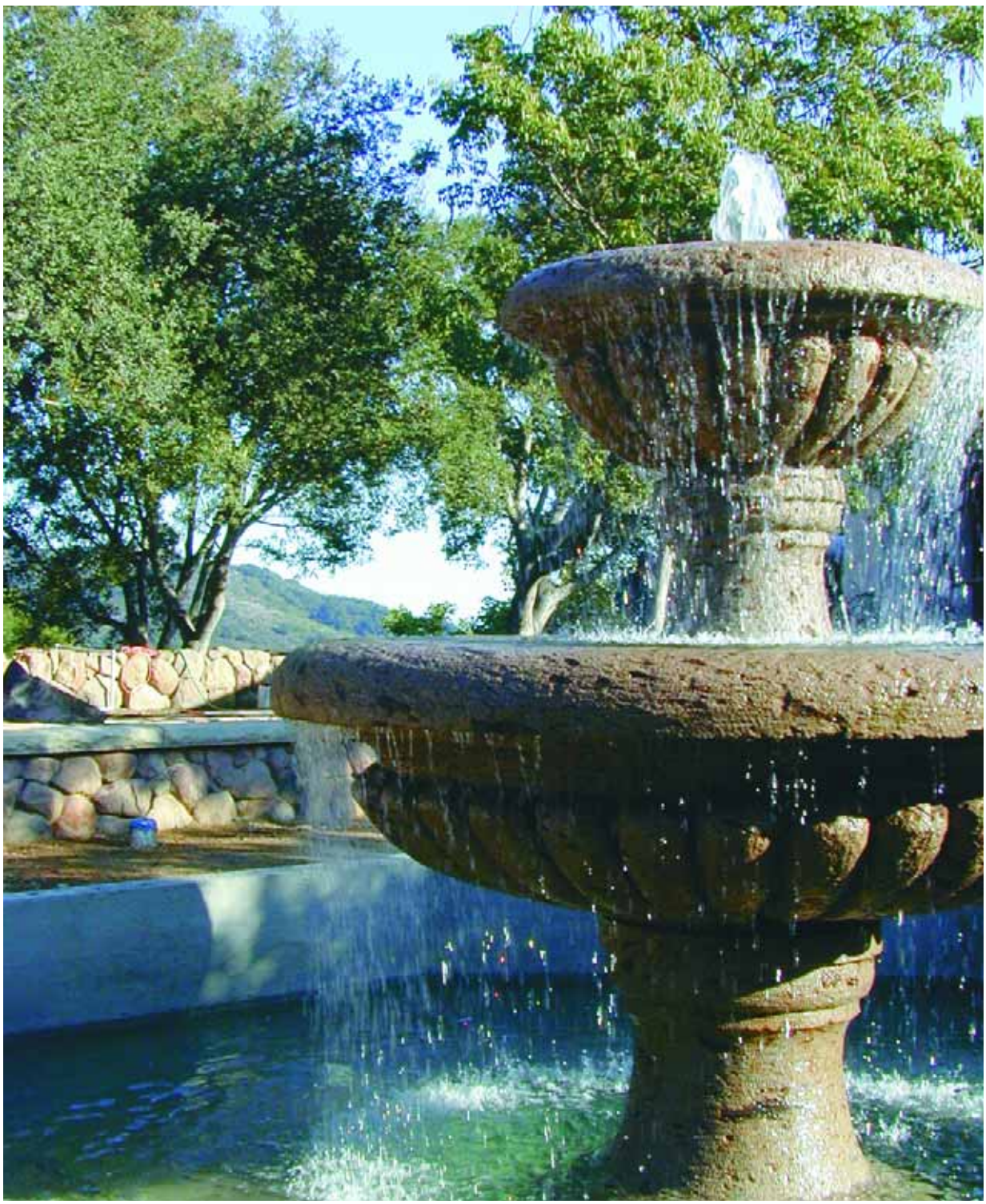


The Crest of the World

It's been the job of a lifetime for contractor and landscape architect Mark Holden: the creation of a multi-faceted paradise at a historic, hilltop estate in Montecito, Calif. The project features a variety of traditional watershapes designed with state-of-the-art technology – but all meant to appear as though they had been built with the original structures in the 1920s. Here, he begins a series of articles that will chronicle this amazing process.

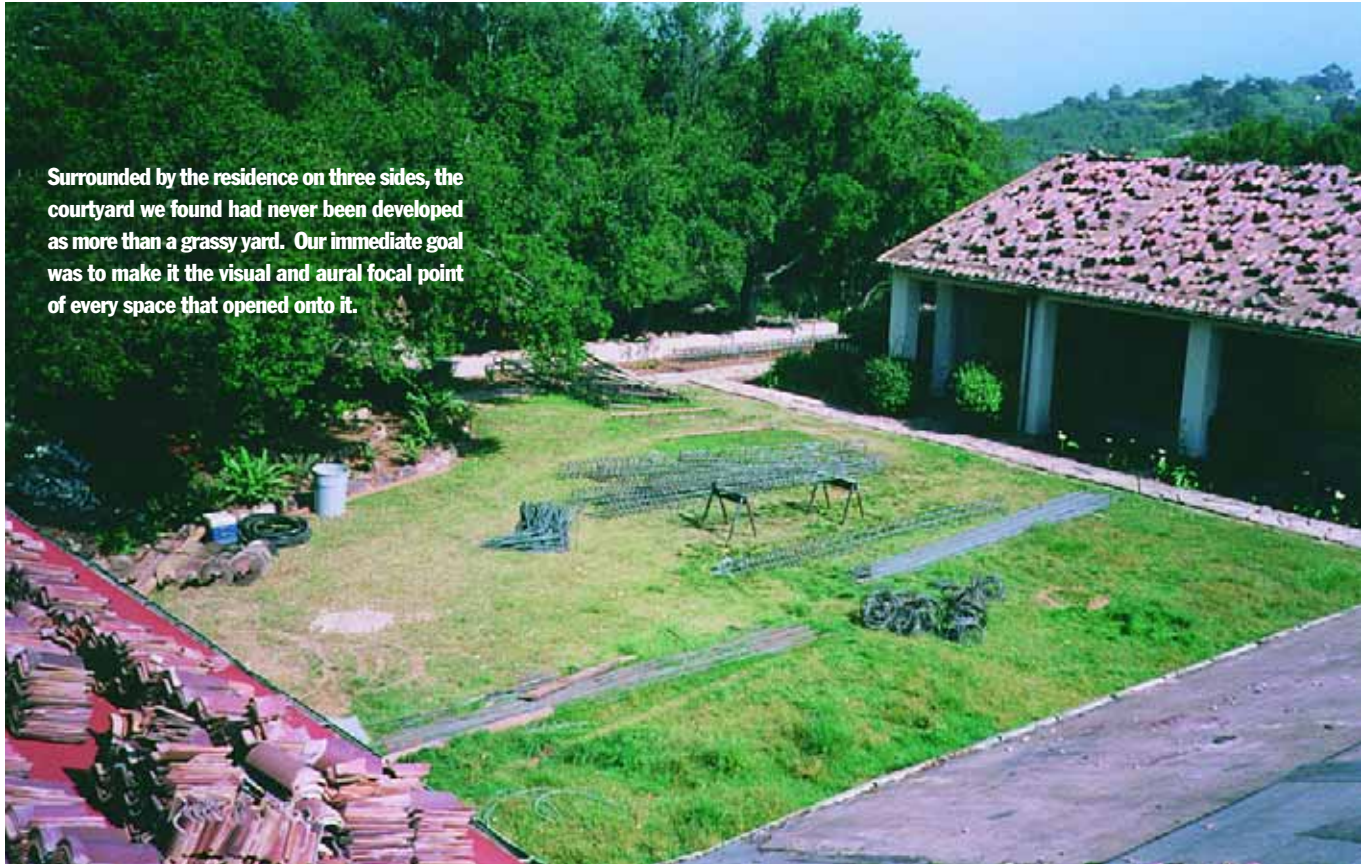
By Mark Holden

Montecito is home to some of the grandest estates on the California coast, but relatively few people know about it or where it is.

A sleepy little town, it lies several miles east of Santa Barbara and some 80 miles or so northwest of Los Angeles. From the beautiful hilltop estates that dot the landscape, you can see Santa Barbara's wharf and downtown in the foreground, with sweeping vistas of the Pacific Ocean dominating the horizon.

The big ranches of Montecito are dotted with hundreds of watershapes inspired by the Spanish-Colonial and Moorish architecture that surround them. Most were installed as part of the Spanish Revival movement that took hold among architects and landscape designers all over California through the first half of the 20th Century.

The revivalists' octagonal and quatrefoil fountains and courtyards provide a visual link to the state's Spanish heritage. Fueled by the explosion of Hollywood's movie industry during this time, the combination of money, lots of open land and a popular architectural style resulted in creation of some of the most beautiful estates anywhere in the world – none more so than a property named *Cima del Mundo*, Spanish for "Crest of the World."



Surrounded by the residence on three sides, the courtyard we found had never been developed as more than a grassy yard. Our immediate goal was to make it the visual and aural focal point of every space that opened onto it.

Art Direction

With a project like *Cima del Mundo*, the jobs of design and construction resemble nothing so much as the skills employed by an art director on a movie set. Our primary goal has been to make the visitor truly believe he or she is walking on grounds that were created in 1925.

To do this, we have trained ourselves to think along the same lines builders must have in those days. In our case, this has meant using indigenous materials and forms, as in the use of the sandstone collected on site and milled to create the courtyard's hardscape.

Even details like the lawn's irrigation system come into sharp focus when you work this way. We couldn't go to the local supply store and pick up modern sprinkler heads, for example. Instead, we used the old, flat, round brass types of the past. Such a detailed pursuit of details may seem frivolous, but if a PVC sprinkler head were to pop up in front of a visitor, then the entire 1920s illusion would be ruined.

To be sure, this process can get tiresome – and frustrating at those times when we can't find what we need. This has led us to create more things from scratch than I care to remember, but it is all worth it when we dream of how this whole story will conclude.

We stick and will keep on sticking to our guiding principles, knowing that authenticity is the highest goal.

– M.H.

This series of articles will deal with the work my company, Earth Patterns of Fullerton, Calif., has done at this spectacular location, with a focus on the design and installation of its watershapes. This first part offers an overview along with details on an inner courtyard that stands at the heart of the estate and all of our work there.

A PLACE TO REMEMBER

The estate and gardens of *Cima del Mundo* originated when architect Myron Hunt – well known as a student of Frank Lloyd Wright's and for designing the Rose Bowl in Pasadena, Calif. – first conceptualized an 18,000-square-foot home for Harry and Lora Knight, aristocrats who'd made their millions in the shoe and dry-goods industries. Hunt began pursuing the Knights' dream in the Montecito hills in 1924, completing the project in 1926.

"Sprawling" is the best word to describe the result: a 47-room home with spectacular views of the ocean from just about every vantage point and amenities such as its own bowling alley. The property originally stretched over 350 acres and was one of the most celebrated in the area. Charles Lindberg once landed on the property, taxied up to the main house and gave the Knights and their neighbors rides, circling the area and eventually making an aerial loop on his departure. (A home movie of Lindberg's visit to *Cima del Mundo* is now archived in the Smithsonian Institution.)

The home changed hands over the years, and portions of the property were sold off, reducing the estate to its current 150 acres. For many years, the property served as a monastery for Jesuit priests; it was eventually abandoned and stood alone, vacant and unlocked, for more than a decade. It survived squatters, vagrants and parties – all without sustaining too much damage.

Three years ago, the property was purchased by my client, who bought it with complete restoration and renovation in mind. Both were necessary: For all of its grandeur, for example, *Cima del Mundo* never boasted much of a formal landscape. The grounds contain mostly California Live Oaks, and the ever-present Santa Barbara sandstone boulders dot the entire site.

The projects currently under way include construction of two new garage structures, enlargements of the kitchen, a complete rehabilitation of the interior (including the spectacular architectural woodwork), and the creation of five acres of densely built ornamental landscape all around the home.

The exterior design includes numerous courtyards and gardens – including a main, central courtyard with a spectacular quatrefoil fountain; a 9,000-square-foot main lawn with an 1,800-square-foot pool and spa; and a meandering stream with a koi pond and a retention pond.

Before this series of articles is complete, we'll cover all of these installations. As indicated above, we'll begin with a discussion of the central courtyard, partly because it is the portion of the project we tackled first, but also because it establishes themes that are expressed in everything else we've done and will be doing in this huge project.

In keeping with the client's desire to make everything we did seem like it had been crafted from local materials in the 1920s, we've worked extensively with the indigenous Santa Barbara sandstone boulders that dotted the estate.

The fountain is indeed the focal point for its courtyard. As planned, the noise of the splashing water can be heard throughout the top level of the huge home and offers a meditative heart that the estate needed – but had previously lacked.

CENTER PEACE

The courtyard is indeed *central*: Almost every room in the house has visual and/or auditory access to this space, so we focused on it both as a visual centerpiece and as a mood setter for all of those interior rooms.

As you approach and pass through the front door of the home, your eyes move to the center of the courtyard and its nine-foot-tall fountain. Made of Mexican igneous cantera stone, this structure sets the stage for the visitor's entire experience, with the fountain providing a landmark amid the confusion of the home's intricate floor plan.

And whether you're seated or strolling in the courtyard, dramatic mountain vistas rise above the roofline of the home, while mature trees and manicured landscaping lend a sense of peace and isolation to the setting.

As mentioned at the outset (and discussed in greater detail in the sidebar on page 34), a guiding principle for this project was the owner's desire to create the feeling that visitors are stepping back in time to the 1920s.

Executing this concept has meant thinking like a movie-set designer in making certain every detail supports the illusion. In that context, *any* misstep would result in a visual anachronism – not unlike watching a movie about ancient Egypt and spotting an actor wearing a wristwatch.

Had this courtyard been installed as part of the original design, everything would've been vintage 1925: The materials used would have been those readily available to the craftsman working the property – in this case, lots of Santa Barbara sandstone. That in mind, we gathered stone material on site and sent it out for custom milling at a shop that boasts one of only two six-foot blade cutters left in California. We then used this stone to create the court's walls, steps and copings.

Once the stone was "cubed" into the rough shapes needed for the eight-foot steps, caps and other hardscape structures, the pieces were hand chiseled and bush-hammered by local artisans familiar with the stone's character. These pieces were then hoisted over the home and into position using a 200-ton crane before being set in place by our masons.

The result is a hardscape that visually fits the home, the surrounding environment *and* the time frame. True, we could've used a more spectacular stone and created a more ornate treatment for the courtyard's hardscape, but this was the best way to remain true to the historic themes we were pursuing.

The subtlety of the stone surrounding it leaves the center fountain to provide the lion's share of the drama in the courtyard. The idea was to create a traditional fountain that would captivate the observer with its elegant visual components.

DRAMA IN THE WATER

The subtlety of the stone surrounding it leaves the center fountain to provide the lion's share of the drama in the courtyard. The idea was to create a traditional fountain that would captivate the observer with its elegant visual components.

The bowls for the fountain were designed and then hand-chiseled out of Mexican cantera stone in a quarry outside Guadalajara. The stone was chosen not for its *dry* appearance, but for how well it blends with the Santa Barbara sandstone when *wet*.

The exterior of the basin, which will be dry most of the time, is also the same Mexican cantera, but to blend with the wet bowls a surface masonry sealer was applied. The basin's interior is lined with classic, hand-painted Malibu tile designed specifically for this project. (We knew, of course, that Malibu tile had its heyday in the '20s.)

The hydraulic network for the fountain was designed with the help of Jeff Freeman of Fluid Logics, a hydraulic design and installation firm based in Oak Hills, Calif. Our idea was to create a system that enabled the owner to set flows at three distinct levels of intensity.

For daily operation, for instance, we wanted a quieter courtyard environment with a mild flow of water and restful sounds. For hot midday weather or for special occasions, we wanted to be able to intensify the flow of water spilling from the bowls – more water and *much* more water, respectively. Freeman achieved this using three distinct pumping systems 170 feet away from the fountain, all run through 3-inch PVC (to keep the pump noise down) and connected to remote controls inside the home.

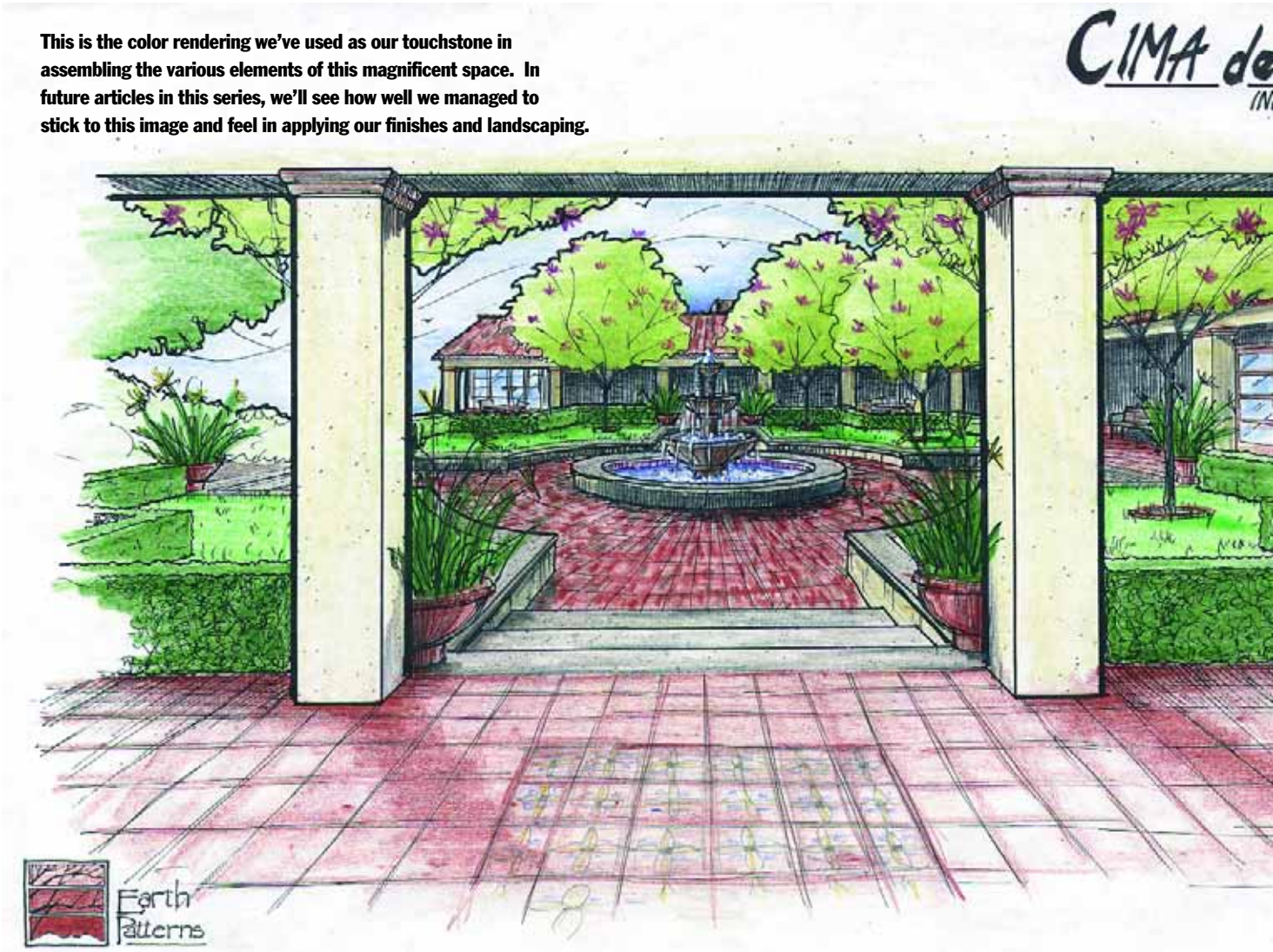
We also wanted to have algae growing in the fountain – but with crystal-clear water. That in mind, we went with ozone and a UV-sterilization unit that kills the bacteria in the water but leaves some of the algae alive and flourishing on surfaces of the fountain. Chemstain and hand-rubbed cement synthesized the effects of algae and calcium buildup. The result is a fountain that appears worn and covered with calcium and algae to look its 1920s age – but one that has thoroughly modern water clarity.

As was true with all other phases of

Continued on page 39

We used a huge crane for multiple purposes while we had it on site. The big slabs of sawn and groomed Santa Barbara sandstone would have been hard to handle otherwise, and the rig made short work of lifting the cantera stone fountain bowls into place.

This is the color rendering we've used as our touchstone in assembling the various elements of this magnificent space. In future articles in this series, we'll see how well we managed to stick to this image and feel in applying our finishes and landscaping.



Concept and Documentation

Our ambition may be to recreate the 1920s, but some of the technology we're using to communicate project details is strictly 21st Century.

Indeed, *Cima del Mundo*'s gardens and watershapes have been developed using two methods of graphic communication: traditional hand-drawn renderings and digitally crafted construction documents.

The conceptual designs and client presentations have all been conducted with renderings done to levels that communicate the basic *feeling* of each idea. (Occasionally, however, we've resorted to digital photography, which lets us superimpose new elements among the current scene to communicate ideas with complete, literal clarity.)

Once the concept is approved, we jump forward about 75 years into the world of computer models in order to pinpoint exact data on every item to be installed at the estate. Matt Randolph, a landscape architect and Earth Pattern's CAD manager, has created a virtual model of *Cima del Mundo* that he uses to communicate design intent and construction guidelines to on-site crews.

Within the 200-sheet design package, hierarchy of information has become an important issue. The plans include computer-generated surveys, soils reports, structural specifications, design concepts and all sorts of technical information that needs to be overlaid and viewed in a variety of ways. Layering of these various elements and a custom file system (organized just for this job) enable us to communicate as best we can with the customer and the field crews alike.

Without our computer-based design services we would be severely hindered by the conventional pencil and blueprint process. Computers enable us to simplify the painstaking process of what we do and focus more valuable time on the really important thing: *creating*!

– M.H.

The trees frame the courtyard, creating a sense of enclosure and giving the courtyard an intimacy it previously lacked.

Continued from page 37

the project, even the courtyard plantings had to stick to the '20s theme. We spent more than a year researching Santa Barbara's indigenous plant species and historic planting trends in creating our palette. We found that plant selections from the turn of the century tended to be simple – lots of green with just a few dramatic points of interest.

We expressed this on site by using palms as focal points amid fields of green. In many cases, we set up the greenery with various texture changes and positioned the palms in front of key architectural features, often adding a single splash of color for interest. We'd found this basic arrangement throughout Santa Barbara and Montecito – an approach that accents the views without disrupting or competing with them.

OPENING A SPACE

The courtyard, however, lacks the long-range ocean views, so we worked to turn viewers' attention inward, always toward the fountain.

The perimeter plantings are simple and serve to reinforce the rectilinear shape of the courtyard and the home. Mature, 96-inch-box Coral and Tabebuia trees were installed with the same 200-ton crane we used to place stonework for the fountain and hardscape. These trees frame the courtyard, creating a sense of enclosure and giving the courtyard an intimacy it previously lacked.

The splashes of color are found in plantings at the corners of the courtyard and in the collection of antiqued terra cotta pottery that adorns the pilasters and surrounding veranda. These were originally simple clay pots, but we "distressed" them through a process of grinding, filing, hammering and sanding. We added an an-

One of the burdens of making our current work look as though it had been around for 75-odd years was bringing in mature trees. The 200-ton crane came in handy here as we moved the 96-inch boxes into position in the courtyard.

The plumbing, which sits to one side of the courtyard in a submerged vault, features 3-inch pipes for super-quiet operation. The system runs at three distinct flow rates for different fountain effects.

tique patina by rubbing gray and white thin-set into the surface of each pot. A green chemical stain was then applied to simulate the growth of algae and mold on their surfaces.

With landscape lighting, we were able to tell yet another story in the courtyard space. By using a mixture of high- and low-voltage fixtures, we were able to change viewers' perception of the space at night by creating a play between light and dark spaces within the courtyard.

The fountain itself has four standard spa lights in the basin and three 12-volt fixtures in each of the bowls, providing a luminescent centerpiece for the nighttime space. The landscape surrounding the basin is lit with much subtler, softer lights. An existing Oak tree in the courtyard, for example, contains more than a dozen low-voltage lights that create mock moonlight through the tree's foliage. The result is a dancing, mosaic-like pattern cast on the stone paths below.

To intensify the presence of the court-

yard's four major trees, high-voltage uplights were used to bathe the trunks in an intense light. Combine all of this with a series of custom path lights, and the overall effect is quite dramatic. The arresting presence of the fountains and the main trees juxtaposed with the softness of the faux moonlight through the live oak, along with the recessive lighting elements, create a textured space gently transitioning between light and dark.

To top it all off, fixtures throughout the entire estate's gardens and courtyards use amber lenses to convey the look and feeling of old-world comfort and richness. The overall mood is bright as a first impression, but it soon gives way to intimacy and elegance.

Next: A focus on the swimming pool at Cima del Mundo *– a massive 60-by-30-foot rectangle with a maximum depth of 10 feet – with a look at its Moorish roots as well as its modern enhancements.*

Soft and Elegant

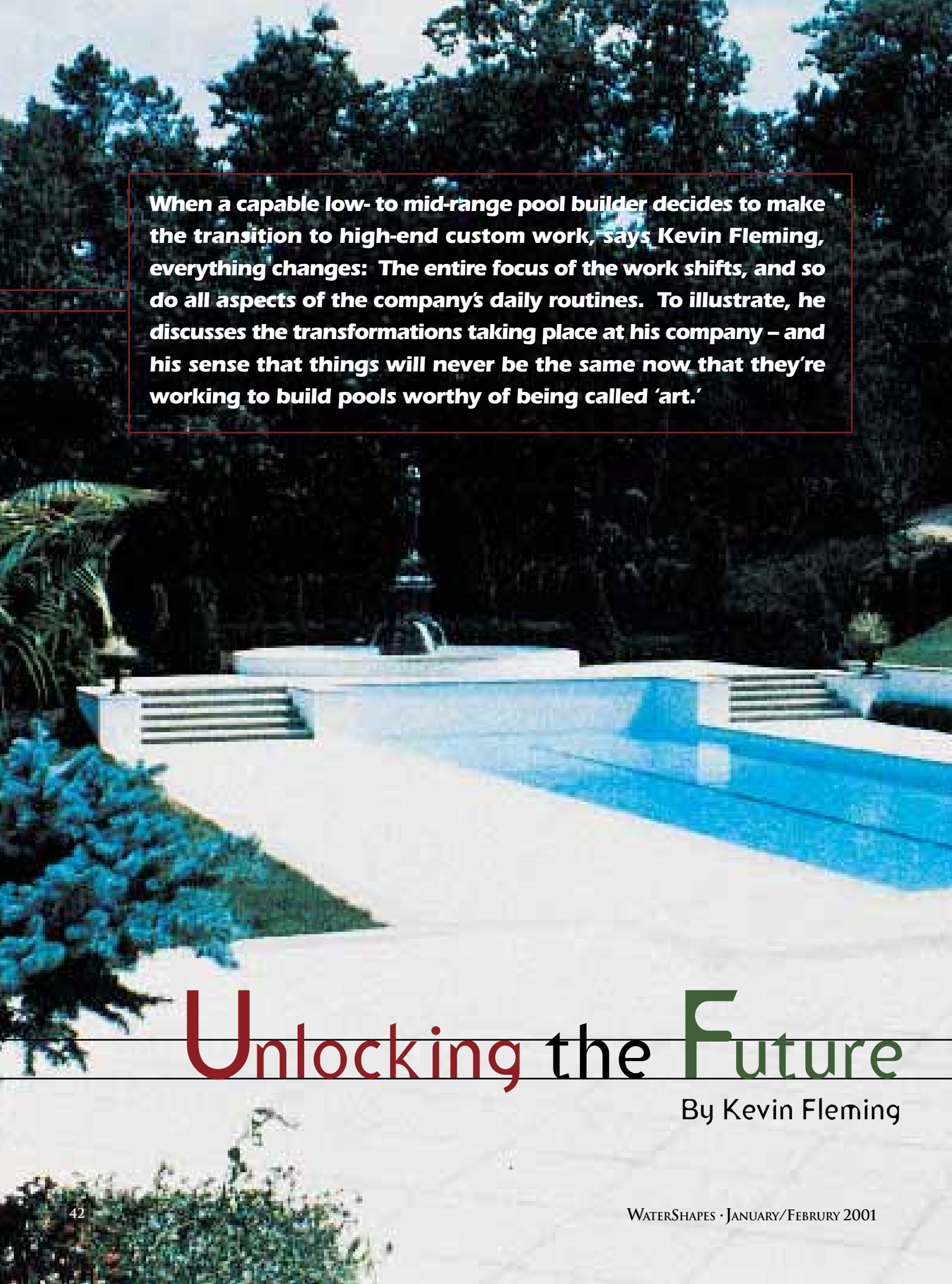
The mood of *Cima del Mundo* is one of subtle elegance.

Each space is designed not to overwhelm visitors, but rather to capture their attention and entice them to move further into the setting to discover more and more variety and detail.

These seductive spaces are not filled with ostentatious "statements" of color or texture, but are designed instead to create sensations of peacefulness and comfort. For example, there are many cool, wooded "vignettes" with just a small architectural form included along with two or maybe three splashes of color.

Our objective here is to create attractive destinations within the landscape that beckon to visitors and then incline them to stay and explore the grounds in quiet comfort.

– M.H.



When a capable low- to mid-range pool builder decides to make the transition to high-end custom work, says Kevin Fleming, everything changes: The entire focus of the work shifts, and so do all aspects of the company's daily routines. To illustrate, he discusses the transformations taking place at his company – and his sense that things will never be the same now that they're working to build pools worthy of being called 'art.'

Unlocking the Future

By Kevin Fleming

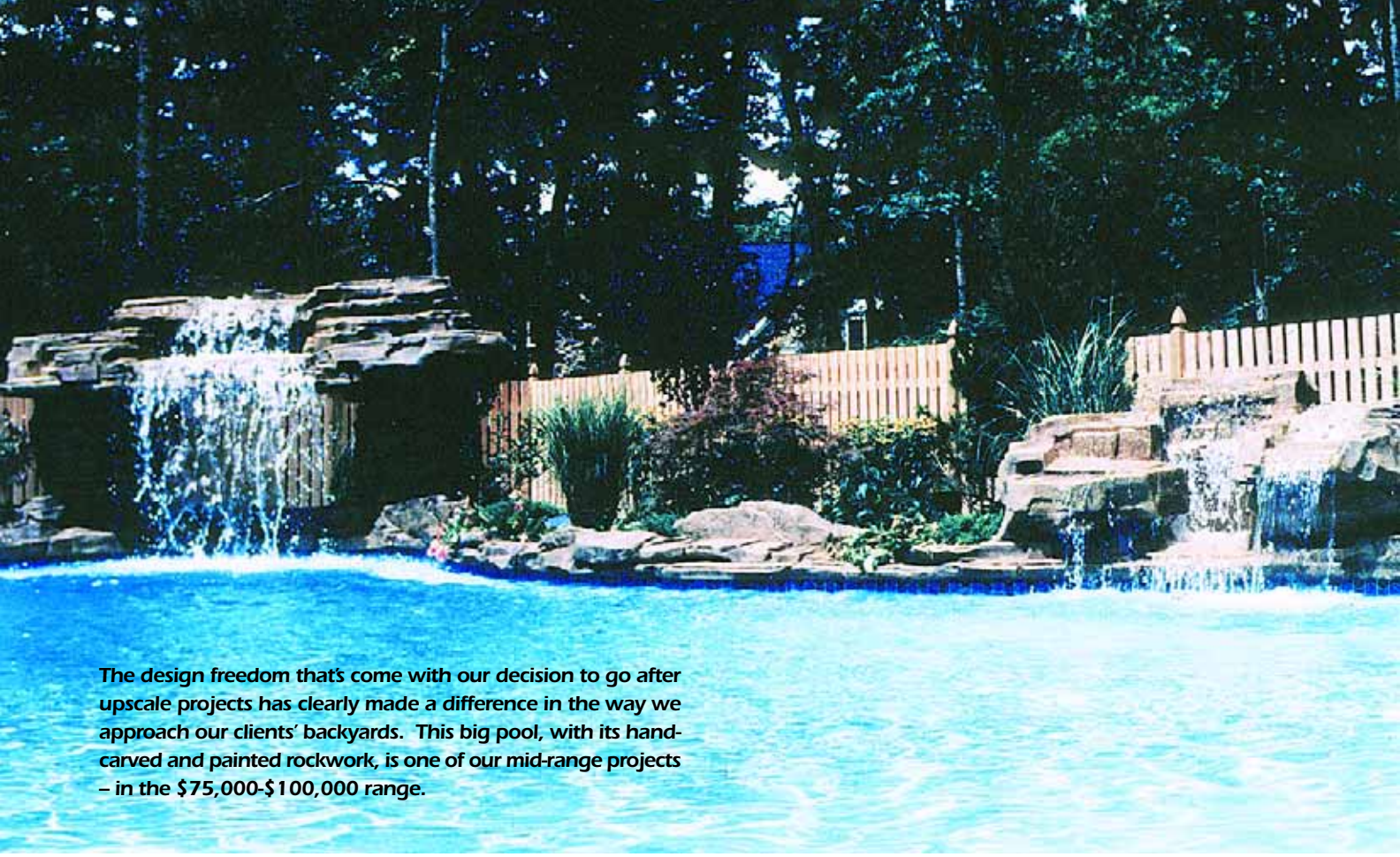
No one ever said that change was easy.

In our case, in fact, it's been a struggle every step of the way. But even though we're still in the middle of the process, I can tell already that it's been worth it – and that the best is yet to come.

Lipinski Pools, an offshoot of Lipinski Landscaping in Mt. Laurel, N.J., has worked with pools as part of the company's overall landscaping business for several years now. We started by acting as general contractors and farming out a lot of the work.

Using that approach, we designed some nice pools to go with our landscape projects – but we kept running into problems. To say that we grew tired of delays, inconsistent construction and unhappy customers is putting it mildly.

About three years ago, we broke out of the box and started bringing most steps of the pool-construction process in house. We quickly discovered that we had a lot to learn about watershape design and engineering – stuff that didn't come naturally to a company that had focused on the landscape side for so many years.



The design freedom that's come with our decision to go after upscale projects has clearly made a difference in the way we approach our clients' backyards. This big pool, with its hand-carved and painted rockwork, is one of our mid-range projects – in the $75,000-$100,000 range.

A TIME TO GROW

In the early days of the pool division, we were pretty ordinary, building $20,000 to $30,000 pools for a mostly middle-class clientele. We did some nice work, but there was nothing exceptionally creative about what we were doing. Uncomfortable with that reputation, we sought to improve the way we did things.

The pattern started changing in 1999, when a couple of us flew to California to participate in the Genesis 3 Level I Design School – and accelerated when we attended the Level II course in Florida early in 2000. It's safe to say that these schools opened a whole new world of possibilities to our company.

In rapid order, we came to view swimming pools as potential works of art; gained the confidence we needed to move forward into (for us) the uncharted territory of high-end custom work; and developed a sense of what it was going to take to reshape the attitude and focus of the pool division.

Among the first lessons we took to heart had to do with understanding the fact that an expensive pool is much more than a big hole that costs a lot because of its sheer size and the fact that it is packed with all sorts of bells and whistles that are put there mostly to drive up the cost. Rather, a worthy custom pool is designed with beautiful materials, fits in with its environment and is built to the highest standards of engineering and construction.

More than anything, we learned that great pools are the products of inspiration, creativity and design expertise rather than a salesperson's ability to add costly extras to a punch list.

Back in the days when our idea of a high-end pool was one that cost $40,000, I had no idea how much could be accomplished with a swimming pool – but now I do. I give a lot of the credit for this personal growth to the people we met through Genesis 3, particularly David Tisherman. He's no stranger to people who've followed this magazine, and I came to know him quickly – and a bit painfully at first.

When we went to California for the Level I school, we'd heard all the praise for Genesis 3 but really didn't know what to expect. Just about the first thing that happened was therefore surprising: Tisherman and I quickly engaged in a rather heated "discussion" about what was possible in our New Jersey market.

I gave him the standard line: Consumers in our middle-class marketplace would never go for his high-minded approach to design and the high-end pricing that came with it. He wasn't buying it – and pointedly challenged me to think about what we could do in a different way to change things.

After I cooled down, what he was saying began to sink in and make some sense. To get to that point, of course, I had to resist the urge to hop on the next plane and get away from one of the most opinionated, argumentative guys I'd ever met.

REWORKING A GOOD THING

Look at it from our perspective: There we were, with a great landscaping business backing us, being told that we needed to change. There we were, highly successful in our market, being told that we could reach *our* full potential only by making a commitment to designing projects to *their* full potential.

As our time in the school passed, we were introduced to materials we'd never considered, to textures and contrasts be-

> There we were, highly successful in our market, being told that we could reach *our* full potential only by making a commitment to designing projects to *their* full potential.

tween textures to which we'd never paid much attention and to an array of technologies we'd never before encountered. Most of all, we were introduced to the concept that you can find inspiration and ideas all over the place – in books and in the works of past masters, great architects and famous designers – when it comes to setting the style and detailing for pools. It was a true epiphany.

Eventually, I was beginning to understand what Tisherman and the other instructors at Genesis were talking about. I also thought I was ready for some direct feedback about my own ideas.

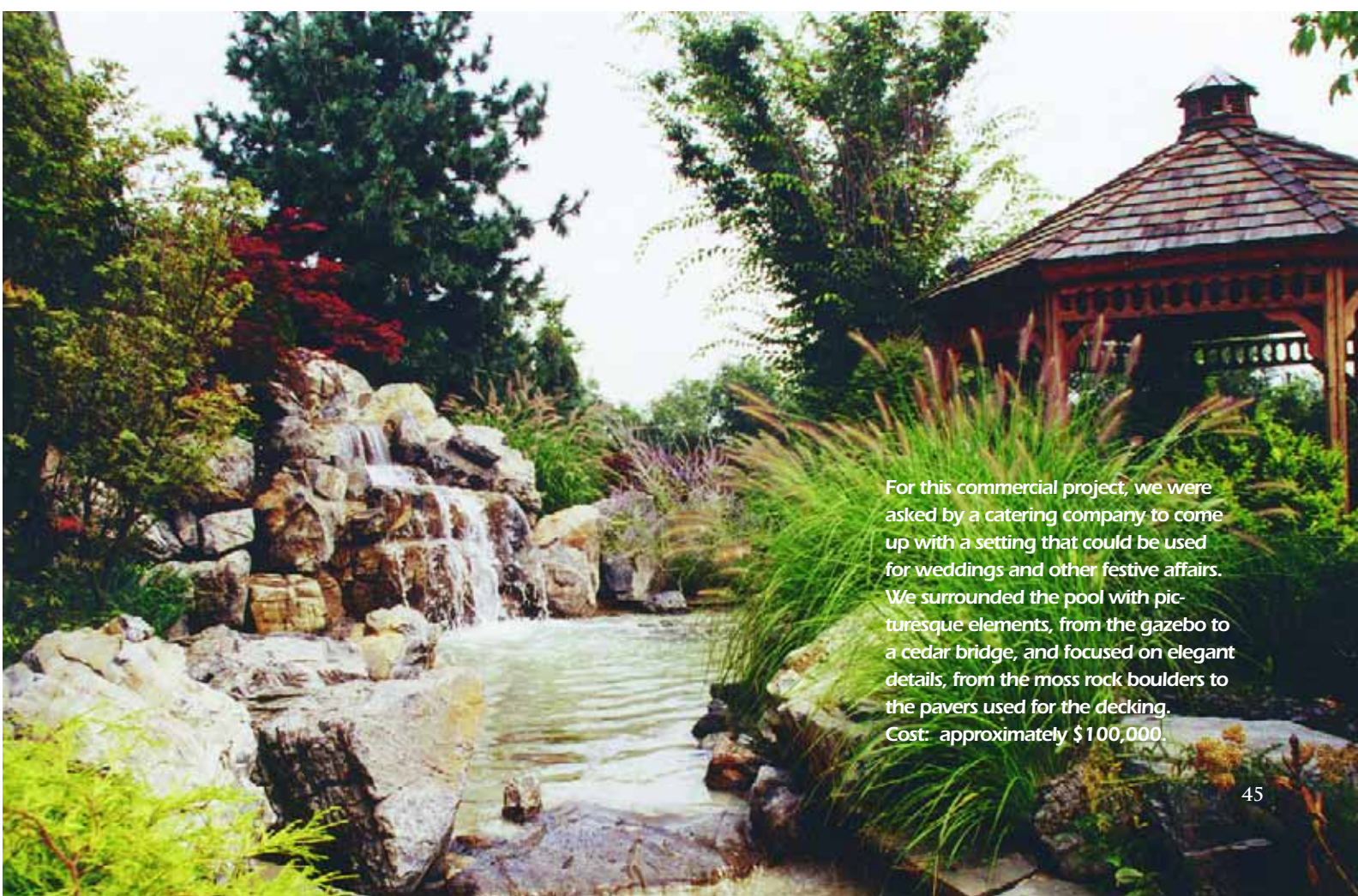
I asked Tisherman if he would take a look at two vanishing-edge designs I had developed for upcoming projects. I hesitated, because he'd spent a fair amount of time trashing the work I'd done in class, but this was different: He gave the drawings a serious look – the kind that comes when you know that the drawings are for real customers and that there are real dollars riding on the work.

He looked at the drawings and, in a much more positive way this time, challenged me to think about the process in a whole, new way. To bring his point home, Tisherman agreed to take the process a step further with us and talk to our customers on our behalf. If asked, he said, he'd even offer his design services.

We didn't take him up on his offer at the time, but after the Level II school about a month later, company owner Bob Lipinski and I made the call: We decided to go back to our vanishing-edge clients and offer them a chance to have their projects redesigned by Tisherman.

To our amazement, both customers were open to the idea, and Tisherman came and met with them. It was during those meetings that we really developed an appreciation for what can happen when a customer sees what can be done at the high end. All Tisherman had to do was walk the clients through his portfolio. Faced with truly beautiful work, their eyes lit up and they immediately said, "*That's* what we want."

They knew working with a Tisherman pool would be significantly more expensive and that the redesign itself would come with a hefty fee attached, but they were so inspired by what they saw that that both pairs of clients went for it. That was



For this commercial project, we were asked by a catering company to come up with a setting that could be used for weddings and other festive affairs. We surrounded the pool with picturesque elements, from the gazebo to a cedar bridge, and focused on elegant details, from the moss rock boulders to the pavers used for the decking. Cost: approximately $100,000.

Our new approach has led us to incorporate design elements we wouldn't have considered or offered to our clients when we first started building pools, but now details like special spillways, raised planters and spas, fire pits, shade structures and much more have become part of our growing design vocabulary. Yes, our pools now cost more than most – but they have what it takes to meet the demands of upscale clients.

when the light bulbs really starting clicking on for me: People who are spending a lot of money on a swimming pool want something beautiful and artistic.

SAVING THE BACON

As if that wasn't enough, our consciousness was about to be raised another practical notch or two. As a condition of his participation, Tisherman insisted on complete soils reports before he'd start redesigning the pools. As fundamental as that seems, it was something we'd never considered – and a real wake-up call.

On one property, the report told us that the top five feet of soil was non-load-bearing, a fact that made us swallow hard given that our first crack at the design had included three-foot concrete footers that would have been worthless. Furthermore, an engineering work-up indicated that a 100-foot-long foundation wall for the house would not be sufficient to support the lateral pressure of the pool and deck we had planned on building.

To get the job done in compliance with this report will entail a doubling of the price of the pool to allow for an extensive substructure. (Had we gone ahead as originally planned, chances are that the pool we would've built could have ended up in the clients' basement at some future date.) The homeowners, who had balked at the expense of the report, were now grateful that a potential disaster had been averted.

We came away from this experience much the wiser for it – and are now committed to sound structural engineering on all of our jobs. In fact, Bob Lipinski and I were struck by the fact that we were looking at an entirely different way of doing business – a much better and ultimately more exciting way.

In fact, this series of revelations has led us to rethink our entire swimming pool operation, top to bottom. It became clear that the lessons we'd learned on these two high-end jobs (both of which will be completed sometime this spring) could and should be applied to *all* of our swimming pool projects.

Continued on page 48

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Continued from page 46

Now we've organized our projects into three distinct tiers (based roughly on price for want of an easier way). On our low end, we still do several pools ranging in price from $40,000 to $75,000. Then there's a second tier in the $75,000 to $150,000 range – and above that there's what we call "Tisherman-style" pools costing $150,000 and up. At each level, we've committed ourselves to applying as much of a high-end design sensibility as we can while providing rock-solid engineering and construction practices across the board.

For our least expensive pools, this means doing a quality job of construction, providing customized designs that fit into the environment and offering a range of material upgrades. (That last factor is key: In most cases, I've found that our customers will raise the price of their pools to include some form of special tile, decking material or coping.)

INTERNALIZING THE LESSONS

It's interesting to note that the $40,000 mark really does serve us as a breakpoint in our work: Above that line, we can stick to our principles and do great work on all three levels; when we move below the line, however, we find that compromises must be made – and that's something we've taught ourselves not to accept.

And we think that the $40,000 mark gives us lots of room to maneuver. It includes hydrostatic relief systems, quality forming, detailed drawings, engineering for prevailing soil conditions, close dimensional tolerances and reliable scheduling – not to mention some nice construction details like placing ledges inside shells to support big rocks and other aesthetic features.

Another nice thing the $40,000 buys is close construction supervision in all job phases, from site clearance through to the day we turn the pool over to the owners.

Of course, this reshaping of attitudes and work practices has had its organizational effects. For instance, we put a sharp accent on efficiency by bringing in a CAD operator to generate detail drawings for use in the field. We've also brought on in-house crews for excavation, guniting, plumbing and steel, and we devote a lot more time (and education) to our design work.

We've also evaluated and updated our approaches to plumbing and equipment installation. We've learned to upsize plumbing and use smaller pumps to increase hydraulic efficiency. All of our decks now feature steel-reinforced concrete and are overdug by 4 to 6 inches to allow for inclusion of a bed of tamped pea gravel.

In other words, we are now investing the time and resources necessary to do a quality job on *every* job. Where once we farmed out all phases of the construction process, we now do about four-fifths of the work in-house. We've found that taking control in this way is helping us tighten our work procedures on just about every job we do.

Naturally, it's more expensive to build swimming pools this way, and our prices to consumers have gone up accordingly. At this writing, I'm currently turning away about 75% of the work that comes to us for bid, most of it because the budgets don't rise to the $40,000 line.

It took some practice, but now I find it is both easier and more satisfying to say "no" to someone who wants a simple pool installed in a hurry for very little money. Now, I couldn't be happier to let those clients go.

For the remaining 25% who do sign on with our "Quality First" program, we know even at the low end of the spectrum that we're doing the best work we can. As we set our sights higher, we're finding that these clients at the lower end of the scale benefit inordinately because the lessons we learn with the high-ticket jobs soon filter down and have made us more creative across all lines and price levels.

UPGRADING THE TEAM

We also know our design limits and have called upon top-notch designers to assist us in our work. Tisherman helps us at the very high end, while Kirk Bianchi of Arizona Pool Builders in Scottsdale helps us with designs in our middle range. (He's another talented person we met through the Genesis schools.)

As I have stressed repeatedly, change is never easy. Finding the right crews and workers to execute this elevated approach has been difficult and almost impossible at times. We've even run into snags because some of the inspectors in our local markets have never seen things like vanishing-edge details, all-stone decks or poured-in-place coping.

We've also had problems obtaining some of the materials we'd like to offer, such as pebble surfaces: We simply don't have subcontractors in our area who do this kind of work. But we keep plugging away, working hard to find people who can help us expand our design palette with respect to both materials and techniques.

Is this still a work in progress? For all the reasons charted above and more, the answer is absolutely "yes." Exactly what the outcome of all of this will be is difficult to tell, but I can say with some certainty that the result will be based on work at a higher standard with a far more open mind about possibilities.

The two vanishing-edge pools David Tisherman has helped us with are still in the works and will represent a real test for us, but so far we've already completed several less-expensive pools under this new regime, and the results have been both striking and encouraging: Not only are these pools beautiful, but our clients have been thrilled with the process, start to finish.

Yes, our pools do cost more now (in some cases a *lot* more), but the result is a client base that is interested in quality and that is pushing us to levels we'd never thought of before. Now we're becoming a firm that can give them what they want – and *that*, we know, is a transformation worth pursuing.

Clear Distinctions

Among those who are the happiest with the new approach we're taking at Lipinski Pools are those who've been through the pool-construction process before.

Over and over, these clients have told us that the process of purchasing and installing the pool was completely different, even enjoyable – praise we have taken to heart, believe me.

– K.F.

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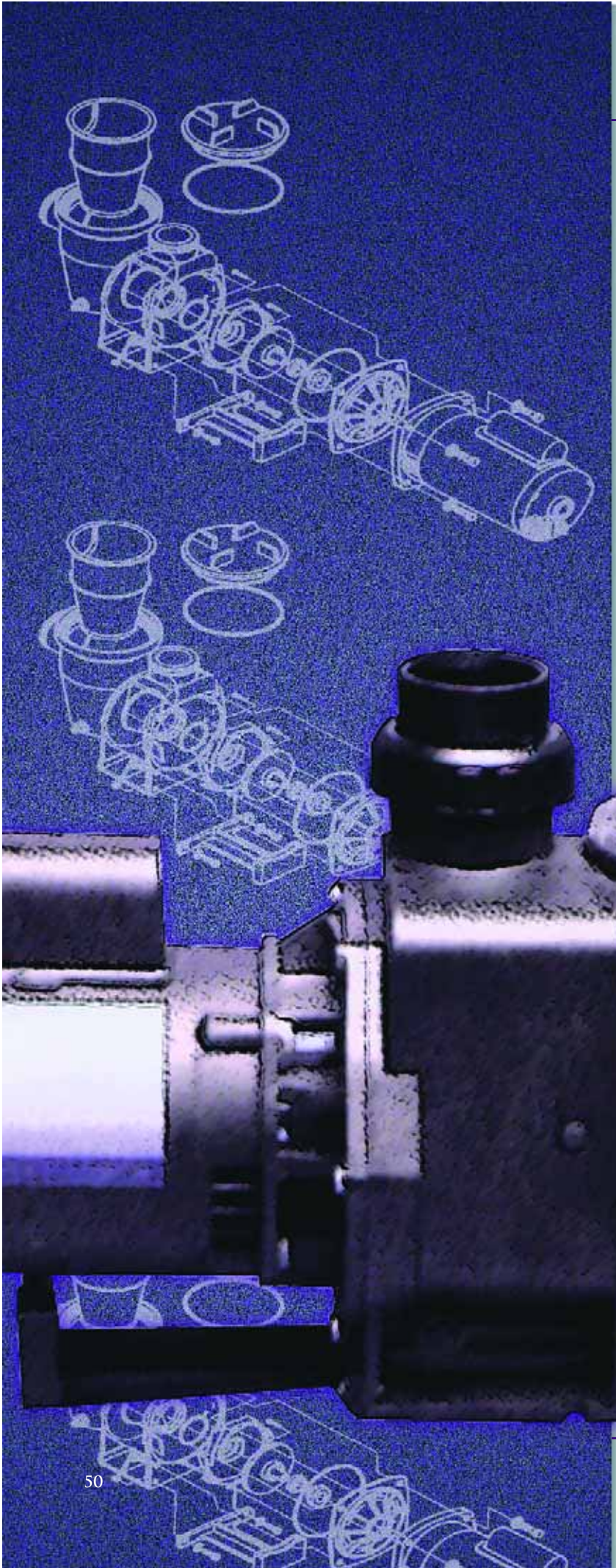
When it comes to watershaping technology, there's nothing more elemental than pumps. In fact, says hydraulics expert Steve Gutai, it's fair to say that an understanding of pumps, how they work and, most important, how they differ may be the biggest factor in achieving desired effects in any aquatic system. Here, he explains how these key distinctions can be used to prime the character, efficiency and reliability of any watershape.



A Pump Primer

by Steve Gutai

Whether you build fountains, streams or Olympic-size swimming pools, you need to install a pump of some kind to make these watershapes work. As fundamental and essential as pumps really are, however, it's amazing to think how casual many of us in the trade are when it comes to knowing about how they work and how their performance characteristics differ.

We've all heard and used terms like "energy efficient," "high head" and "self-priming," but for the most part, the real meanings of those words get lost in the competitive marketing blizzard that surrounds these products. Without a clear understanding of how pumps are designed and how they do their jobs, these distinctions are no more than words on a label – and that's definitely not the way it should be.

As watershapes become ever more complex and hydraulically challenging, cutting through the promotional hype to find out what truly makes pumps work becomes even more important: No matter how beautiful a design may be, without a properly selected and installed pump working at the heart of the system, the best projects will fall short in performance and ultimately in customer satisfaction.

In the following, I'll define pump technology in a way that sheds light on the important differences in basic pump design and function – and how you can use the choices available to you to the greatest possible advantage and effect.

DEFINING TYPES

Let's begin this exploration of pump technology by crossing some technical terrain and reviewing a bit of physics.

In engineering terms, a *pump* is a mechanical device used to move liquid and raise that liquid's pressure. To achieve this, the pump must accomplish a series of basic energy transformations.

In the first, the input energy to the pump's driver is converted to motor-shaft output in the form of horsepower or torque. (In most cases, the driver is powered by electricity, but pump drivers can be powered by air, steam, hydraulic fluid or diesel-engine oil). This shaft in turn rotates an impeller, a component that is quite familiar to most anyone who's ever worked on a pump.

The second energy transformation takes place in the pump, where the rotating impeller causes the liquid to pick up speed as it passes through. This increase in water velocity raises the kinetic energy of the liquid.

Next, as the liquid exits the impeller into a casing known as the *volute*, a diffusion process takes place. In other words, as the impeller rotates, the outlet tip of the impeller discharges water into the pump housing where the flow area increases. This diffusion or expansion of the flow area causes the water's velocity to decrease, thus converting some of the kinetic energy into pressure energy. (Despite the decreased water velocity, it's important to note that the water's velocity is still higher now than when it first entered the pump.) This is what re-

sults in the pump's flow and head (or pressure) characteristics.

That all sounds simple and familiar enough to anyone who has spent time with watershapes, but to understand the implications of these energy transformations fully, we need to back up a step and look at the basic ways that pumps are categorized and what those classifications really mean.

The Hydraulic Institute, which acts as the pump industry's trade association, classifies pumps in two ways, as *dynamic* pumps and *positive-displacement* pumps. Dynamic pumps *continuously* add energy to the liquid; positive-displacement pumps *periodically* add energy to the liquid by the use of direct force.

In the swimming pool industry and the watershaping trades, we use dynamic pumps – in other words, our pumps work continuously once the system is turned on. For the most part, our dynamic pumps are of the *centrifugal* type, which work by means of kinetic energy. By contrast, you might be familiar with positive-displacement pumps of the reciprocating-piston type, as in some chemical feeders. Here, the force is projected directly on the liquid as the piston moves back and forth, thus raising the liquid's pressure.

CENTRIFUGAL FORCES

By far, watershapers are most familiar with dynamic pumps of the centrifugal type. These are in fact the mainstays of the watershaping industry.

In simple terms, a centrifugal pump consists of the aforementioned impeller, which is attached to a rotating motor shaft, along with the housing or casing that surrounds it. Water is forced upstream into the pump's inlet (or suction) side by atmospheric pressure or upstream pressure.

As the impeller rotates, the liquid flows through the impeller's vanes, which generally curve backward in the direction of the rotation. This creates a low-pressure area or void at the impeller's eye (or inlet). The higher pressure forces water into the void of low pressure and causes the pump to prime.

As the liquid exits the outlet tip of the impeller, it is at its highest velocity. At this point, it enters the pump's volute, where the aforementioned expansion of the water's flow area occurs.

Some of the kinetic energy created by the increase in water velocity as it travels through the impeller is transformed into *potential* energy, causing the *pressure* energy to increase. Simultaneously, as the water leaves the impeller and travels around the volute, the inner pressure increases. This increased pressure produces an upsurge in what is known as the *radial force* at the periphery of the impeller.

In layman's terms, this inner pressure is projected across the surface area of the impeller. The total of these radial forces is what engineers use to calculate the maximum net radial force that the motor shaft and bearings will sustain. Having the radial loads running at a minimum will cause the pump to operate at what is known as its best efficiency point (BEP).

Pumps that are forced to work beyond their BEPs are said have excessive radial bearing loads. Symptoms of this problem include premature seal failure, bearing failure and shaft deflection. By contrast, pumps operating right at their BEPs are said to deliver optimum flow and pressure while the motor is running at its proper amperage.

PRESSURE AGAINST FLOW

Everything we've reviewed so far is pretty basic and comprehensible. Once you get beyond this point, however, you need to start paying closer attention, because this is where we get to the real distinctions among pumps available in the marketplace.

In general, manufacturers design their pumps to be either "high flow" or "high head." If they don't clearly designate them as such for whatever reason, you can determine what you're dealing with by reviewing their respective pump curves.

A pump curve represents the relationship between a pump's ability to deliver flow at a given head or pressure. We'll discuss these curves in detail a bit later on, but for the moment let's fo-

Prime Rate

Understanding what makes a pump *self-priming* will help you in determining optimum equipment locations and in understanding a pump's limitations.

As described in the accompanying text, the process of priming the pump is basically one of evacuating all of the air or condensable gas out of the suction-side lines. Centrifugal pumps of the sort most often used in watershapes are typically not self-priming unless they are specifically designed for that purpose:

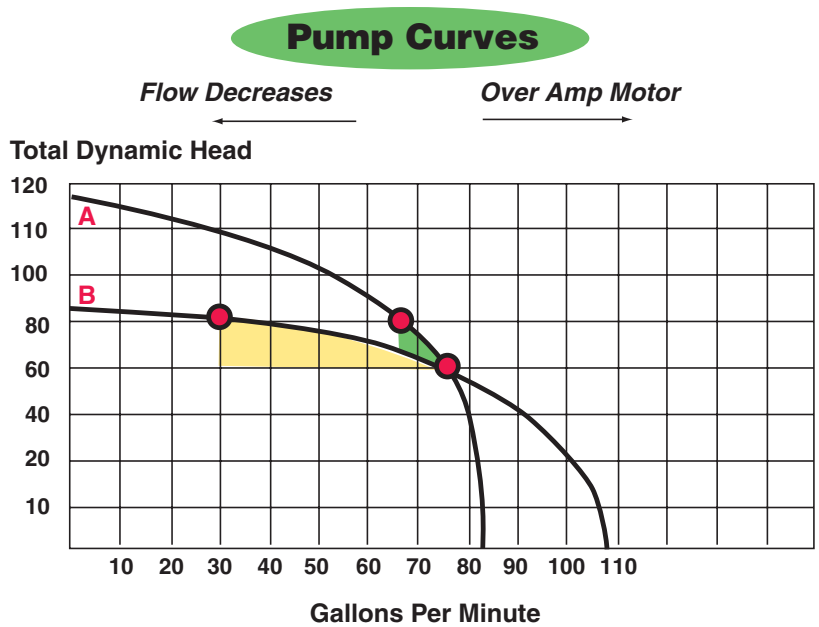
These specially designed pumps have the ability to remove all the air from the suction-side lines by means and virtue of their volute designs. A self-priming pump has a double volute or priming chamber: When the pump is turned off, the water drains out of the pump and suction lines, but a small portion of the water remains in the lower volute area of the pump.

This reserved water serves two purposes: First, it keeps the internal seal wet and ensures that the seal faces are wet during the priming process. Second, the water moves to the upper portion of the volute as the impeller rotates, thus purging air out of the pump's discharge line.

What this means in terms of application is that self-priming pumps are useful in situations where they are called upon to lift water above the waterline of the system, typically when they're installed above the body of water. The self-priming feature is not needed if the pump has a flooded suction line – typical of below-waterline installations.

– S.G.

Figure 1



cus on how impeller design influences these relationships and, ultimately, a pump's performance.

The two most common types of impellers are the *closed-face* type and the *open-face* type. Closed-face impellers are typical for residential swimming pool pumps and can perform in high-, medium-, and low-head applications. Closed face impellers are usually made of a plastic of some sort (such as noryl). These designs have really brought high-head pumps to the forefront of the swimming pool market.

By contrast, open-face impellers tend to be medium- to low-head devices with high-flow characteristics. They offer the advantage of working well in environments with lots of debris, such as with ponds or pools with lots of associated landscaping, because they do not bind up as easily as do closed-face impellers. These impellers may be made of plastic, but they also are made of cast materials.

Within each of these two categories of impeller are variations that have to do with the relationship between flow and pressure. In general, high-flow impellers tend to have deeper vanes and shorter diameters across impeller faces, while high pressure or high-head impellers have shallower vanes and broader faces.

Many pumps also include what is known as an internal diffuser – a shroud that completely encases the impeller. The diffuser creates a flow channel that is close to the outer periphery of the impeller: Instead of water traveling around the inside of the pump casing, it moves into the nearest flow channel provided by the diffuser, which helps reduce radial bearing loads. The diffuser also plays a role in the priming process by allowing air to escape as the pump seeks to prime.

Pumps that have no diffuser and open-face impellers provide minimal back pressure and therefore need a six- to eight-inch standpipe on the discharge side to create the pressure needed for priming. (For more on priming, see the sidebar on the opposite page.)

LEARNING CURVES

It's because of all these design distinctions that knowing your way around pump curves is so important. Once you understand what you're looking at, it's possible to make the accurate (and right) choice among all available pumps rather than falling victim to the hype and getting into the "more bang for the buck" mode of using greater horsepower than is needed.

On that level, pump curves are almost certainly the most important tool we have. For starters, they give us information we need to set a pump in the proper environment and tell us what the pump's flow and head characteristics are in relationship to each other. In Figure 1, for example, we see curves for pumps A and B. The flow characteristics are expressed in gallons per minute along the horizontal axis; pressure is measured in total dynamic head (expressed as feet of head) on the vertical axis.

Lots of courses and articles dealing with basic hydraulics have shown us all how to read pump curves and calculate total dynamic head, so I won't belabor those points here. Suffice it for now to say that total dynamic head is the amount of back pressure provided by the circulation system that the pump is forced to overcome in order to provide a certain level of flow.

More important for this discussion is what these pump curves and calculations mean when it comes to real-world applications.

Referring back to Figure 1, you see that both pumps are rated to provide 75 gallons per minute of flow at 60 feet of total dynamic head. We know this because that is the spot on the graph at which the two curves intersect. But the pumps we're examining are very different: Pump A is considered to be a high-head pump, while Pump B is a medium-head pump.

To understand the practical difference between the two pumps, let's see what happens when we increase the resistance by 20 feet of total dynamic head (which amounts to about 9 pounds per square inch). According to these performance curves, when you increase the system resistance from 60 feet to 80 feet of head, Pump A's flow decreases to 65 gpm while Pump B's flow drops to just 30 gpm.

What this means in terms of applications is that Pump A is better suited for systems that experience fluctuations in pressure of the sort that come from using a filter. Likewise, systems that experience high amounts of resistance from in-floor cleaning systems or that have long plumbing runs also would be bet-

Cavitation Confusion

Perhaps the most common pump problem – and one of the most confusing as well – is *cavitation*. Cavitation is directly related to a pump-system variable known as "net positive suction head." If you understand what the variable is all about, it's easy to see what causes the problem – and how to avoid it.

Net positive suction head is divided into two categories: what is *required* by the pump and what is *available*. The net positive suction head that is required is a function of pump design, while the net positive suction head that is available is the pressure at the pump's inlet.

The idea is to have net positive suction head available that exceeds the net positive suction head required by the pump. The pump begins to cavitate when the net positive suction head available is less than the required net positive suction head.

So what is cavitation and why is it an issue? Technically speaking, it's the formation of vapor bubbles along the impeller vanes: As the vapor bubbles flow toward the impeller outlet, the increased pressure causes the bubbles to implode – causing the sound that is often described as "rocks jiggling around inside the motor," a disturbing noise to say the least.

Knowing the *required* net positive suction head isn't difficult and should be specified by the pump manufacturer; by contrast, knowing the *available* net positive suction head is a different story – a function of the system's friction losses, static head or lift and vapor pressure of the water.

If you have a pump that requires 17 feet of net positive suction head when installed at sea level, the sum of static head or lift, plumbing friction loss and vapor pressure should not exceed 16.9 feet. Of course, isolating those values can be a daunting process, which is why I'd recommend seeking advice and assistance from a manufacturer if you're not comfortable with hydraulic engineering at this level.

– S.G.

ter served by Pump A.

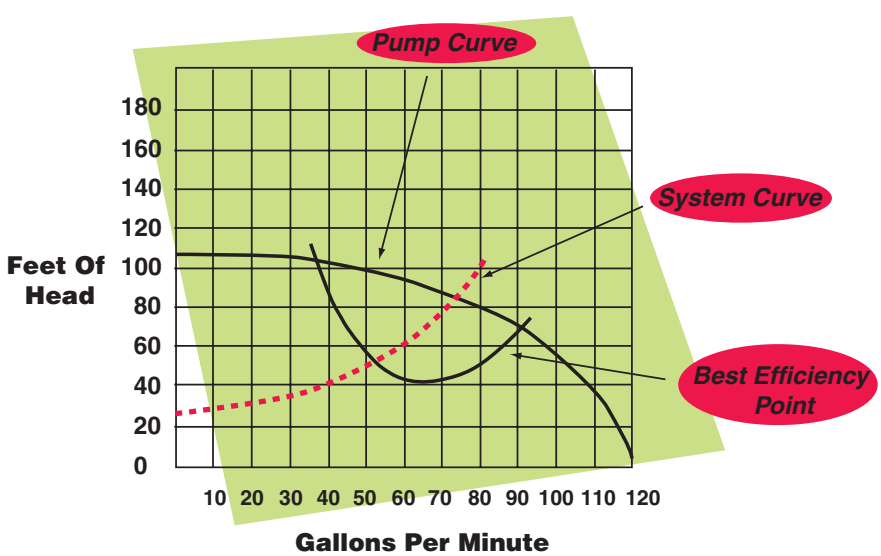
By contrast, Pump B is the choice for situations in which the pressure does not fluctuate. This would be the pump to choose for application as a spa booster or to drive a waterfall or a vanishing edge: These systems generally do not include filters and for the most part are designed to work at one constant flow rate to maintain a specific, desired effect.

WITHIN LIMITS

Just as helpfully, pump curves also tell us what happens in the event the pump is forced to operate beyond its best efficiency point, as defined by the shaded areas on Figure 1 on page 53.

If an excess of pressure is put on the pump by increasing total dynamic head, we can see how rapidly the flow decreases to the point where it will actually stop.

Figure 2



On the other extreme, we can see what happens when pressure decreases and how rapidly flow accelerates.

In addition, if we go far to the front of the curve by not having enough resistance, the pump will "overamp" the motor: This means the motor's rotational rate will increase, thus increasing the wattage, wasting energy and leading to early motor failure. And in both cases, of course, the system is operating outside of the pump's BEP, which means we would eventually see bearing or pump-seal failure because the radial bearing forces I mentioned above will be out of balance.

The lesson here: Select a pump that matches desired characteristics in terms of pressure fluctuation and that you will ask to operate at its BEP. In this way, understanding pump curves not only helps us choose a pump, but also helps guide us in overall system design.

The characteristics of the system – that is, the environment within which the pump is asked to operate – can be expressed by what is known as a *system head curve* of the sort I've incorporated into Figure 2. This curve dictates how much resistance we will find at a given rate of flow and is developed by crunching several variables in the plumbing design, from pipe size and elevation changes to

Continued on page 56

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Continued from page 54

plumbing turns, jets, special effects and more.

These calculations are a topic unto themselves and well beyond the scope of this article. For our purposes here, the important thing is to understand the relationship between the pump and system curves demonstrated by Figure 2.

This comparison is an important (but often neglected) part of pump selection, and it's a step where many system designers run into surprises. Typically, we'll see that slowing down the water velocity through the system greatly decreases the resistance. In the system curve shown in Figure 2, for example, we see that slowing the flow down from 80 gpm to 70 gpm decreases the resistance from 100 to 80 feet of total dynamic head.

In practical terms, what you'll see in many cases is that by decreasing the pump size from, say, 2 horsepower to 1-1/2 hp, you'll increase the system's efficiency by decreasing the flow and the associated total dynamic head. In other words, you'll find large drops in pressure gained with relatively small decreases in flow. This helps create what many experts refer to as a "hydraulically balanced" system.

More important, this is why, when it comes to selecting pumps, bigger is not necessarily better – and less often quite literally gives you more.

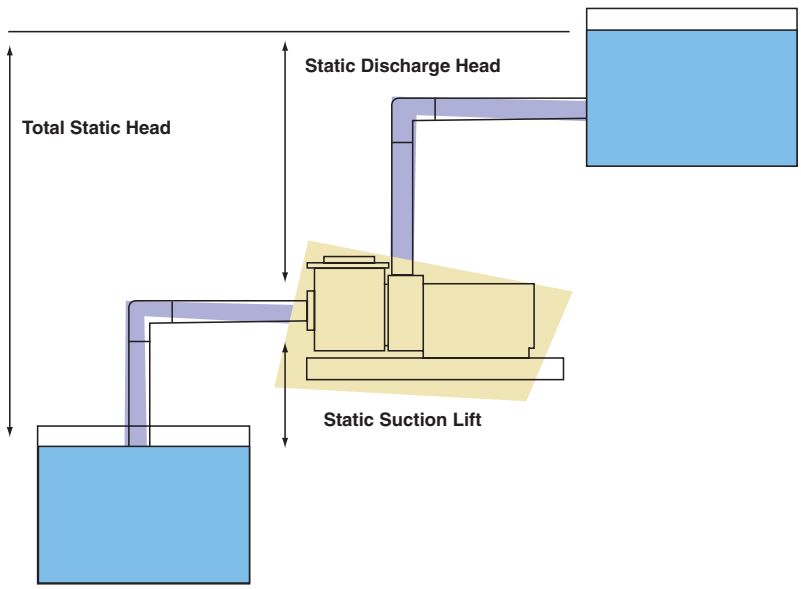
ENERGY TO PERFORM

The bottom line in all of this is that pumps are all designed to perform optimally within certain parameters. The better job you do in matching the pump to the application in terms of pressure and flow requirement, the more reliable and energy efficient the system will be.

There is no such thing as a pump that does it all – there is no high-head, high-flow, general-purpose pump. As a result, it's important to understand what you're asking a pump to do and how best to specify one that is suited to meet the demands you'll place on it.

When you do, the best of all possible scenarios will unfold: Your clients won't think about the pump at all as they enjoy the watershape that would not function without it.

Figure A



Level Variations

Setting pumps in situations in which the vessels they supply and draw from are on different levels can be difficult. For this, you need a good understanding of total static head and how it relates to your system.

When a pump is above its supply source, it has a *suction lift* assigned to it. If the pump is below its supply source, it has *suction head*. If it is pushing water uphill to a delivery vessel, it has a *static discharge head* assigned to it. *Total static head* is measured from the surface of the supply vessel to the surface of the delivery vessel – regardless of the pump's location.

Figure A shows a system in which the pump is pulling water from a supply vessel below and is pushing it to a delivery vessel above. In this situation, the plumbing should include a check valve in front of the pump to enable it to maintain its prime.

If the pump is below both the supply side and the delivery side, as shown in Figure B, it has flooded suction and will not have a problem with priming. You should, however, install ball valves on *both* the suction and return plumbing in order to isolate the pump for servicing. Moreover, if you position equipment below the water's level, you must be certain the pump can handle the weight of the water!

– S.G.

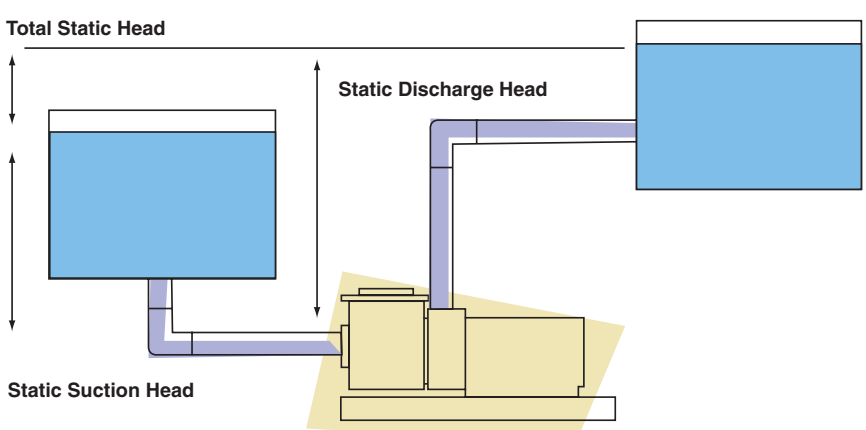
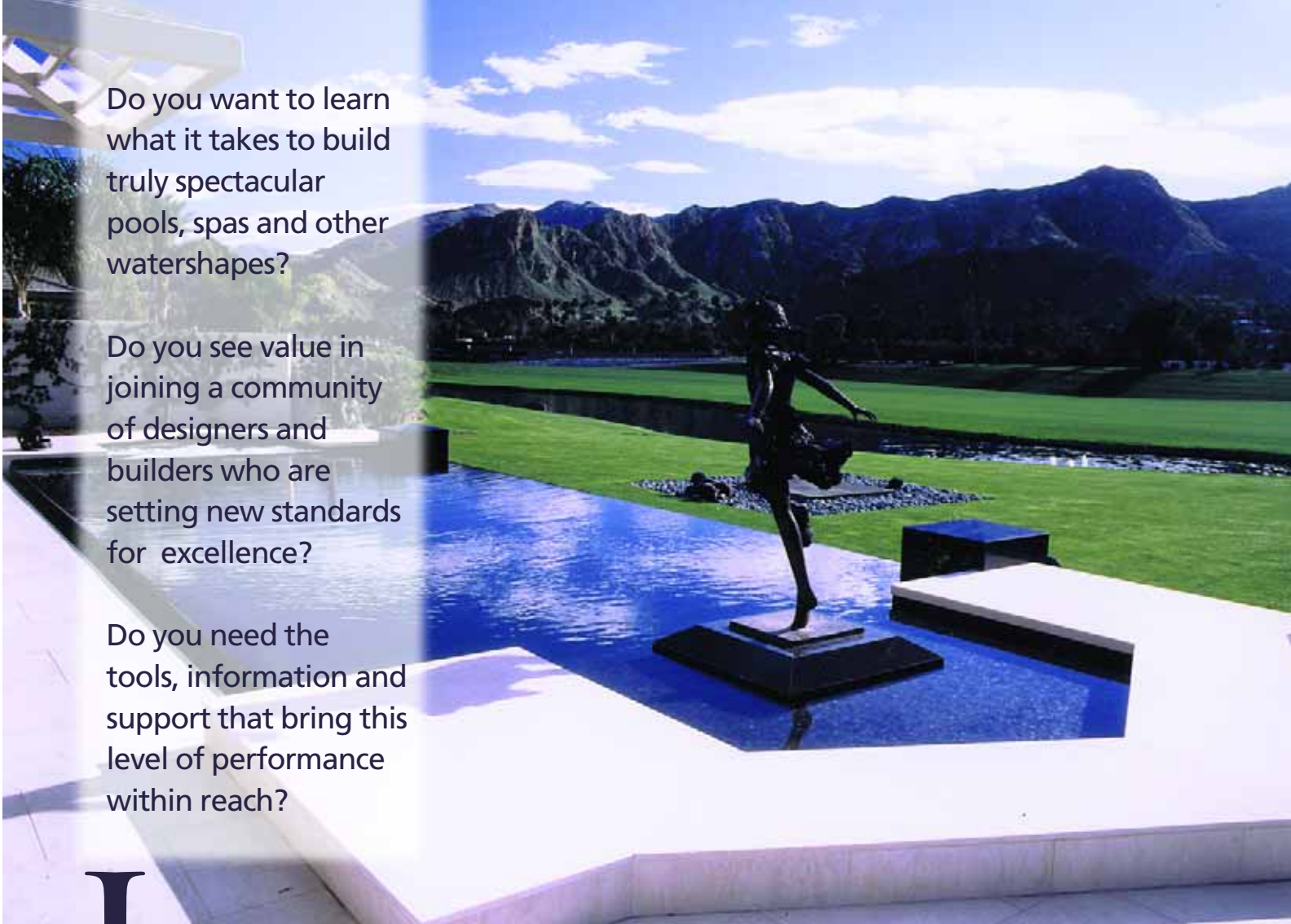


Figure B



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LIQUID GLASS

The relationship between glass and water can be a powerful one, says John Gilbert Luebtow, a modernist sculptor who uses water to spectacular effect in some of his work. Here, he explores the nature of that relationship while describing three major projects in which the 'visual dance' between water and glass is expressed in multi-dimensional shapes and sweeping, organic lines.

By John Gilbert Luebtow

As a designer and artist, I believe that water and glass walk hand in hand: Both are transparent and translucent. They distort and reflect surrounding colors and forms. And depending upon whom you ask, water and glass are both liquids.

The visual and physical resonance between these two fascinating materials is important to me: I know that their interplay adds an entirely different dimension to my work that enhances the effects I can achieve using glass, metal and ceramics, so I'm always eager to explore artistic solutions when my customers want the project to include water.

In this article, I'll examine three of my projects that use water to accentuate and reflect the sculpture while providing the soothing sounds that create an overall feeling of peacefulness in the surrounding space. But first, a bit more about what I do – and how I do it.

Ahead Of The Glass

As with many forms of sculpture, working with glass requires technical know-how and, like many modern artists, I have acquired a background in construction and fabrication techniques.

Back in school my undergraduate studies emphasized math and science as well as art. Although I never figured I'd be able to make a living as an artist, my love for art and my need to create, build, invent and solve visual and technical problems in unconventional ways led to a Masters degree in ceramics.

In the late 60s and early 70s, I worked as the director of the architectural department for a Dutch company called De Porcelyne Fles in Delft, designing and building large architectural murals. It was there, doing collaborative works with Leerdam glass, that I was seduced by the properties of the medium of *glass*.

Up to then, glass had been considered a craft material, and the most "artistic" work being done with the material was the province of glass blowers. As a natural offshoot of what I was doing professionally, I returned to Los Angeles (one of the great creative centers of the universe) and began studying glass blowing at

UCLA, culminating in a Master of Fine Arts degree in glass.

It was during this period that I decided to put my technical background to use in the art world. I had it in mind to do big sculptures using huge sheets of thick glass. To make a really long story short, I developed a method for heating inch-think panels of glass in furnaces and bending those panels in unique and interesting ways.

I import one-inch-thick glass panels from a company in England and subject them to a deceptively simple process. After cutting them to the desired sizes and shapes, I lay them over a series of ceramic, steel or fiber molds that are carefully assembled and arranged in a massive furnace I built years ago with the help of a brilliant engineer, Dave Brunette of Mechtronics Resources in Oakland, Calif.

Once everything is positioned, I slowly heat the glass to about 1,500 degrees Fahrenheit, and the glass slowly drapes itself over the pipes and whatever other objects I've placed to support it. Then I gradually cool the glass and let it anneal for a couple of days.

I remove these bent panels and begin to alter the surfaces. On most pieces, for instance, I will mask them very carefully with tape to create lines and shapes on their surface in preparation for sandblasting. I then take these etched and bent panels and mount them in metal braces to create the finished works. To this basic process I can add colored glass, all sorts of lighting effects, an endless array of metal and ceramic components – and water.

The Art Of Shaping

Aesthetically speaking, my primary concern is for what I call "linear form." I am able to express lines and shapes both *externally*, with the physical contours of the cut glass panels, and *internally*, by way of the visual interplay among the layered panels and their etchings.

When I arrange the panels in layers, the effects can be spectacular: Light shifts as the viewer moves around the piece and changes perspective. This "internal space" within the sculptures adds another dimension in which I manipulate shapes and create interesting forms and lines.

I get pretty excited by the work, and I'm always amazed at the endless number of things I can do with the medium. Exploiting this potential, however, takes time and patience.

In fact, when I'm designing these pieces, I plan their effects very carefully. I'm always manipulating and repositioning panels, keeping in mind the way they interact and watching what happens as I initiate changes in spacing, lighting, colors, textures and the surrounding environment. And I'm constantly changing my perspectives, too, moving around the piece and assessing what's happening from all angles and at various elevations and lines of sight.

I've now been working with glass for more than half my life, and I think I am beginning to understand its absorptive, reflective, refractive, transparent and translucent qualities. I apply that understanding as I go, and I find that the external simplicity of the shapes I create become more complex the longer and deeper you look at the work.

As the etched and overlapping lines and forms intersect within the piece, they *become* the piece. Shapes appear and dissolve as you move around them, and each assemblage of individual panels ultimately creates its own internal space with a visual language all its own. And because glass is transparent, the surrounding environment inevitably gets involved: Adjacent structures or landscapes are distorted and "interpreted" within the lines and forms of the piece.

The effects can be startling as the mind's eye opens to take them in. As the observer learns the language and perceives what's happening, the effects take on a depth and complexity that keeps drawing you in.

Through the years, I've done a variety of projects, several for public or commercial clients, some for private residences and many that exist solely for the sake of my own personal expression. Some of my work is political; some of it is deliberately sensual or even sexual. Oftentimes it is meant to convey emotions running the gamut from anger and conflict to love and acceptance.

I like to think that none of it is boring.

The Scripps Research Center

This piece was completed in April 1996 for the Arnold and Mabel Beckman Research Institute at the Scripps Research Institute in La Jolla, Calif. The panels stand 11 feet tall and are mounted atop a black absolute granite base that appears to float on water.

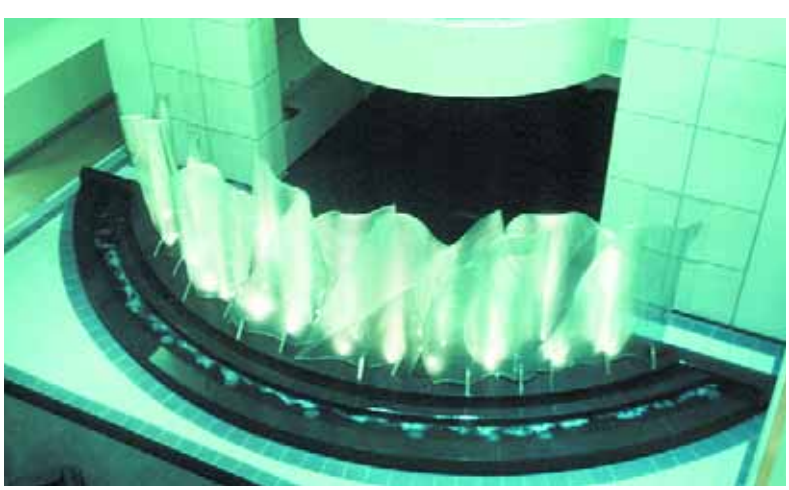
The piece consists of 12 geometric shapes of inch-thick slumped glass. The overlapping panels work to create a variety of geometric shapes that exist only when you move past them and observe the striped, quarter-inch etchings and the variety of moiré patterns they create along the 40-foot arc.

The water comes out of an arcing weir set below the sculpture and flows very gently over a step in the granite base into a narrow trough. Its effects are both visual and aural: The gentle movement and highly reflective surface work in perfect harmony with the undulating glass panels, while the soft sound of the falling water creates a meditative ambiance in the area around the piece.

That was right in line with the objectives of the people at Scripps, who wanted something that would be visually evocative – yet gentle and meditative.

This is a major research facility and the atmosphere and work can be extremely serious and intense. The trustees wanted those who work there to be able to come out of their labs into this atrium area to relax in a beautiful environment. Yes, the piece is massive and formal, but that sense of control and discipline is thoroughly balanced by its soft, gentle lines and the soothing sounds it makes.

Soft white lighting emanates from a series of fixtures mounted in the black base, highlighting the sensuous curves and lines of the panels.

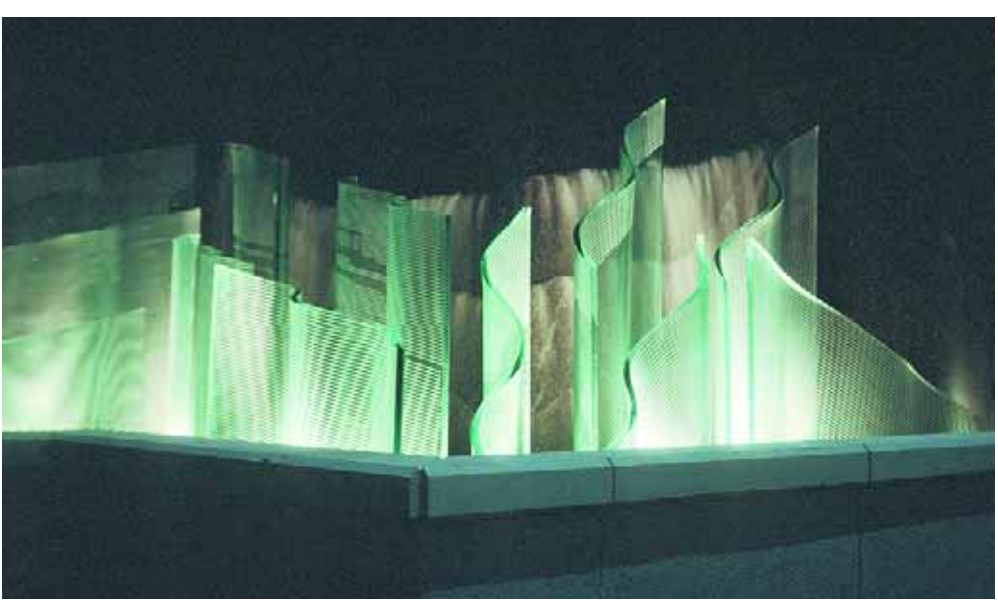


Barker Patrinely

This linear fountain was completed in November 1988 in conjunction with a beautiful 23-story high rise in San Francisco. The work stands in a garden atop a three-story parking garage next to the building. Access to the space comes through the building lobby as well as from the street.

Slumped glass panels are located in two separate waterfeatures: a 12-by-12-foot reflecting pool and a 45-foot fountain.

A seven-foot wall of Urazuba granite backs the big fountain. Water breaks over a weir at the top of the wall and falls down its face, where the sheeting effect is disrupted by breaks in three layers of the one-inch granite sheets. The motion of this water is visible through the layers of glass and works to create a complex set of interrelationships among the contours of the glass and the etchings.



The sound made by the overall composition is important here. Masking of the traffic noise below was one objective, and that's taken care of by the almost visceral sound made by the water as it breaks on the layered granite sheets. But because this action takes place *between* the granite and the glass panels, there are echoes, reverberations and distortions of the strong, primary sound that create a sort of rolling rumble that is actually relaxing rather than jarring.

The visual shapes and textures of the fountain are echoed in the reflecting pool. The low-profile panels rising out of its water demonstrates the seamless relationship that can exist between glass and water.

This work was done at a time when very few people really appreciated glass or saw it as a viable sculptural element. I credit the architects and the owners for having the courage to do something truly unusual.

Is It Really a Liquid?

I'm often asked whether glass is a liquid or not, and I'll attempt to answer that question here because the accompanying article is in part about the visual and aesthetic boundaries between water and glass.

For years now, scientists and others have discussed and debated the notion that glass is an extremely slow-moving liquid. Some dismiss the idea as little more than an urban legend, but others point out that even though we generally experience glass as a solid, it also has some qualities of a liquid.

Since Aristotle's time, men and women of science have classified things as being liquid, solid or gaseous and have traditional rules that define those states. In general, the rules say that solids hold their shape while liquids and gasses do not. Because glass certainly *appears* to hold its shape while also exhibiting liquid-like behaviors, scientists have been forced to improvise a bit.

Through the years, descriptions from *plasma* to *vitreous state* have been attached to glass. In a 1996 article, glass expert and researcher Florin Neuman called glass "an amorphous solid," observing "a fundamental structural divide between amorphous solids, including glasses, and crystalline solids. Structurally, glass is similar to liquids, but that doesn't mean that it is a liquid."

That's dense enough to make sensible people wonder why anyone cares, but let me observe quickly that there are good, practical reasons why generations of scientists have tried to figure out what glass is all about.

A friend of mine, a biologist specializing in the field of histology (which involves study of animal and plant tissues using powerful microscopes), practices what is known as *ultramicrotomy*, a procedure in which glass "knives" are used to cut or shave extremely thin tissue samples for detailed examination under his microscope.

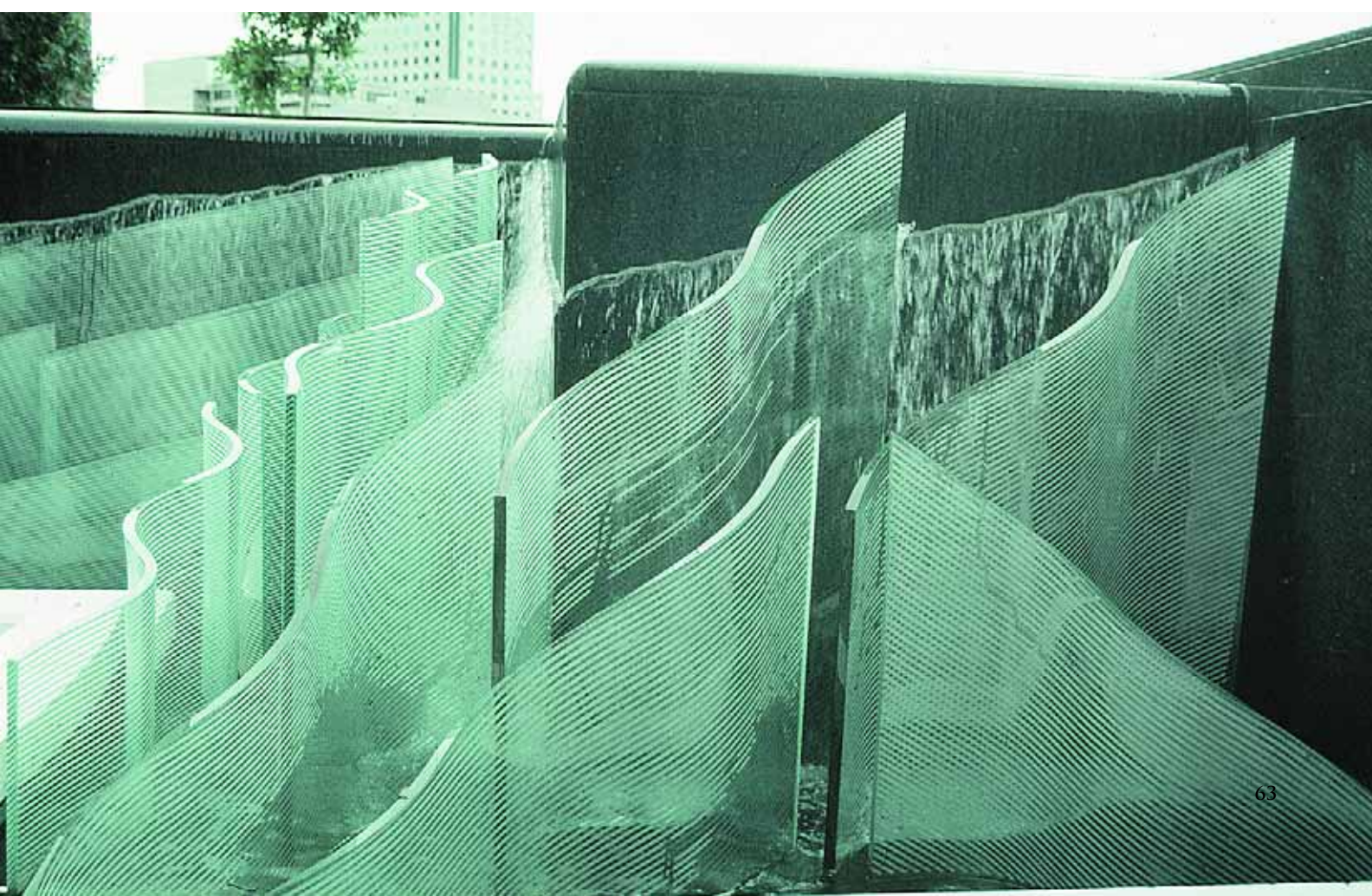
He has observed that the edges on the glass knives appear "sharper" if they are used immediately after being made. The glass cutting edge, he says, soon appears to "heal over" just enough to alter the tool's effectiveness.

In my own work with glass, I've observed another characteristic that fits into this discussion. When I cut my thick sheets of glass, I do so by scoring the surface with a cutting tool. This sends an invisible shiver or shock wave through the entire thickness of the inch-thick material, causing it to break very precisely along the scored line when pressure has been applied. No other solid I'm aware of reacts in this way.

Let me wrap up by saying that, on a purely aesthetic level and removed from the considerations of physicists and materials scientists, the internal visual quality of glass – its *apparent* liquidness – seems to align itself beautifully with water, a substance far more well known for its liquid qualities.

It is the controlled visual movements of glass combined with the actual movement of water that encourages me to bring the two together whenever I get the chance. This is why, as an artist, I like working with water and glass.

– J.G.L.



PRIVATE RESIDENCE

This is my most recent foray into sculptural work with water. Installed in June 2000, this fountain piece was created in conjunction with a spectacular backyard project designed and built by David Tisherman. (For details on the overall project, which is now complete, see *WaterShapes*, February 1999, page 22, and April 1999, page 48.)

The owners wanted something truly unique in their backyard – something that would make a distinct artistic statement while working with the beautiful surrounding greenery and the pool.

The three glass panels sit on a square absolute granite pedestal. Water rises as a motionless sheet around the sculpture's base, spilling over on all four sides into a trough filled with smooth black and dark-gray stones.

The piece itself evokes basic geometrical shapes – triangle, circle and square – that pick up and echo lines found in the swimming pool and surrounding structures. The water flowing beneath the panels

reflect the foliage of the surrounding eucalyptus trees – also reflected and distorted when viewed through the glass.

As with many of my designs, this piece offers a changing set of views as you walk around it. Combined with the etching, the outer contours of the panels themselves take on different shapes and appearances when viewed from different angles.

On this job in particular, the use of a scale model was all-important. During the design phase, the owners were having trouble visualizing what I was trying to do – and I have to admit that it's not easy to use words and two-dimensional renderings alone to describe the multi-dimensionality of the work I do. Where other forms of sculpture offer only exterior dimensions and shapes, mine are transparent and translucent and also have this complex set of interior dimensions and forms.

We soon saw that the only way to help everyone visualize the work was by way of a model: I built one to scale (an inch to a foot), complete with the glass etchings and the fountain base, and brought it over to explain the effects I was trying to achieve. We even took the little thing out and put it in the yard at the spot where the finished piece was to go. Now they were able to walk around the yard and the model and get a sense of the shifting profile and shapes I was pursuing.

This visualizing process had the further effect of helping us decide to orient the piece so that it presented a very frontal, almost flat, view from the main rooms of the home. As you move into the yard and walk toward the pool, the perspective shifts and your eye is led from the sculpture itself into the surrounding environment.

Seduced by Shapes

The interaction of lines and shapes is crucial to the work I do.

I've been fascinated by geometric shapes for as long as I can remember, from building blocks influenced by the cubes, squares and triangles of Freidrich Froebel, to Euclidean geometry and trigonometry in high school and on to the art-historical approaches of the Bauhaus and the abstractionist movements of the 20th Century. I have always been intrigued by the inventive ways geometry and perspective have been "encountered" and used throughout this history.

But my love of shape goes beyond geometry. Many of my works use gentle, sweeping lines that suggest natural forms and movement and reflect my deep and abiding love of and respect for the female nude.

I believe the lines of women's torsos, backs and limbs are among the most graceful and intriguing that exist anywhere in nature. I don't work literally with this "source material," but rather see those forms as the inspiration for the sweeping shapes and lines I use in my work.

I use these lines to soften the effects of hard materials and to create a sense of balance and movement within my sculptures. Even in works that are obviously abstract or architectural in nature, I believe that the forms of nature are expressed in the contours and shapes that make up the work.

No matter whether you're an architect, a sculptor or a watershaper, I believe these sinuous, natural lines will inspire you to create works of extreme beauty and subtlety.

– J.G.L.

The following information has been provided to WaterShapes by product suppliers. To find out how to contact these companies, look for the Product Information Card located on page 72.

NEW pH AND ORP SENSORS

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ACU-TROL PROGRAMMABLE CONTROLLERS now offers pH and ORP sensors for its AK200 multi-pool controller system. These sensors offer long life and superior performance under extreme conditions and support the company's remote control system for chemical feeders, heaters, pumps and solar and water-leveling devices on as many as three pools. **Acu-Trol Programmable Controllers**, Auburn, CA.

POOL TILE CATALOG

Circle 101 on Reader Service Card

INTERNATIONAL POOL TILE has published a catalog of its current tile selections. The 16-page, full-color booklet highlights dozens of styles, patterns and cuts, most available in 1 sq. ft. sheets for ease of application. The catalog also includes mosaic tiles, unglazed tiles, glass block and several styles of coping. **International Pool Tile**, Brooklyn, NY.

CHLORINE-GENERATING SYSTEM

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PEBBLE TECHNOLOGY has released a brochure on Nature Soft, a water-purification system that converts common salt into sanitizing chlorine. In addition to offering bathers soft, silky water in an automatic recycling process, the system also has features that reduce mineral build-up at the waterline. It comes with a five-year warranty – including full three-year coverage on the chlorinator cell. **Pebble Technology**, Scottsdale, AZ.

DECK-DRAIN SYSTEM

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GRATE TECHNOLOGIES offers Drain the Deck System, a two-component package designed to ease the flow of water off of and away from decks. The first component is a UV-stabilized PVC trench-drain base with a rounded bottom for smooth flow. The second is a 4-in. wide by 1-in. deep grate with open spaces amounting to 35% of the surface. Available in beige, white, gray or black. **Grate Technologies**, Naples, FL.

Ceramic Wall Fountains

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ARCADIA CERAMICS manufactures hand-crafted, hand-glazed ceramic wall fountains that follow the rustic design principles of the Arts & Crafts movement. The units come with pumps and are frost resistant. The company also offers several styles of waterfeature/pool fountains and tiles. Each piece is a unique work of art – the perfect spouting accent for watershapes of all sorts. **Arcadia Ceramics**, Corona, CA.

Watergarden Systems

Circle 105 on Reader Service Card

LITTLE GIANT PUMP CO. offers a line of professional-series pond systems. Included are out-of-pond pumps designed for efficient, safe, reliable, quiet operation of filtration systems, streams, fountains, waterfalls and more. The company also supplies pond skimmers, biological waterfall filters, plumbing components, EDPM liners and safety systems. Simple designs mean trouble-free performance. **Little Giant Pump Co.**, Oklahoma City, OK.

Pure-Water Fog Systems

Circle 106 on Reader Service Card

MEE INDUSTRIES manufactures fog-emitting systems that use pure water and high-pressure nozzles to create billions of droplets of water – each just a tenth the diameter of a human hair. No chemicals are needed: The fog is natural and energy efficient and can be used for special effects and subtle modification of the visual and tactile aspects of aquatic and other environments. **Mee Industries**, Monrovia, CA.

Of Interest

Faux-Rock Waterfeatures

Circle 107 on Reader Service Card

CASTART BY NATURESCAPES uses a unique building-block system to create rock structures in any environment, from interiors to outdoor watershapes. The system includes standard Classics and Sandstone structures that can be installed in less than a day. The company also offers a range of fossil accents along with complete waterfall packages and custom designs. **Castart by Naturescapes,** Tucson, AZ.

Compact Garden Fountains

Circle 108 on Reader Service Card

HADDONSTONE (USA) LTD. offers literature on its new Arcadian Garden Features line of products. The line includes fountains and waterfeatures that are affordable, stylish and easy to install, from pebble fountains with an array of centerpieces to self-contained fountains in various shapes and sizes as well as trough fountains and centerpiece fountains designed for ornamental pond or pool surrounds. **Haddonstone (USA) Ltd.,** Bellmawr, NJ.

Portable Aquatic Fitness

Circle 109 on Reader Service Card

QUAKER PLASTIC CORP. introduces Swimcizor, a portable device that turns any pool into a lap pool, gym, hydrotherapy spa or playground for kids. The wheeled unit has an easy-lift handle, deck mounts, variable-speed control and a finned deflector to give any pool a swim-in-place feature that provides for aerobic exercise, hydrotherapy, swim training and family fun. **Quaker Plastic Corp.**, Mountville, PA.

Automated Pool/Spa Control

Circle 110 on Reader Service Card

PENTAIR/COMPOOL has released a brochure on its family of automated control systems for pools and spas. The units offer fully programmable remote control of a spa and pool and up to seven auxiliary functions, from outdoor or in-vessel lighting systems to fountains, waterfalls and more. Options include spa-side controls, telephone remote control, automatic backwash, solar control and dimming circuits. **Pentair/Compool**, Sanford, NC.

Fountain System Catalog

Circle 111 on Reader Service Card

STONEWEAR has released a catalog on its line of composite stone fountains. The 24-page, full-color booklet highlights turnkey as well as custom fountain designs built for utility, aesthetics and reliability. The catalog covers the design process, starting with sizing the basin and working through the choice of the center feature along with colors, textures and finishes. Coordinated planters and benches are available. **Stonewear**, Carson City, NV.

High-Head Pump Series

Circle 112 on Reader Service Card

LAARS AND JANDY POOL PRODUCTS offers high-head pumps for superior hydraulic performance in situations that demand maximum output. The pumps are available in sizes from 3/4 to 3 hp, a range that allows for matching pump capacity to the job at hand for any combination of cleaning system, heater, fountain, waterfall and swim jet. Features include quiet operation, quick priming and a 5-year warranty. **Laars and Jandy Pool Products**, Petaluma, CA.

UNDERWATER FOUNTAIN LIGHTING

Circle 113 on Reader Service Card

CRYSTAL FOUNTAINS offers a specification sheet on a 12V system designed for underwater lighting of heavy-volume water effects. The fixtures may be installed in water depths from 10 to 18 in. and must be submerged and fastened to the pool floor while in operation. Made of cast bronze with clear, convex, tempered, heat-resistant cast-glass lenses, the units operate with 225 W quartz halogen lamps. **Crystal Fountains**, Concord, Ontario, Canada.

IN-LINE CHLORINE GENERATOR

Circle 114 on Reader Service Card

ENVIRONMENTAL POOL SYSTEMS manufactures Pool Thing, a top-quality in-line chlorine generator designed to kill bacteria, microorganisms and algae without strong chlorine odor, red eyes or skin irritation. The NSF/ETL-certified device is compatible with all known swimming pool equipment. **Environmental Pool Systems**, Scottsdale, AZ.

FILTRATION/AERATION BOOKLET

Circle 115 on Reader Service Card

ADVANCED AQUACULTURE SYSTEMS has a booklet on the company and its approach to filtration and aeration of ponds large and small. Included is an overview of products, from the Aquacube filtration module to Perma-Bead filter media and a line of pumps, blowers and accessories. Also featured is a system-design checklist that ensures proper sizing and selection of a pond filtration/aeration system. **Advanced Aquaculture Systems**, Brandon, FL.

COMMERCIAL-GRADE CONTROLS

Circle 116 on Reader Service Card

STA-RITE INDUSTRIES has announced the availability of its new SR2700 control. The device automates filter backwashing as well as numerous auxiliary functions. It can be set to backwash a filter at a particular time on a given date, or when the pressure increases by a prescribed amount. The unit also can be programmed to control lights, water level, system flow, temperature and chemical levels. **Sta-Rite Industries**, Delavan, WI.

Repair Compound Dispenser

Circle 117 on Reader Service Card

AQUABOND introduces the CR2000 hand-held dispensing and mixing system for its two-component concrete-repair compound. The compound is dispensed around a lubed bolt and is then allowed to dry. The bolt is then unscrewed, creating a custom thread – perfect for anchoring ladders and handrails. Designed for pool and spa applications, the compound is unaffected by chlorinated water. **Aquabond**, Orange, CA.

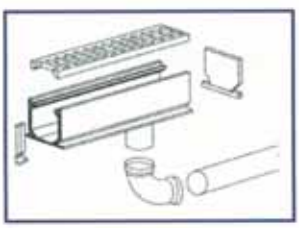
Water-Level Manager

Circle 118 on Reader Service Card

SYSTEM DYNAMICS offers the Levolor electronic water-level manager. The device maintains water levels in pools, ponds, spas and fountains – any application in which a constant water level is needed to maintain appearance and/or protect equipment. Easy to install for new or existing vessels, the unit has no moving parts and operates reliably and automatically. It even compensates for wave action. **System Dynamics**, Scottsdale, AZ.

Heavy-Duty Deck Drains

Circle 119 on Reader Service Card



NDS offers a range of Profile deck-drainage systems, including the Micro, Mini, Dura and Spee-D channel drains. Each features a patented flying-buttress design that provides load-bearing support from the sides as well as the bottom. Each also features unique bottom flanges for easy anchoring and straight installation. Grates are available in six colors and (for the Mini line) in brass. **NDS**, Lindsay, CA.

Lannon Stone Resource

Circle 120 on Reader Service Card

HALQUIST STONE offers a brochure highlighting applications of Lannon Stone as everything from decking to building veneers in a variety of natural and fabricated finishes. Projects include uses as outcropping stones, wall- and flagstone, steps and coping. The material can have a thermal finish, can be tumbled or bushhammered or can be installed with a natural appearance. **Halquist Stone**, Sussex, WI.

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Product Information Card

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STAIN-RESISTANT CONCRETE COATING

Circle 121 on Reader Service Card

L.M. SCOFIELD CO. announces the availability of Repello, a stain-resistant coating for concrete that provides an invisible barrier to water, food, oil, chemicals and the effects of pollution and acid rain. It provides an easy-to-clean surface that reduces maintenance, improves durability and retains the appearance of colored or uncolored porous concrete – indoors or out. **L.M. Scofield**, Douglasville, GA.

WATER-QUALITY MONITOR

Circle 122 on Reader Service Card

APPRISE TECHNOLOGIES offers the R.U.S.S. Dynamic Profiler, a system that captures water-quality data with a single multi-sensor package extending from the surface to the bottom of a body of water. Designed for use in lakes, ponds and other bodies of fresh or salt water, the sensor packages can test to 100 m for pH, temperature, turbidity, conductivity, dissolved oxygen, chlorophyll and more. **Apprise Technologies**, Duluth, MN.

RETAINING WALL SYSTEMS

Circle 123 on Reader Service Card

BOULDERSCAPE fabricates rockwork for a range of applications, from huge freeway retaining walls to watershapes. Waterfalls, slides, beach entries, swim-in caves, grottos and zoological settings are all sculpted to blend in flawlessly with their surroundings. Each installation is fashioned after natural formations with an eye to exceptional detail. **Boulderscape**, Capistrano Beach, CA.

POOL HEATERS IN SIX MODELS

Circle 124 on Reader Service Card

FOCUS TEMP INTERNATIONAL manufactures a line of heat-exchange pool heaters. Designed for innovation, beauty and durability, the heat pumps come in six models ranging from 55,000 Btu/hr to 145,000 Btu/hr. All operate at a flow rate of 30 gpm with standard 1-1/2-in. plumbing and feature air flows ranging from 1,200 cfm to 2,800 cfm. The sturdy ABS cabinet is treated to resist UV rays, and the compressor is acoustically shielded. **Focus Temp International**, St. Hyacinthe, Quebec, Canada.

Fountains and Aerating Systems

Circle 125 on Reader Service Card

VERTEX WATER FEATURES manufactures custom floating fountains and lake aeration systems. Units range in size up to 60 hp but can be customized to the specific needs of any lake or pond. Designed for performance, quality and dependability, the fountains come in nine basic configurations, while the bottom-aeration systems aid overall circulation and eliminate thermal stratification. **Vertex Water Features**, Deerfield Beach, FL.

Brochure on Upscale Pool Finishes

Circle 126 on Reader Service Card

AQUAVATIONS has published a full-color brochure highlighting its Hydrazzo and SunStone pool finishes. Hydrazzo, a polished-marble finish available in eight basic colors, offers the toughness of stone with the unmatched smoothness and virtual impermeability that come with the polishing process. SunStone and SunStone Select are both exposed-aggregate finishes that combine beauty with durability in a wide range of colors. **Aquavations**, Coral Gables, FL.

Details on Pumps and Fountains

Circle 127 on Reader Service Card

OASE PUMPS has published a brochure on its history and capabilities in the design and manufacturing of pumps, fountain systems and a wide variety of custom water effects. Highlighted are services ranging from project planning, budgeting and development to fabrication of custom components, fountain design and engineering, construction supervision and provision of maintenance and operations manuals. **Oase Pumps**, Irvine, CA.

Custom Rockwork Services

Circle 128 on Reader Service Card

CEMROCK has been designing and installing naturalistic rockwork environments for zoos, parks and themed resorts since 1978, specializing in aquatic enhancements for residences as well as commercial buildings that are virtually indistinguishable from the real thing. The company offers a pamphlet highlighting its services, which start with consulting and fabrication and include construction, engineering and cost control. **CemRock**, Tucson, AZ.

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for the distribution of gas. Various threaded fittings were readily available to mate with the standard threads on each end of these pipes. Experiments also moved forward with other internal insulating coatings, including thin wooden strips bent to form a tube.

The required strength had finally been achieved. But as all of this development work was going on, there was a group asking themselves if the insulating jacket on the inside of the iron pipe was really necessary.

The fact that paper, wood or some other material had to be inserted into the pipe added significantly to the cost of the finished product. The insulation on the wires themselves was improving rapidly; rubber insulation had been improved and its cost was dropping. So why not try well-insulated wire in the plain iron pipe?

As it turned out, it worked just fine.

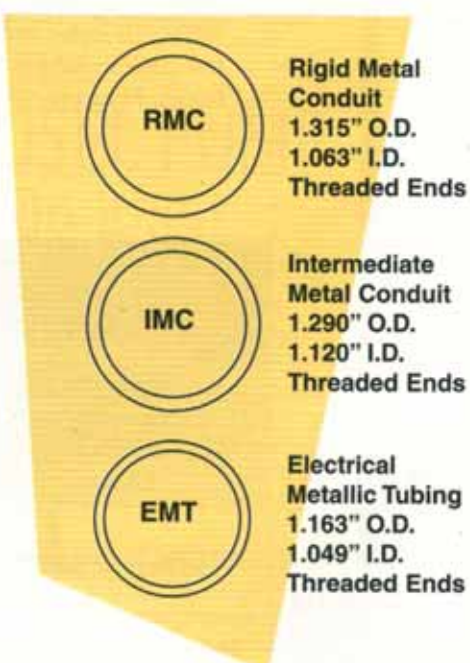
Conduit Basics

At that point, there were only two minor hurdles to overcome: manufacturing methods had to be devised to ensure that the inside of the pipe was relatively smooth so that the wire's insulation would not be damaged as it was pulled into the pipe; also, suitable coatings had to be developed to ensure that the iron pipe would not rust.

The latter problem was solved by *galvanizing* – that is, the application of a coating of zinc to the iron pipe. By the turn of the century, this non-insulated, galvanized iron pipe was the conduit of choice and in fact has survived to the present day virtually unchanged. (We refer to it now as *rigid metal conduit.*)

During the past hundred years, the number of conduit types has grown considerably. The *National Electrical Code*, the source of the vast majority of regulations governing almost all things electric in our country, currently lists more than a dozen types of conduit as acceptable wiring methods.

Not all of these conduit types are of



The most successful of the earliest conduit designs was one fabricated of spirally wound paper, much like the tube in a roll of today's toilet tissue.

immediate interest to readers of this magazine. In fact, Article 680 of the *NEC*, entitled *Swimming Pools, Fountains, and Similar Installations,* references just six types of conduit for specific applications in watershapes. The following paragraphs provide a description of each of these.

❑ *Rigid Metal Conduit (RMC), Intermediate Metal Conduit (IMC), Electrical Metallic Tubing (EMT):* These three can be grouped together because they all are constructed of galvanized steel pipe. They differ in two major areas – the dimensions of the product (both inside and outside diameters) and whether the ends are threaded. The thicknesses of the conduit walls vary as shown in the diagrams. The dimensions apply to a one-inch size in each case.

Each of these three conduits can be bent in the field. EMT, commonly referred to as "thinwall," is the easiest to work with. It can be bent by hand using a tubing bender designed for the purpose. The smaller sizes of IMC also can be bent by hand, but only with considerable effort.

To that purpose, there are large mechanical and hydraulic machines available for bending IMC and RMC, and pre-formed bends also are available for those not wishing to get into bending these conduits in the field. Complete lines of connectors and fittings are also readily available.

❑ *Rigid Nonmetallic Conduit (RNMC):* This is a PVC product, available in Schedule 40 and Schedule 80 wall thicknesses. It looks very much like PVC water pipe, but has markings along its length indicating its use in electrical constructions. (Be aware that this is *not* the same product as PVC water pipe, and the two should never be interchanged.)

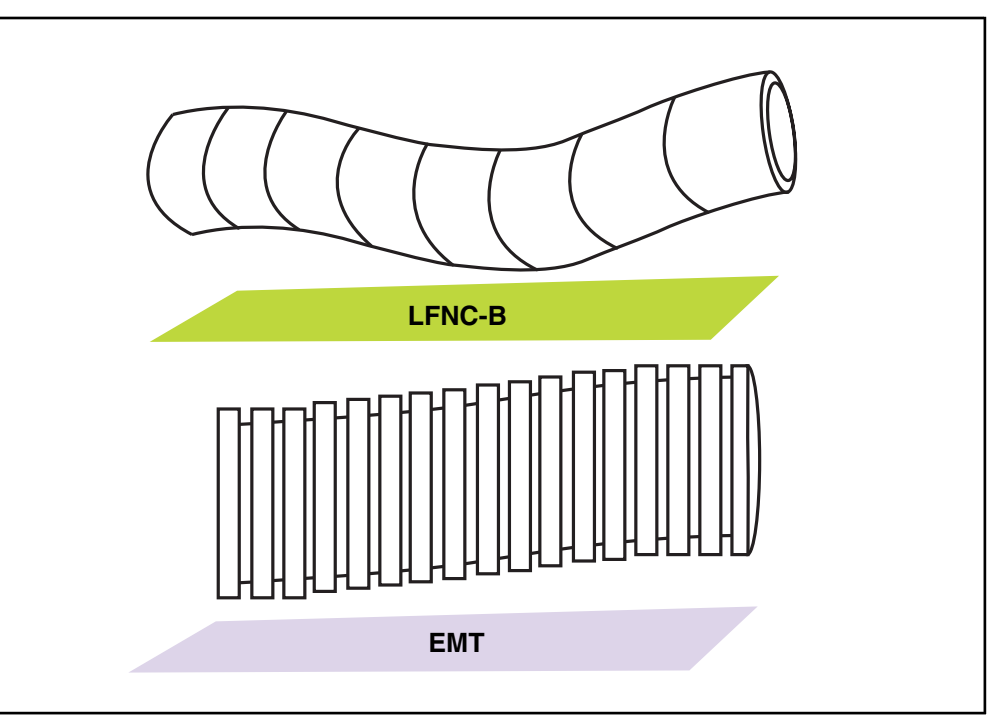
RNMC can be bent in the field in an oven designed especially for the purpose, but bends, connectors and fittings are readily available. RNMC and its associated components are connected together by solvent welding with a primer and solvent cement – similar to the method used to connect PVC water pipes.

❑ *Electrical Nonmetallic Tubing (ENT):* The corrugated design of this molded copolymer conduit makes it quite flexible. Snap-on fittings are the generally accepted method of installation, although some specially marked products will accept solvent-welded fittings. It is not permitted for outdoor use, but it may be imbedded in poured concrete.

❑ *Liquid-tight Flexible Nonmetallic Conduit:* This versatile product is available in three configurations:

- When made with an inner layer and a separate outer layer bonded together with a reinforcing webbing between the layers, it is designated as LFNC-A.
- When it is made with a single-thickness wall with the integral reinforcement molded within the wall, it is designated as LFNC-B.
- When the conduit wall is corrugated inside and out and contains no reinforcement within the wall, it is designated as LFNC-C.

Type "B" is the most common and versatile. Special fittings and connectors are available for field assembly.



On-Site Applications

In Article 680 of the NEC, whenever the requirement is for RMC the text will also state that IMC is acceptable – and these two heavyweights are indeed interchangeable.

In most cases, RNMC and LFNC are also listed as acceptable alternates, but the usage of ENT and EMT is fairly limited. When the electric current for the watershape is coming from a building, either ENT or EMT may be used to protect the conductors on the *inside* of that building. If the conduit is attached to the *outside* of the building, however, only EMT is permitted. When the conductors leave the building, they must continue inside of one of the other types of conduit.

Please note that local communities may choose to adopt regulations differing from those contained in the *NEC*. Always check with the local authority having jurisdiction when in doubt.

A Layered Approach

By Jim McNicol

A little more than 100 years ago, in the first big growth spurt in the use of electricity, the harsh realities of the hazards involved with it quickly became apparent. Fires were common occurrences everywhere electricity was distributed, and serious (and often fatal) accidents made daily headlines wherever people came into contact with this wondrous phenomenon.

Virtually all of the electric works being built in those early days were set up to provide lighting for a population tired of living in the gloom of candles, gas lamps and coal-oil lanterns. That meant that electricity for illumination was being taken to homes, factories and office buildings – virtually everywhere – at the same time.

The rush was on: In their haste to serve everyone at once (and make gobs of money in the process), many entrepreneurs entered the field. The fact that very few of these individuals had anything more than a minimal understanding of electricity, combined with the lack of components and materials specifically designed for the application, might have caused the quick demise of a less desired product.

Wires At Work

The major technological problem facing early providers of electricity was the poor quality of the wiring installed to convey electric current to the end user. More specifically, it was the poor quality of the *insulation* on the wire. In some instances, the wires had *no* insulation: Bare conductors were simply fastened to wooden cleats with iron staples, creating a huge shock hazard.

The best insulator of the day was rubber, but it was difficult to apply and therefore very expensive. So most of the wire used was insulated by a covering of braided cotton fibers impregnated with some form of wax.

It quickly became obvious that the answer lay in providing an additional layer of protection around the insulated wires. It was time for *conduit* to enter the picture.

The most successful of the earliest conduit designs was one fabricated of spirally wound paper, much like the tube in a roll of today's toilet tissue. These tubes were made in ten-foot lengths in various diameters up to one inch. They were impregnated with a waterproofing compound, and brass sleeves were available to couple the lengths together.

Although it was quite popular when introduced, this paper conduit was not particularly easy to use. It was fragile and easily damaged during normal handling and installation. Wrapping a thin sheet of brass around the outside of the paper conduit during the manufacturing process improved the product somewhat, but careless installers could still crush the conduit quite easily, making it difficult to pull any wires through it.

The need for greater strength led to the next configuration – that is, placing the paper conduit inside a length of the wrought-iron pipe then in common use

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- The AquaLink RS OneTouch is the only pool and spa control in the industry with 2.4 GHz RF wireless technology.

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