landscape architecture

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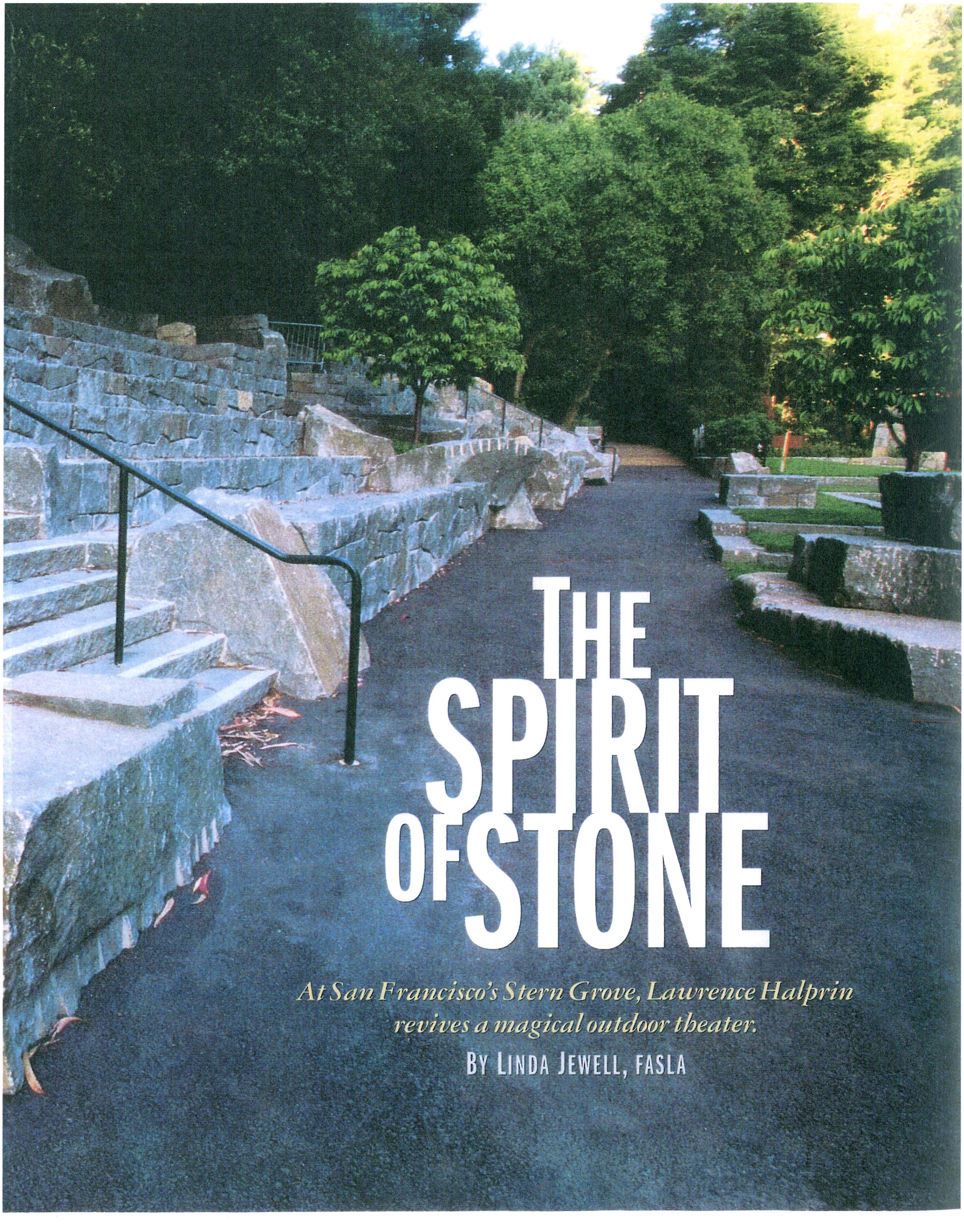
PEG SKORPINSKI



THE SPIRIT OF STONE

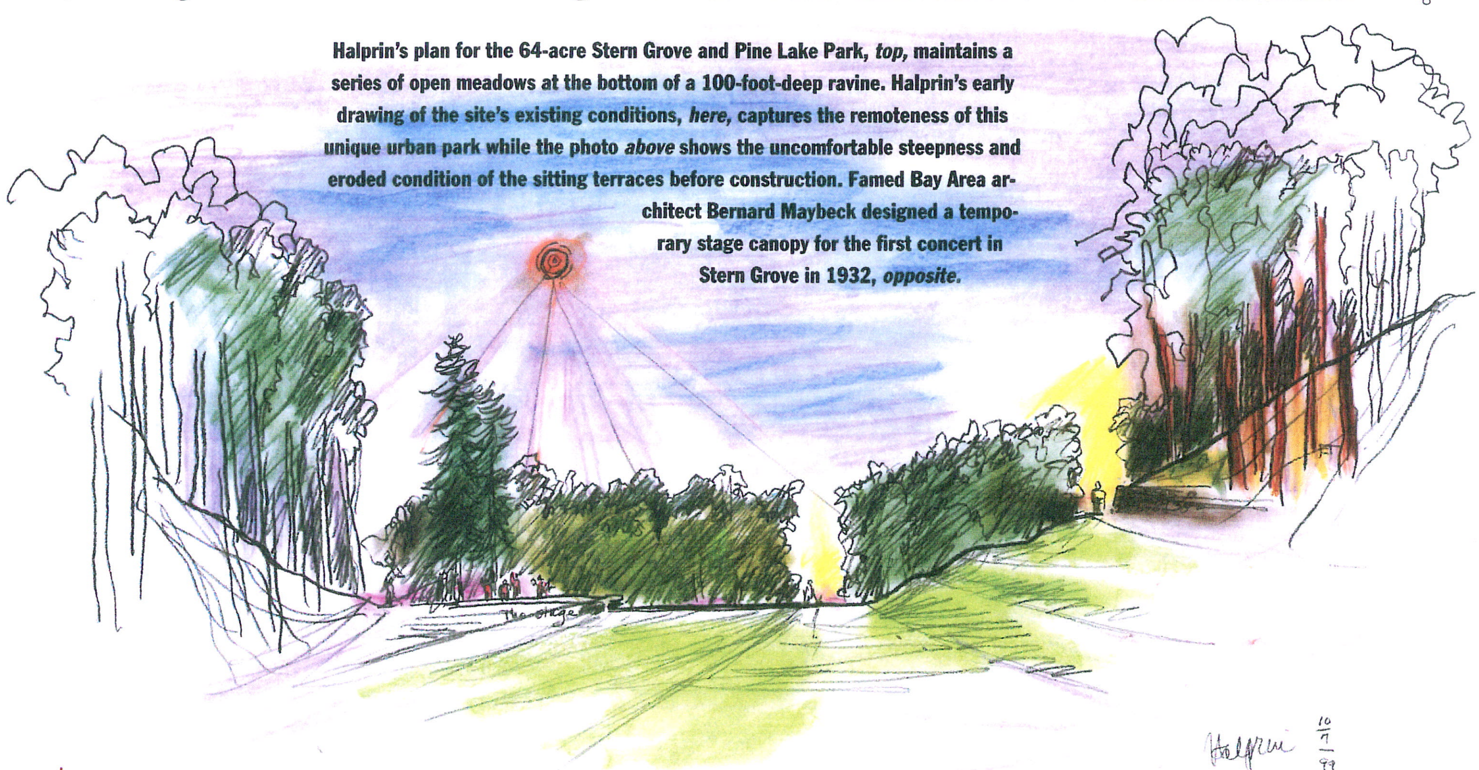
At San Francisco's Stern Grove, Lawrence Halprin revives a magical outdoor theater.

BY LINDA JEWELL, FASLA

"TO CREATE A MYSTICAL PLACE where one would be inspired to reach into oneself" was the intent of Lawrence Halprin, FASLA, in his design for San Francisco's Stern Grove Rhoda Goldman Concert Meadow. Calling upon a reiterative and collaborative design process, Halprin has woven a magical landscape experience into the everyday lives of thousands, and he has done so within the constraints of contemporary codes and the strenuous public review of a city-owned landscape. This new outdoor theater was constructed through a $15 million gift to the city of San Francisco and opened in June 2005 in San Francisco's Sunset District.

Halprin achieved his goal by artfully inserting a stage, grand stone bleachers, grass terraces, stone ziggurats, and 175 granite boulders into a half-mile-long

COURTESY OFFICE OF LAWRENCE HALPRIN. THIS PAGE



Halprin's plan for the 64-acre Stern Grove and Pine Lake Park, *top,* maintains a series of open meadows at the bottom of a 100-foot-deep ravine. Halprin's early drawing of the site's existing conditions, *here,* captures the remoteness of this unique urban park while the photo *above* shows the uncomfortable steepness and eroded condition of the sitting terraces before construction. Famed Bay Area architect Bernard Maybeck designed a temporary stage canopy for the first concert in Stern Grove in 1932, *opposite.*

ravine that has been a city park for more than 70 years. Halprin recalls his first visit to the grove in the 1950s when he came to watch his wife, Anna, dance. "Even then, it was kind of a mess, with a terrible setup for the backstage. And the people sitting on the slope would slide down to the bottom." Nearly 50 years later, Halprin attended a concert at the invitation of Doug Goldman, president of the Stern Grove Festival Association (SGFA) and great grandson of Rosalie Stern, who turned the property into a public park. While discussing the theater's condition with Doug's father, Richard Goldman, Halprin sketched a concept for a possible theater scheme on a cardboard lunch box. The three men left the concert agreeing that the SGFA must address Stern Grove's deteriorating conditions if it was to continue to serve large audiences and preserve the natural setting.

In 2001, SGFA retained Halprin's firm to determine a conceptual direction for the theater. Concept in hand, Doug Goldman approached the city with a proposal that the SGFA raise funds for a new theater. The Recreation and Park Department was intrigued but had already identified the entire park landscape—the 31-acre Stern Grove and the adjacent 33-acre Pine Lake Park—as a site in need of a landscape improvement plan. With a donation from the SGFA, Halprin began a plan for the entire 64 acres that included a design for a new theater space, to be named the Rhoda Goldman Concert Meadow after Rosalie Stern's granddaughter.

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Judi Mosqueda, a landscape architect with San Francisco's Department of Public Works, began working with Halprin and the SGFA on a series of public workshops. A vociferous group of neighbors and advocates for off-leash dogs attended the early workshops with objections to any changes to the park. After assurances that off-leash dogs could occupy designated areas and that the concert space would remain the same size and unfenced, the tone changed, and neighbors provided positive input on how the park could serve both the large concert venues and the neighborhood. The improvement plan, published in 2003, identified six phases of needed improvements totaling nearly $37 million. The SGFA immediately began raising $15 million for the concert meadow and attendant areas and established an ambitious schedule. With design work starting in the winter of 2004, the goal was to complete design, construction drawings, city review, and construction of the new theater in time for a June 2005 concert. Fortunately, the project's private funding allowed the SGFA to negotiate with contractors and avoid the lengthy process of competitive bidding normally required on public projects.

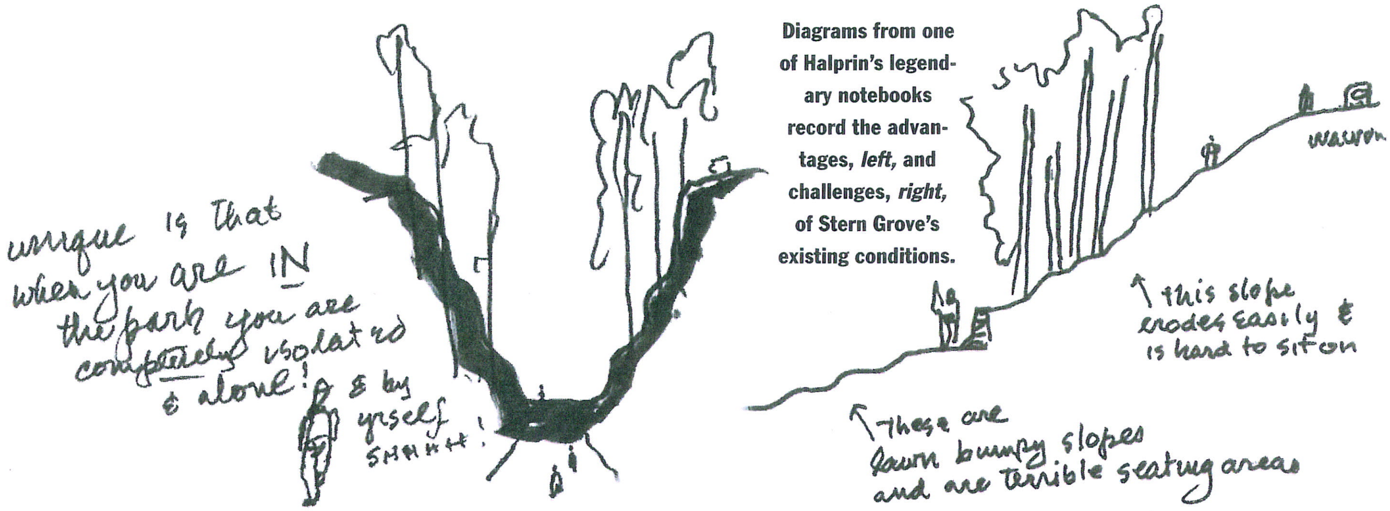
Halprin immediately set into motion a version of his RSVP Cycle, a repetitive, nonsequential cycle of four design steps: Resources—examining what you have to work with, including

Stern Grove's Early Years

ONCE SURROUNDED by coastal dunes, the park floor of Stern Grove contains one of San Francisco's three natural ponds and a series of meadows that lie as much as 100 feet below the surrounding residential streets. San Franciscans have used this site for recreational entertainment since the 1890s when Alvin Green, a colorful entrepreneur, transformed the treeless landscape into a "suburban resort." Green built a deer park, a boating pavilion, a trout farm, a beer garden, and an inn along the valley and planted hundreds of eucalyptus on the side slopes. Today these plantings provide protection from the city's wind and fog, creating temperatures warmer in the park than in the neighborhoods above. Green's resort declined in popularity after 1910, but sporadic public use continued until 1931 when Rosalie Stern purchased the eastern portion of the property, known as The Grove, for a public park in memory of her husband, Sigmund Stern. Rosalie Stern, a supporter of the playground and recreation movement, began a decades-long commitment to expanding the park property to provide both recreation and free concerts for the citizens of San Francisco.

Rosalie Stern admired the serenity of The Grove because its topographic remoteness allowed visitors to escape the turmoil of urban life by descending into a wooded glen where the activities of the streets above virtually disappear. Consequently, she directed the park designers, including noted architect Bernard Maybeck, to develop the park with as few structural changes as possible. They complied by proposing little more than subtle paths and low granite walls built by the Works Progress Administration. Finding the site's natural acoustics to be excellent, Stern began planning the first concert for June 19, 1932. The improvements were simple: Maybeck designed a temporary fabric canopy for a raised stage at the base of the southern slope, and portable chairs were aligned along the length of the meadow.

In 1938, Stern formed the Stern Grove Festival Association (SGFA) to raise funds for free summer concerts. She led the SGFA until her death in 1956, when its leadership passed to her daughter, then to her granddaughter, and eventually to her great grandson. The SGFA continued to raise funds sufficient to support free, Sunday-afternoon summer performances that have included such nationally renowned artists as Isaac Stern, Arthur Fiedler, and Carlos Santana as well as the San Francisco Symphony, Opera, and Ballet. By the 1990s, some Stern Grove events were attracting more than 10,000 people, but the park had had few improvements since the 1950s, when the city built a modest backstage area and a steep earthen slope for sitting. Consequently, preparation for concerts was difficult and expensive. Hundreds of portable seats needed placement, exit aisles had to be roped off, and temporary barrier-free access had to be set in place. The rudimentary stage required time-consuming readjustment of each performer's equipment and the cumbersome installation of a canopy to protect the musicians' instruments from the sun. The limited number of seats meant that thousands of spectators sought precarious perches on the steep slopes, causing soil erosion and damage to the trees.

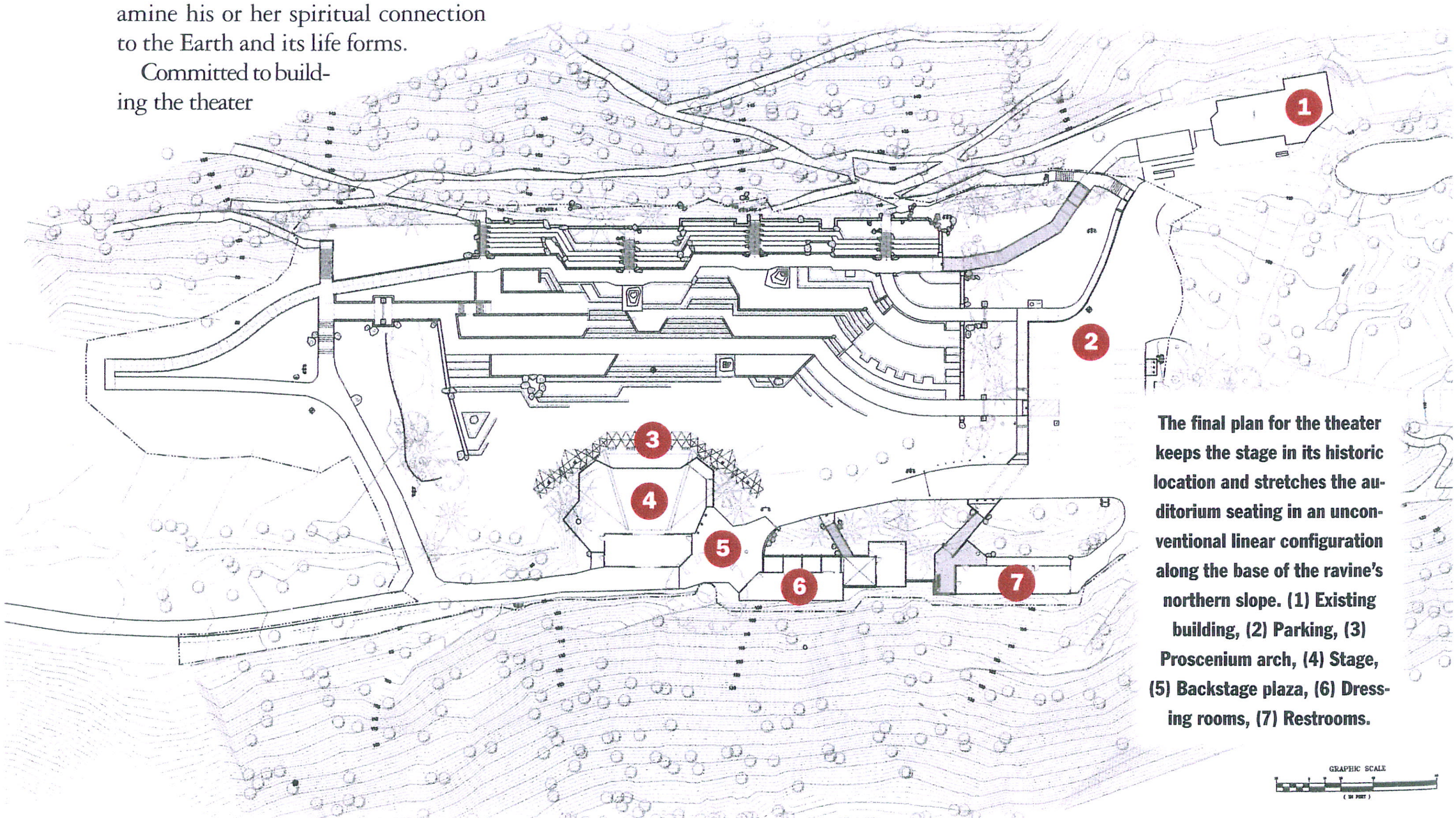


Diagrams from one of Halprin's legendary notebooks record the advantages, *left,* and challenges, *right,* of Stern Grove's existing conditions.

both human and material resources; Scoring—describing and making a design process visible to all participants; Valuaction—analyzing and acting; and Performance—the result of the design score. This cycle is described further in *RSVP Cycles: Creative Processes in the Human Environment,* Halprin's 1969 book. Although the specifics of the RSVP Cycle can seem brilliantly understandable one minute and obscure the next, the underlying message is quite clear: Design should be a collaborative, open-ended, and reiterative process that pursues an idea rather than a predetermined form. At Stern Grove, the idea, prompted by Halprin's memories of walking through ancient Greek theaters, was for visitors to inhabit a sculpture of stone such that stone's primordial, timeless character would inspire each person to examine his or her spiritual connection to the Earth and its life forms.

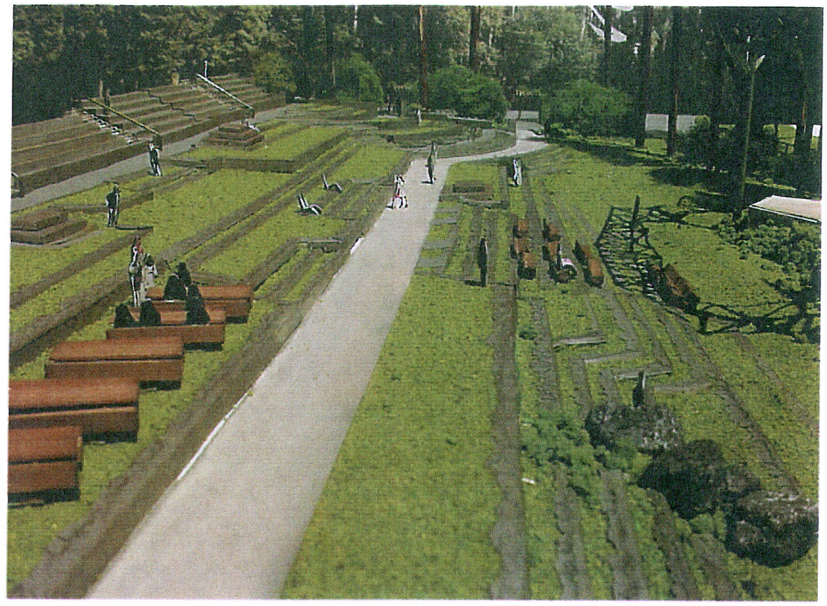
Committed to building the theater in stone, Halprin's office began studying models of prototypical rows of 3-foot-deep stone seats interspersed with rugged boulders. These boulders, although sculptural, also functioned as unobtrusive points to incrementally step the bleacher rows down the valley's natural 2.5 percent longitudinal slope. Smaller boulders also provided an ingenious solution for a safe and graceful transition from the 18-inch-high seats to the three adjacent risers of the access stairs. But creating artistic arrangements of the boulders while solving these pragmatic problems would require that the boulders be precisely selected, arranged, and installed. Additionally, the scheme included several sculptural stone ziggurats that reference the mystical qualities of the stone monuments of prehistoric cultures.

COURTESY OFFICE OF LAWRENCE HALPRIN



The final plan for the theater keeps the stage in its historic location and stretches the auditorium seating in an unconventional linear configuration along the base of the ravine's northern slope. (1) Existing building, (2) Parking, (3) Proscenium arch, (4) Stage, (5) Backstage plaza, (6) Dressing rooms, (7) Restrooms.

Halprin showed the study model to Edward Westbrook of QuarryHouse, a San Anselmo, California, stone masonry contractor, and asked him to find a stone that matched the park's historic walls to use in both the seat walls and the boulders. Westbrook, who has a 25-year history of working with Halprin, might be described as a "stone entrepreneur" who routinely hunts for the right stone in old fields, quarries, and abandoned structures—rather than relying only on suppliers for stone. He then determines a construction system that meets applicable codes and oversees the stone's fabrication and installation. Unfortunately there was no reliable North American stone source that could provide the quantity, color, and character that the Stern project needed. But on a trip to Shandong Province in China, Westbrook spotted a granite quarry and brought back photos, samples, and approximate costs for Halprin, who immediately approved the selection.



Above,* Halprin's office generated numerous study models as it investigated how to maximize the number and type of seats while maintaining an open feel to the meadow. Halprin visited the site several times each week to work with the masons on stone placement, *below.

Halprin investigated numerous seating layouts as the scheme evolved. Rather than remold the landscape into the semicircle of the classical theaters or the fan shape of a contemporary one, he pursued an unusual linear configuration. The scheme retains the stage in its historic location at the foot of the south slope, preserves the vegetation on all four edges of the concert meadow, and stretches a 400-foot-long bank of bleacher seating along the base of the ravine's northern hillside. The new backstage building, dressing rooms, greenroom, and restrooms are tucked into the southern hillside, mostly hidden behind vegetation. A metal structure, with the branching forms of a tree, frames the stage while supporting lighting, sound equipment, and a removable sailcloth canopy. In front of the densely packed bank of 6,000 bleacher seats, curbed grass terraces gradually transition into the meadow. By confining the stepped seating and staircases—and their attendant ADA-compliant handrails—to the steep bleachers, the scheme avoids obtrusive structures jutting into the meadow.

As the design evolved in response to reviews by the clients and code officials, a constant exchange of information between Halprin's office and QuarryHouse provided budgetary and technical input for design decisions. Using only a rough schematic, QuarryHouse had the quarry cut the stone for a full-scale mock-up of a typical bleacher section and shipped the dismantled pieces to California for reassembly. After substantial field modifications of the mock-up, revised costs determined the linear feet of stone seating that could be built. Meanwhile, Halprin's staff produced clay models of the large stone ziggurats and drawings of prototypical boulders to provide images for quarry workers to tag, number, and photograph 300 boulders similar to these drawings. With numbered images of the tagged stones, Halprin's staff selected 175 boulders and located each by number on the construction drawings. Once the basic bleacher dimensions were established, the quarry began fabrication and shipped 80 percent of the stone even before the construction drawings were complete, enabling construction to begin in September 2004.

Halprin's flexible, open-ended process tapped the creative energies of all participants to strengthen his vision. Everyone involved—benefactor, client, staff members, city officials, contractor, and masons—felt that he or she had made a creative contribution to a fantastic project. Halprin and his staff were good listeners and included everyone's expertise as a resource to be recycled and re-scored with

COURTESY OFFICE OF LAWRENCE HALPRIN, BOTH drawings, models, and dialogue, allowing the new information to give shape to the vision. But Halprin never responded to a request with simple compliance; he found a way to incorporate each comment into the vision that he passionately defended, using his fantastic sketches and poetic words to convince all interested parties to be flexible in their thinking.

But design decisions were by no means finished when the final construction drawings left Halprin's office in September and the general contractor began moving earth. The stair treads and other repetitive pieces were cut in China, but the final cuts and decisions on the boulder placement and ziggurat construction and the precise joint patterns of the walls were made on site. Throughout the nine months of construction, both Halprin and his project landscape architect, Andrew Sullivan, visited the site several times a week to fine-tune the stonework with QuarryHouse's project manager, David Elkington, and field superintendent Jason Joplin. Halprin critiqued the construction of the walls and bleachers, insisting that joints follow a discontinuous zigzag across the seat wall's elevations and that the variably sized stones maintain a crisp horizontal line along the top. But it was the installation of the sculptural ziggurats and boulders that demanded the most diligent on-site critiques. After the designer and builder had worked together for many days on the final placement of the two- to nine-ton boulders, their roles became blurred, as Joplin, a sculptor as well as a mason, developed a bond with Halprin and Sullivan in their common

The curved terraces at the eastern end depart from the linear gesture of the bleachers to provide a direct view of the stage, *left*. Even when filled with a concert's traditional lawn chairs and picnic tables, *below*, the space keeps its sense of seclusion and long views through the linear meadow intact.

PEG SKORPINSKI, BOTH

At last June's inaugural concert, an estimated 13,000 people covered the meadow, bleachers, and adjacent park lawns while surrounded by vegetation and earthen slopes.

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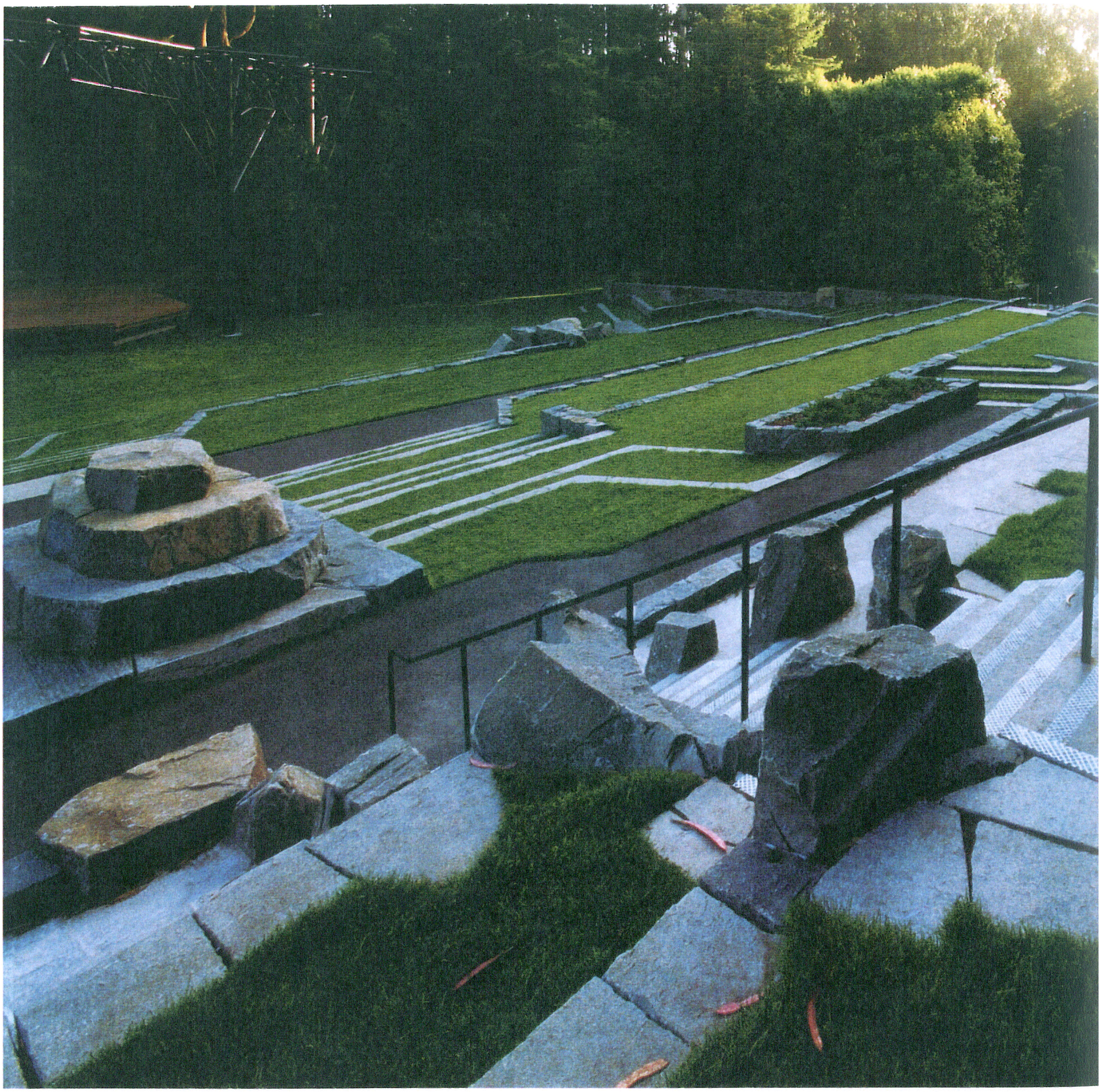
search for poetic stone compositions. Throughout one of San Francisco's rainiest winters, they, along with 30 masons, worked in the mud and rain to complete the stonework by May so that the entire site could be ready for a concert on June 19, 2005.

The preopening reviews of the theater were glowing, and an estimated 13,000 people attended the inaugural concert, covering the bleachers, ziggurats, boulders, terraces, concert meadow, and even distant lawns.

The performance meadow works equally well during the 355 nonconcert days. The dog walking and jogging have returned, but now families and construction workers eat lunches on the sunny stone seats, children climb the ziggurats, and lovers snuggle between boulders. The space is even bringing the city new revenue from rentals for weddings and corporate gatherings. Although everyone is happy with how the theater functions, the greatest praise has been for the evocative space, particularly for the views looking toward the horizontal sweep of stone seats. This exuberant display of stone bleachers, boulders, and ziggurats is an unexpectedly monumental gesture to discover in a quiet public park. Yet the prevailing ambience is one of a sensual, womblike embrace by the mature vegetation and green lawns. One performer described the descent to the stage as a fantastic trip into Middle Earth, where surrounded by stone, soil, and vegetation, one is compelled to gaze upward at the soaring tree trunks and at the sky above.

THROUGHOUT HISTORY, outdoor theaters have been inherently remarkable landscapes. Not only do they mark the land with a durable record of grand public gatherings, but they also place visitors in a uniquely intimate relationship with the earth and sky, focusing their attention on the landscape. In preparation for a book on American outdoor theaters, I found hundreds of theaters built before 1950 where this intimate relationship with the landscape inspires reflection, but I have seen very few post-1940s American theaters that prompt visitors to even notice the landscape. It is easy to attribute the difference to the demands of contemporary codes and public review, but Stern Grove is a public landscape in a city known for rigorous review. So what methods did Halprin use to create a theater that elicits such positive and passionate reactions from a diverse and demanding community?

First, he began his design by looking to the great Greek theaters as models for what a theater can "do and be" rather than replicating their geometry. He sought to capture the sensation of being inside the classical theaters—surrounded by ancient stones that are anchored in the earth while also reaching toward the sky. The stone used for the seats references the timelessness



of its precedents, thereby memorializing Stern Grove's 70 years of concerts. Today many designers choose stone to convey timelessness, but the results are often awkward boulders lying on turf or oddly detailed veneer walls. Here, as in the classical theaters, the careful selection and placement of each stone tells the visitor that human hands and minds have considered color, shape, and texture in the search for each stone's proper place in the landscape. The connection of these aeons-old objects with human decisions about where they are to rest imparts a mystical quality to this place that connects it with the spiritual aspirations of the ancient theater builders.

Second, the design is a bold, deliberate intervention that responds to the particulars of this landscape. The introduction of 2,000 tons of imported stone into a coastal ravine is an unapologetic move that cannot be overlooked. Like Stonehenge, Avebury, the Great Pyramids, or the Greek theaters, the Stern Theater calls attention to the existing landscape through contrast rather than mimicry or integration. Yet, its form was shaped by

Curbed lawn terraces, *here,* accommodate various types of flexible seating and provide a gradual descent onto the meadow floor. Throughout the site, irregular stonework contrasts with precise linear edges. Halprin, *inset,* looks over the meadow from one of the many human-scaled perches among the stones.

PEG SKORPINSKI

the natural patterns of the site; almost no vegetation was removed, the drainage pattern was maintained, and the theater adjusted its shape to the valley rather than contort the valley to it. By taking cues from the site, this scheme sets itself apart from many of Halprin's urban projects where their imagery is based on nature's rugged power. Here, the trees, meadow, and green terraces more clearly focus on the sensual, life-giving qualities of nature.

Third, the scheme's abstracted spatial vocabulary had the flexibility to adjust to a range of conditions. Some critics might dismiss Stern Grove as a Modernist piece, and it is true that its formal composition relies on the abstractions of natural patterns typical of Halprin's 60 years of work. But because Halprin's approach is based on a flexible process rather than graphic pattern, each new situation redefines his formal organizational system. Like Freeway Park, Ira's Fountain, and the FDR Memorial, here Halprin bases the scheme's geometry on a rectilinear system that allows unexpected deviations. The masonry pattern on Stern Grove's walls offers a graphic explanation of his organization of the entire site. The parallel lines of the flat tops of the seats establish a rectilinearity, but the zigzagging joints provide a deliberate, although seemingly random, departure from this system. Likewise, Stern Grove's plan establishes its datum with long parallel lines of seats, but protruding terraces, assemblages of boulders, angled walls, and scattered trees periodically interrupt the regularity of the rows, creating delightful spots to sit, look, and think.

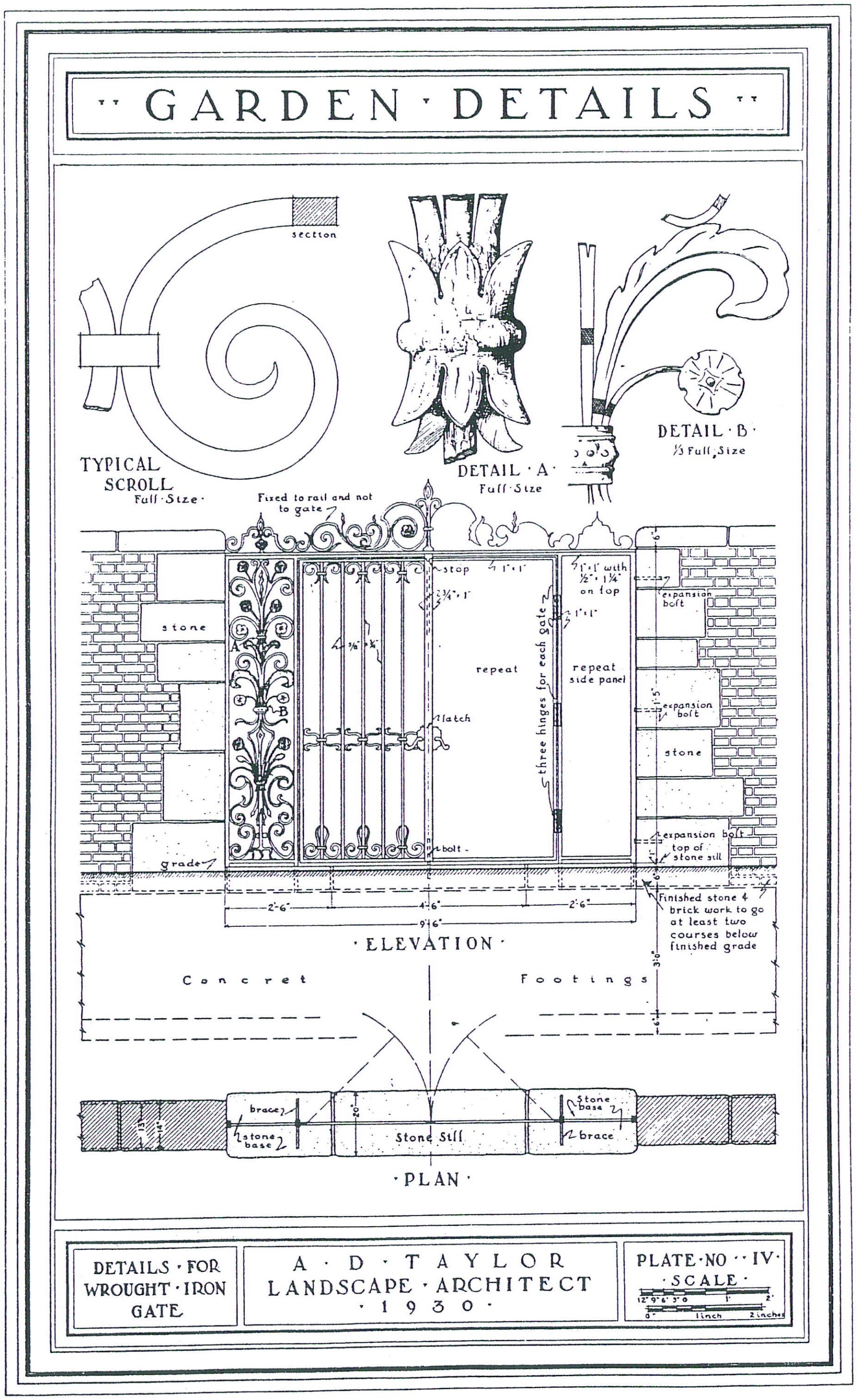
But the key to Stern Grove's success goes beyond Halprin's physical design decisions on the seats, terraces, and stones that create a functioning theater. It also lies in the reiterative and open-ended process that included builders, bureaucrats, and benefactors in the evolution of a new theater. The interests of these parties varied, yet each one became an enthusiastic ally and advocate for Halprin's vision. In Halprin's words, "it was a happy project," and that happiness has created a magical landscape.

Linda Jewell, FASLA, is a professor of landscape architecture and environmental planning at UC Berkeley and a consulting design partner at Freeman & Jewell, Berkeley, California, and Reynolds and Jewell, Raleigh, North Carolina.

PROJECT CREDITS **Client:** Stern Grove Festival Association (Corrina Marshal, executive director; Peter Palermo, project manager); San Francisco Recreation and Park Department (Elizabeth Goldstein, general manager; Judi Mosqueda, project manager). **Master planner and designer:** Office of Lawrence Halprin (Lawrence Halprin, FASLA, overall design; Paul Scardina, FASLA, principal in charge; Andrew Sullivan, project manager). **Architect of record:** Hamilton + Aitken Architects (Chad Hamilton). **Associate architect:** Edmund Burger Architects (Ed Burger). **ADA consultants:** Moore, Iacofano, Goltzman, Inc. **Stage cover consultant:** Pineapple Sails (Kame Richards). **Theater/acoustical consultant:** Auerbach Pollack Friedlander. **Structural engineer:** GFDR Engineers. **Geotechnical engineers:** Miller Pacific Engineering Group. **Lighting consultant:** Patrick B. Quigley & Associates. **Consulting arborist:** James MacNair & Associates. **MEP consultants:** MHC Mechanical Engineers; C&N Engineers (electrical). **Civil engineers:** Nolte & Associates, Inc. **Cost consultant:** Davis Langdon. **Construction manager:** Conversion Management Associates, Inc. **General contractor:** Vance Brown Builders. **Stone masons:** QuarryHouse, Inc. (Edward Westbrook, CEO; David Elkington, project manager; Jason Joplin, field superintendent).

CONSTRUCTION

By Linda Jewell



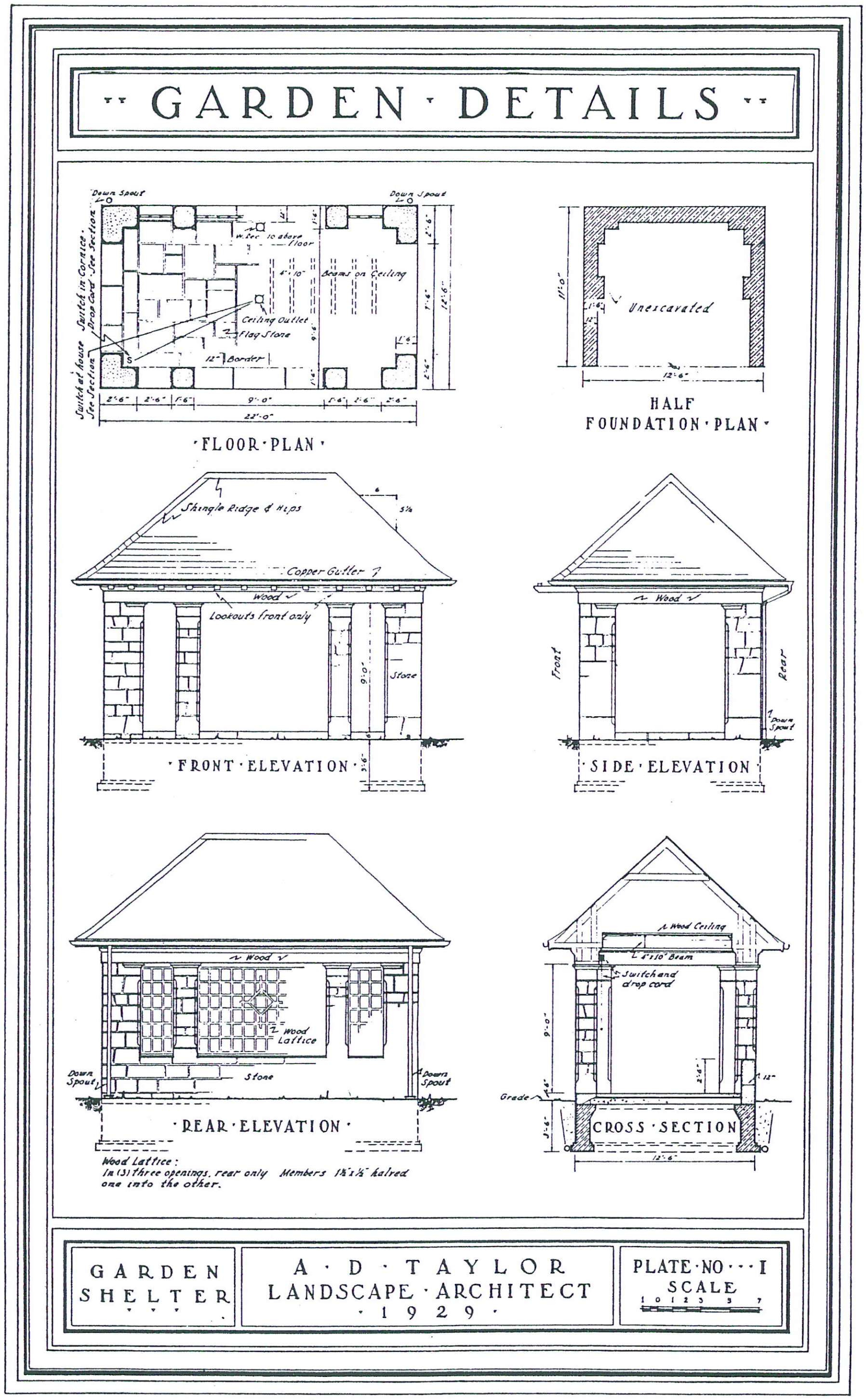
CONSTRUCTION TECHNIQUES AND dimensional standards have been an important part of this magazine since its beginning as *Landscape Architecture* Quarterly. Frederick Law Olmsted Jr. published an article on street intersections in the first issue. For the second, he wrote "Notes on the Sizes of Steps for Comfort," a thorough analysis of existing steps and "rule-of-thumb" proportional standards. Throughout the first decade of the magazine, Olmsted, Henry Hubbard and others wrote articles on such technical and office-practice concerns as specifications for topographic maps, irrigation techniques, and space requirements for outdoor games. Most techniques and standards drew from the experience of "established offices" across the country.

This exchange of information was a necessary part of the magazine because there were no standard references available—no *ASLA Construction Handbook,* no *Urban Design and Planning Criteria,* no Seelye's *Data Book for Civil Engineers,* not even an *Architectural Graphic Standards* (first published in 1936). Although *Architectural Forum, American Architect and Building News, Pencil Points,* and several other magazines for architects, builders and engineers had existed for many years, any construction details they published were closer to the Renaissance architectural rule books of proportion and ornament than to the concerns of landscape construction and design.

In January 1922, A. D. Taylor published the first "Landscape Construction Notes," which was a regular feature of the magazine until 1936. Of the 44 "Construction Notes" published under Taylor's direction, approximately thirty were written by Taylor himself. Guest authors included Gilmore Clarke and Earle Draper. In 1929 and 1930 Taylor supplemented the column with "Garden Details," a series of dimensioned drawings and photographs of gates, arbors, walls and other garden structures designed in his office.

Taylor's rich and varied columns attempted to fill the numerous gaps of reference information within the profession. He had worked in the office of Warren Manning before establishing his own office in Cleveland in 1913. His office practice was extremely diverse, with clients

CONSTRUCTION



from business, local governments, the U.S. Forest Service, Federal housing agencies, and the war department.

The "Notes" often reflected the needs of current projects in his (and others') offices. In the 1920s it included topics such as roads for private estates, and standards for polo fields and outdoor bowling greens. Many are reminders that changing times have resulted in changing concerns and methods within the design profession. In 1924 he discussed construction labor camps because:

> most large undertakings, especially in connection with the development of private estates, are located in the country districts, often times far from a source of desirable labor supply.

Later columns concerned topics with broader applications than estate design. In 1932 there was a fascinating two-part series on the design and construction models of the Mount Vernon Memorial Highway; in 1936 an extensive article discussed the construction of small earth dams. Taylor was as rigorous in specifying soft, naturalistic methods for the "Treatment of Banks and Streams" as he was for concrete and stone bulkheads:

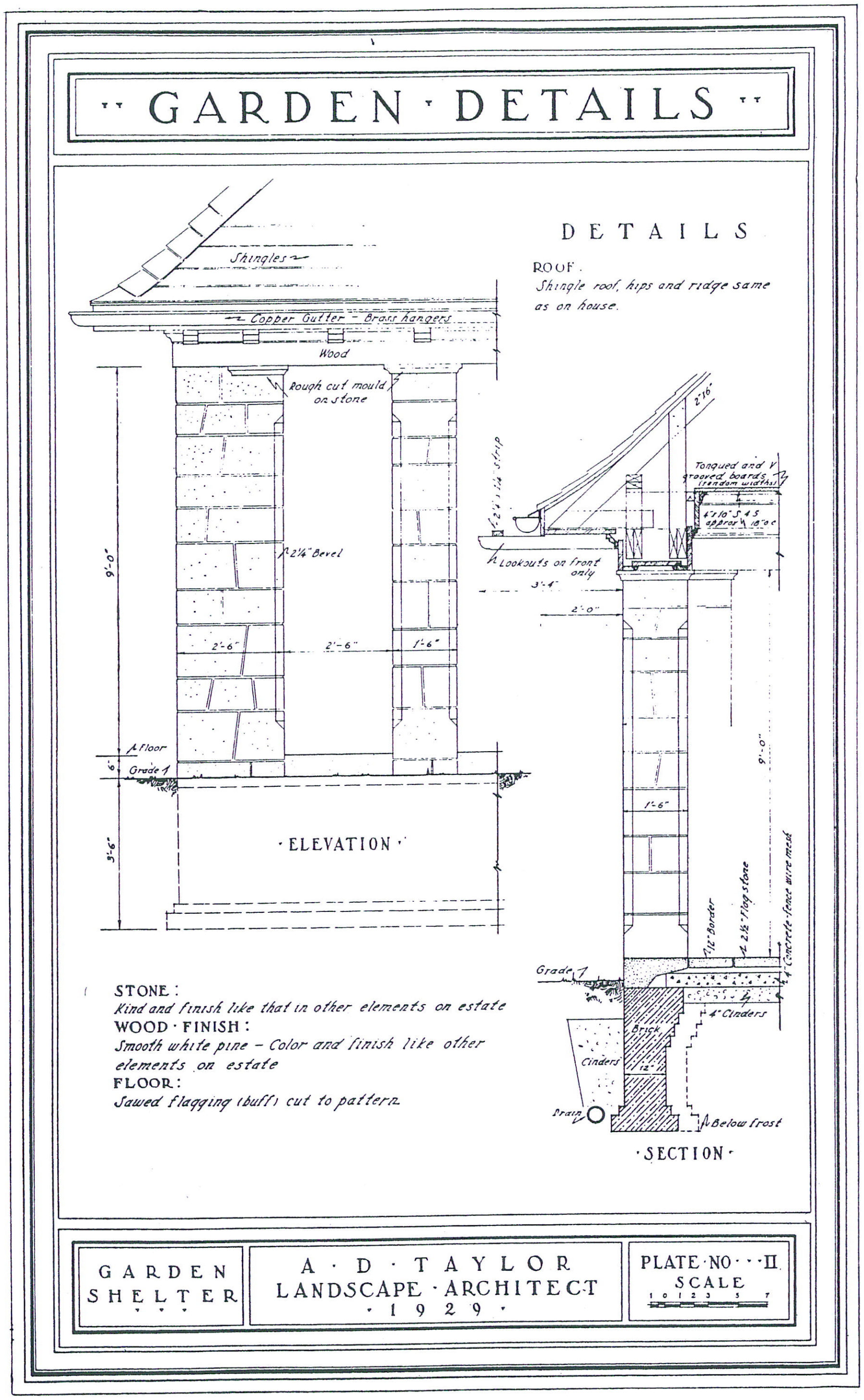
> Oftentimes the bank is protected by cutting willow trees approximating from three to five inches in diameter, into lengths ranging from four to six feet and laying these willow sticks on the surface of the bank with the long axis of the stick up and down the slope. These sticks are then covered with four to six inches of earth. In a short time roots will be formed and growth developed over the entire bank. Willows readily propagate by cuttings and a planting may easily be created by sticking these cuttings into the ground in a naturalistic manner.

Many of the columns went into exhaustive detail, particularly when dealing with costs, which he always dissected into the number of man-hours required for each step needed to complete the task. After his death in 1951, *Landscape Architecture* said of Taylor,

> His genius was to take a disheveled, disorderly problem, let in the light of common sense, and bring planned order accompanied by organization of the last detail . . .

His observations about a successful ha-ha wall clearly demonstrate this:

A gutter should be created at the base of the wall in order to dispose readily of surface drainage, and especially to create a condition which will prevent sheep or other animals from taking a natural stance, from which position they may easily leap to the top of the wall. This grading should be contoured so that no animal can run directly toward the wall without coming in contact with this slope which prevents a natural leap. Many ha-ha walls are failures because of the lack of attention to the proper grade on the slope at the base of the wall. This slope should approximate from 15 per cent to 18 per cent so that the front feet of the animal will be much below the hind feet—a very awkward and unfavorable jumping position which destroys much of the animal's confidence and desire to leap to the area above.

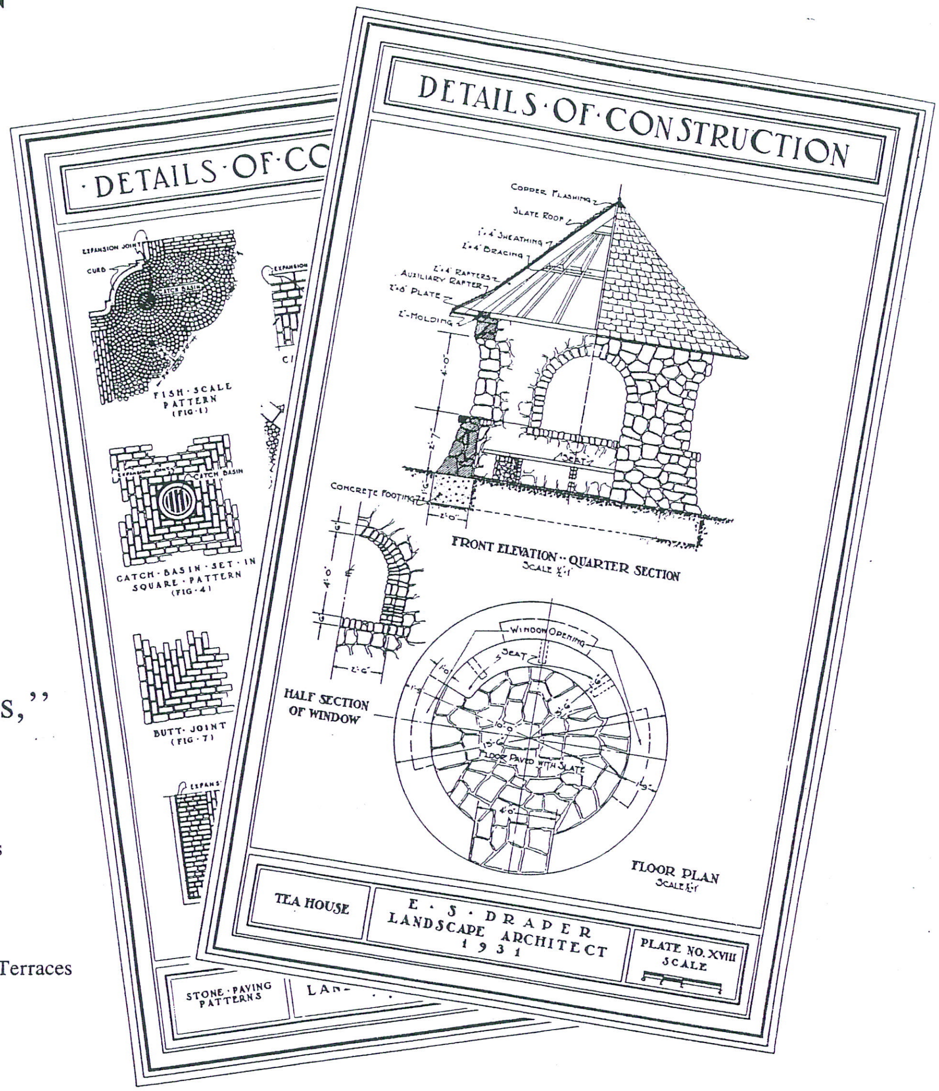


In a 1930 article he carefully compared four types of tennis courts, which he classified by drainage patterns. He used cross sections and a mathematical analysis of ball projectiles to determine the impact of drainage slopes on the player. He observed that players could adapt a serve learned on any of the three other court types most easily to a court drained in a single longitudinal direction. Although his recommendation for the longitudinal slope is an often-repeated standard, his logic and rationale for the choice usually are not included.

Today we often rely on standards from numerous resources that do not repeat the rationale which determined the standard. Although it is unreasonable to "reinvent the wheel" for every detailed decision, we should not lose touch with our ability to use the "light of common sense" so evident in the technical articles of Olmsted, Taylor and other early *Landscape Architecture* Quarterly contributors.

We have republished a limited selection of plates from "Notes" and a list of titles to encourage a glance through the articles contained in back issues of this magazine. The reading is entertaining—it takes you back to a time when concrete curb and gutter cost 70 cents per linear foot—but it also provides insight and information not available elsewhere. Perhaps you have no need for the requirements of a polo field, roque

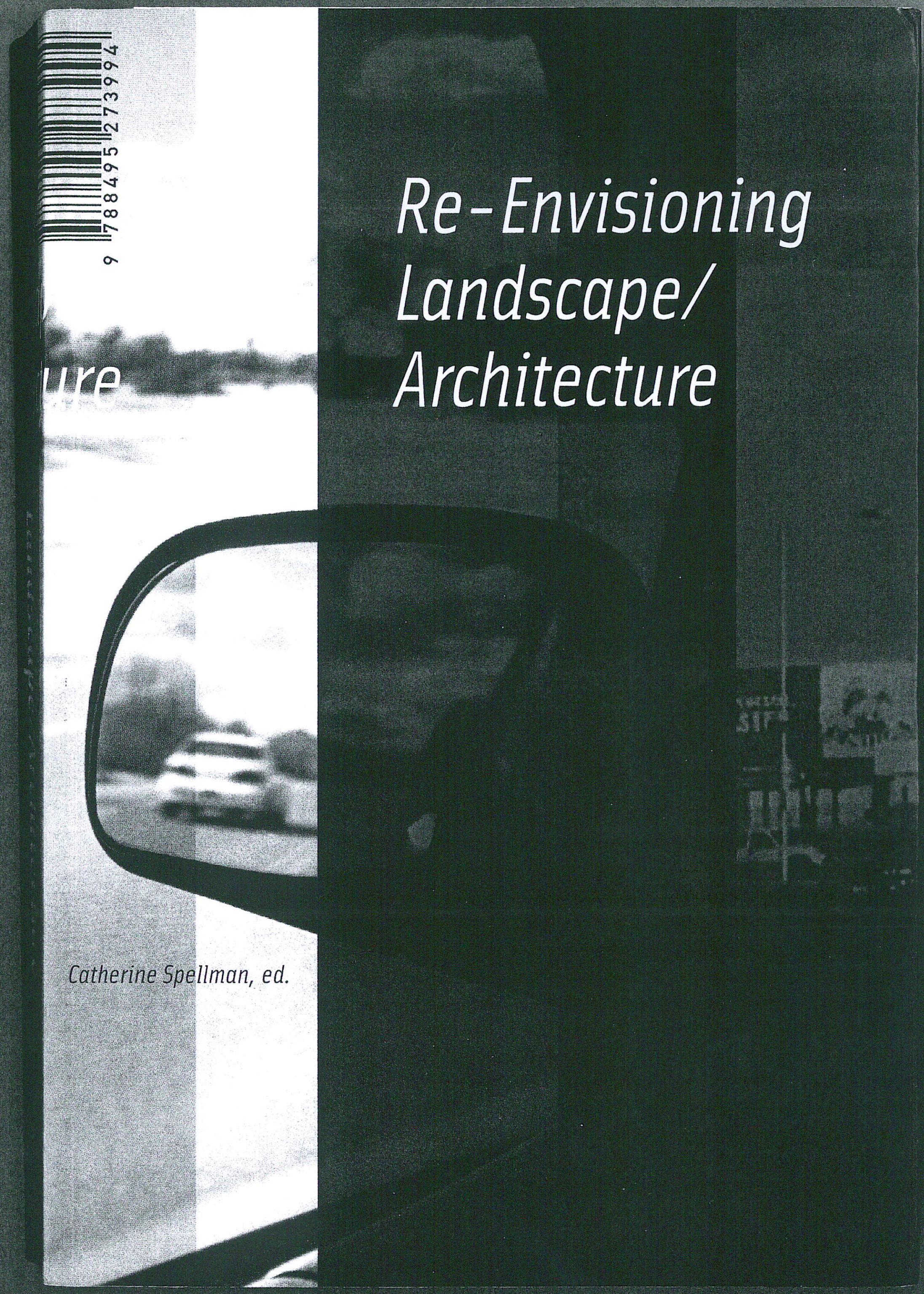
CONSTRUCTION



court or clock golf lawn, but we all could benefit from a review of the careful analysis given to both small details and larger technical problems by Taylor and his guests. ■

"Landscape Construction Notes," 1922–1936

January 1922	Construction of Flagstone Walks
April 1922	Construction of Clay Tennis Courts
July 1922	Drainage
October 1923	Roads for Private Estates
January 1923	Cost Data Notes
April 1923	Cost of Topographic Surveys
July 1923	Construction of Walks, Trails and Terraces
October 1923	Construction of Steps and Ramps
January 1924	Pools
April 1924	Curbs and Gutters
July 1924	Labor Camps
October 1924	Walls
January 1925	Polo Fields
April 1925	Bowling Greens
July 1925	Fertilizers
January 1926	Water Supply and Irrigation
April 1926	Pruning
July 1926	Planting and Transplanting
October 1926	Lawn Sports
January 1927	Construction of Turf Areas for Lawn Sports in the Northern & Southern States
July 1927	Contracts and Specifications
October 1927	Contracts and Specifications II
January 1928	Contracts and Specifications III
April 1928	Pruning and Transplanting in Florida (by A. D. Taylor and Herbert Flint)
July 1928	Construction of Sand-Clay Surface for Play Areas in Florida Bowling Greens
October 1928	Playground and Recreation Areas
January 1929	Office Forms and Practice
April 1929	Office Forms and Practice II
October 1929	Treatment of Banks of Streams and Other Water Areas—"Garden Details"
January 1930	Notes on the Construction of a Park Bench (by Gilmore Clarke)—"Garden Details"
April 1930	Cost Data for Park Maintenance (by Conrad Wirth); Notes on Construction of Ha-Ha Walls (by A. D. Taylor)—"Garden Details" (by A. D. Taylor)
July 1930	Cost Data for Maintenance of Golf Courses—"Garden Details"
October 1930	Notes on the Concrete Work of Meridian Hill Park, Washington, D.C. (by Horace Peaslee); Stone Pavements for Entrance Courts and Driveways—"Garden Details"
January 1931	Driveway Lighting Installation (by Gilmore Clarke); Notes on Construction of Curb-Gutter and Inlet (by E. S. Draper); Footbridge Construction (by G. Clarke)
April 1931	Notes on Texture in Stone Masonry (by Gilmore Clarke)
July 1931	Pool, steps, Pergola and Tea House (by E. S. Draper); Footbridge (by Al Boerner)—"Garden Details"
October 1931	Garden Details & an Outdoor Fireplace (by T. H. Desmond)
January 1932	Wall Seat
January 1932	Mount Vernon Memorial Highway (by Wilbur Simonsen)—"Garden Details" (by Wheelwright and Stevenson)
July 1932	Mount Vernon Memorial Highway II (by Simonsen)
October 1932	Models of Mount Vernon Memorial Highway (by Rose)
January 1935	Construction of Small Earth Dams
April 1936	Supplementary Specification for Roadside Improvement (by A. D. Taylor and John Boady)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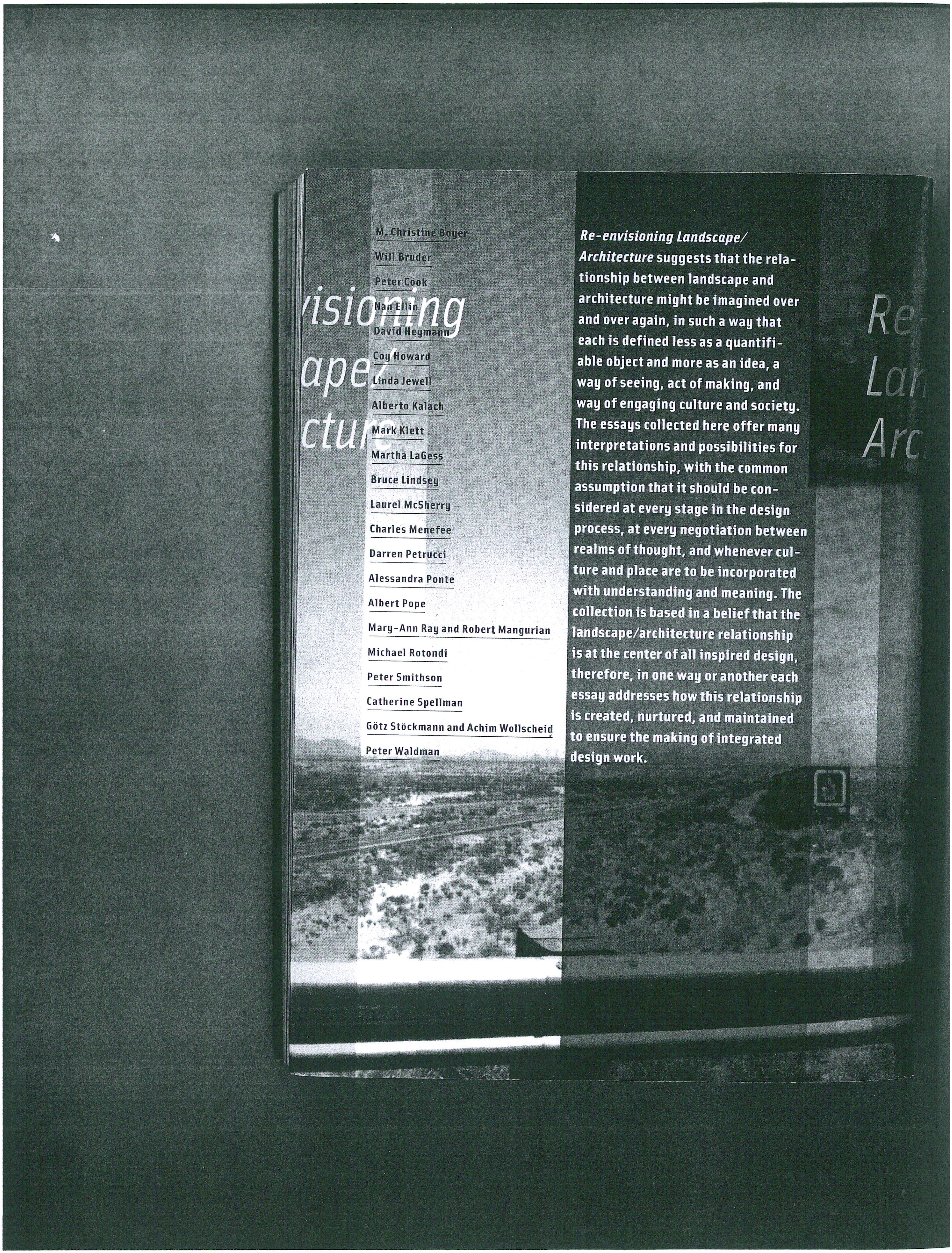
Re-Envisioning
Landscape/
Architecture
Catherine Spellman, ed.


M. Christine Boyer
Will Bruder
Peter Cook
Nan Ellin
David Heymann
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Linda Jewell
Alberto Kalach
Mark Klett
Martha LaGess
Bruce Lindsey
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Darren Petrucci
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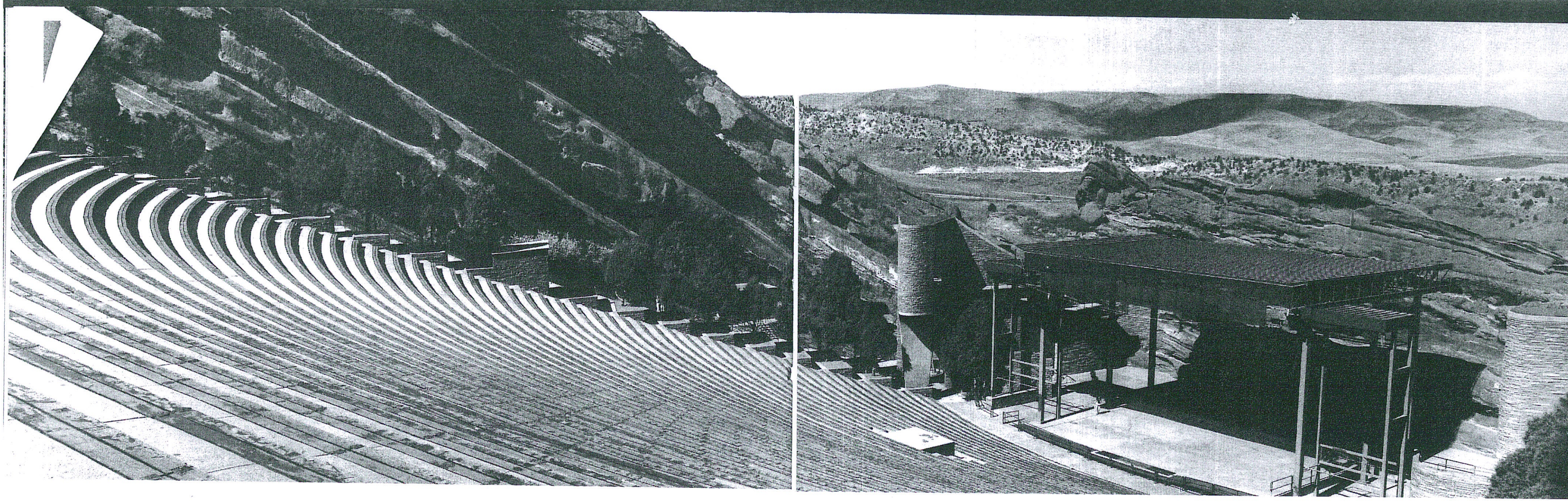
Albert Pope
Mary-Ann Ray and Robert Mangurian
Michael Rotondi
Peter Smithson
Catherine Spellman
Götz Stöckmann and Achim Wollscheid
Peter Waldman
Re-envisioning Landscape/Architecture suggests that the relationship between landscape and architecture might be imagined over and over again, in such a way that each is defined less as a quantifiable object and more as an idea, a way of seeing, act of making, and way of engaging culture and society. The essays collected here offer many interpretations and possibilities for this relationship, with the common assumption that it should be considered at every stage in the design process, at every negotiation between realms of thought, and whenever culture and place are to be incorporated with understanding and meaning. The collection is based in a belief that the landscape/architecture relationship is at the center of all inspired design, therefore, in one way or another each essay addresses how this relationship is created, nurtured, and maintained to ensure the making of integrated design work.



[Fig. 1] Denver's Red Rocks Theater (1937–41) remains one of the country's most popular outdoor venues for musical performance. Photo by Anton Grassl

The American Outdoor Theater:

A Voice for the Landscape in the Collaboration of Site and Structure

Linda Jewell

Through the spoken work, the rendition of music, through song and dance the outdoor theater can contribute to mental, physical, and spiritual growth. If it is healthful to exercise, work, play, and sleep in the open, it should be even more beneficial to have our finer sensibilities unfolded in the same favorable atmosphere.

Emerson Knight, "Landscape Architect," in Architect and Engineer, *1924*

Contemporary outdoor theaters, like so many of today's public structures, are typically erected by entrepreneurs and institutions who view the landscape as real estate. In fact, today, the primary motivation for building a theater outdoors is that it costs only a fraction of a comparably sized interior theater. As a landscape architect, I find this attitude deplorable.

During the early decades of the twentieth century, a group of theatrical professionals, naturalists, wealthy patrons, and designers spawned a movement that created outdoor performances as antidotes to the commercialism and technical emphasis of interior theaters. Influenced by Greek artistic and democratic ideals, these drama enthusiasts built outdoor theaters to "contribute to mental, physical, and spiritual growth" of the American public. The only two books written on American outdoor theaters: Outdoor Theaters (1917) by the landscape architect Frank Waugh and The Open-Air Theatre (1918) by theater critic Sheldon Cheney, were published during this period. Significantly, both publications focused less on architectural style and programmatic concerns than they did on the importance of a creating a meaningful landscape experience. This concern for the landscape continued into the early 1940s with the numerous outdoor theaters built by Roosevelt's New Deal programs in federal, state, and local parks.

After World War II, priorities in outdoor theater design shifted to concerns for large seating capacity, audience comfort, commercial concessions, and the accommodation of sound and lighting technology. Although these issues still dominate new theater designs, the public continues to support performances in numerous pre-World War II theaters that lack these amenities. For example, Denver's Red Rocks Theater [fig.1], built between 1937 and 1941, remains a prestigious location for major performers despite its relatively small seating capacity, box office receipts, and less technical support than newer theaters. In fact, Red Rock's spectacular rock formations and dramatic vistas have insured its continued top position in Pollstar magazine's annual survey of "best outdoor concert venue."[1]

The post-war tendency to ignore the landscape has by no means been limited to the building of outdoor theaters; it has dominated the construction of all built environments. While it is easy to blame this situation on the commercial demands of clients and ever increasing code requirements, the influence of modernist architecture also explains the devaluation of the landscape. Elizabeth Meyer discusses the tendency of modern architecture to separate architecture and nature: "When architectural historian Sigfried Giedion writes about 'the juxtaposition of nature and human dwelling' as a constituent fact of architecture, he defines architecture and nature in binary terms that are juxtaposed as opposite. Architecture is the positive object and nature is opposed to it, negative."[2]

This binary thinking has identified the landscape as either wild and untouched or a neutral counterpart to the architectural object. For architects, the result has often been to locate and design all buildings, roads, and other structures first and then assign a shapeless, undifferentiated landscape to the "leftover" spaces. On the other hand, many landscape architects joined forces with the environmental movement to create a milieu—as well as legislation—mobilized around what not to do or where not to build. Both positions supported the land developers' view of the landscape as a locational commodity while neither examined the opportunities that landscapes offer. Consequently, the landscape has often been overlooked as a positive contributor to the complicated equation of designing contemporary environments.

My own education, first in architecture and later in landscape architecture, has reflected these separate roles of the two disciplines. As an architecture student, my studio assignments emphasized the creation of architectural objects, usually with little regard for the landscape as anything other than an amorphous background for the sculptural building. Later, studying landscape architecture during the height of the 1970s environmental planning movement, I frequently saw buildings and other structures presented as a menace or disturbance to a pristine landscape that was to be preserved rather than changed.

Yet I continued to be fascinated by designed places where structures and landscapes were not separate, but parts of a common effort. My view of outdoor theaters as equally site and structure made them important references for teaching and practice. Although I was intrigued by the classic Greek and Roman theaters, American theaters, especially those constructed by Roosevelt's New Deal, were accessible models. I therefore began collecting images and measurements of these terraced structures.

Eight years ago I began a more comprehensive study of American outdoor theaters by visiting more than seventy theaters and producing measured drawings and histories of twenty-four theaters as case studies for an exhibition and book. To my delight, I discovered numerous outdoor theaters that became memorable spaces through the interdependency of landscape and architecture.

Although most such theaters were built before World War II, many still host scheduled performances. Moreover, they attract people for weddings, picnics, and impromptu events as well as for quiet contemplation of the landscape. So the question arises: can early outdoor theaters help us design new theaters and other built environments that reveal the positive attributes of the landscape? I believe they can if we examine the following strategies that were used to create them.

1 Spend time at the site to understand its changing physical characteristics

Frequently designers are so intrigued with the effects they wish to create with their proposed new elements they forget to identify and take advantage of the drama inherent in a site. Landscapes are not a mere background; they are complex and dynamic. Even the smallest site has distinctive variations. To understand the nuances of a landscape's natural systems and aesthetic components, a designer must spend considerable time on the site at different times of day and under different climatic conditions. The designers of many early theaters, including the Hollywood Bowl and Red Rocks, had the advantage of seeing performances on the unimproved sites before permanent facilities were built. They observed various seating layouts, stage arrangements, and circulation schemes that they

[Fig. 2] At the Mount Tamalpais Mountain Theater, the stone seats undulate with the topography to accommodate native oaks and rock outcrops. Photo by Anton Grassl

evaluated and adjusted to avoid unnecessary disruption to the site's natural patterns.

Before producing a schematic design for the California's Mountain Theater, landscape architect Emerson Knight saw many performances on the Mount Tamalpais site. He learned its variations in sunlight, breezes, views, and natural acoustics and observed vegetation growth and drainage patterns. Although his scheme was inspired by classical Greek theaters, it warps the traditional semicircular seating plan towards the site's partially filled drainage way, creating an axis around the old ravine. The stone seats, constructed by the Civilian Conservation Corps under Knight's direction, undulate up and down with the topography, accommodating native oaks and protruding rock formations [fig.2].

On the other hand, landscape architect Thomas Sears proposed a regularized circular geometry of stone seats at Swarthmore College's Scott Theater. The bowl-shaped land form, already used for student gatherings, was carefully regraded to

[Fig. 3] At Scott Theater, new tulip poplars were planted to supplement ones saved. Photo by Anton Grassl

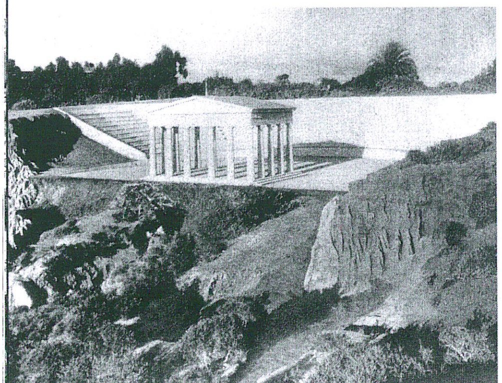
maintain the existing soil around most of the tall tulip poplars that cast dappled sunlight across the site. A few poplars were left protruding from the low walls while several others were removed, but young poplars were planted in random patterns to reestablish the original density and verticality of the grove [fig.3].

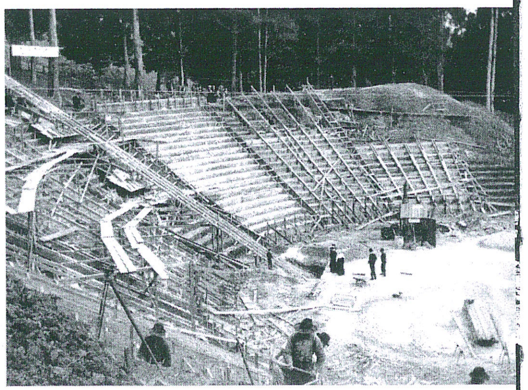
2 Accentuate a memorable site feature

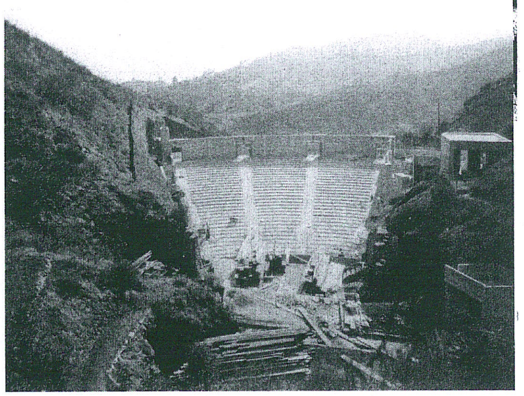
Unusual rock formations and topographic configurations, soil or vegetation colors, the sounds of a nearby stream, or a spectacular vista are a designer's tools to make a theater experience more memorable. But respecting a natural feature does not mean the landscape cannot be changed. Landscape manipulation, inherent in the building of any structure, can enhance the original site if the change intensifies the audience's perception of its unusual aspect while still respecting the site's ecological functions. For example, a thirty-foot deep cut of soil adjacent to Red Rock's monumental Creation Rock not only provided a usable platform for seating, but it exposed formerly buried portions of this extraordinary sandstone ledge, reinforcing its role as an enclosing wall for the theater. Yet this grandiose earth movement accommodated the site's natural drainage pattern by collecting run-off in open swales and tilting the entire auditorium floor towards its original low point. To emphasize the majestic rock formations rather than the new construction, architect Burnham Hoyt created a simple sloped plane for the seating from which the rugged stones ascend. Avoiding the visual clutter of individual seats or the distraction of feeder aisles, this simple surface is articulated only by a series of long, gently curving backless benches.

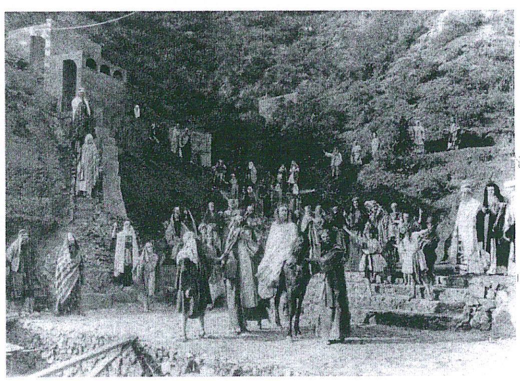
3 Evaluate whether or not architectural features will contrast or merge with the surrounding landscape

Structures that blend with the surrounding landscape are easily identified as respectful of nature, but those with contrasting forms can also respond appropriately to a site's ecological systems and aesthetic character. Although followers of the early drama movement were motivated by the desire to experience nature, they did not have a bias for theaters that merged with the landscape over those that had forms and colors that contrasted with it. In









From left to right:

[Fig. 4] The intact Theosophical Society Greek Theater (1901), an example of Cheney's "architectural theater" was sited for its view from the theater and relies on its contrasting color and geometry to draw attention to the adjacent ravine. Photograph courtesy of San Diego Historical Society, Photograph Collection

[Fig. 5] By locating Berkeley's semicircular Greek Theater (1903) on a naturally concave site, topographic manipulation was minimized. Photograph courtesy of Bancroft Library

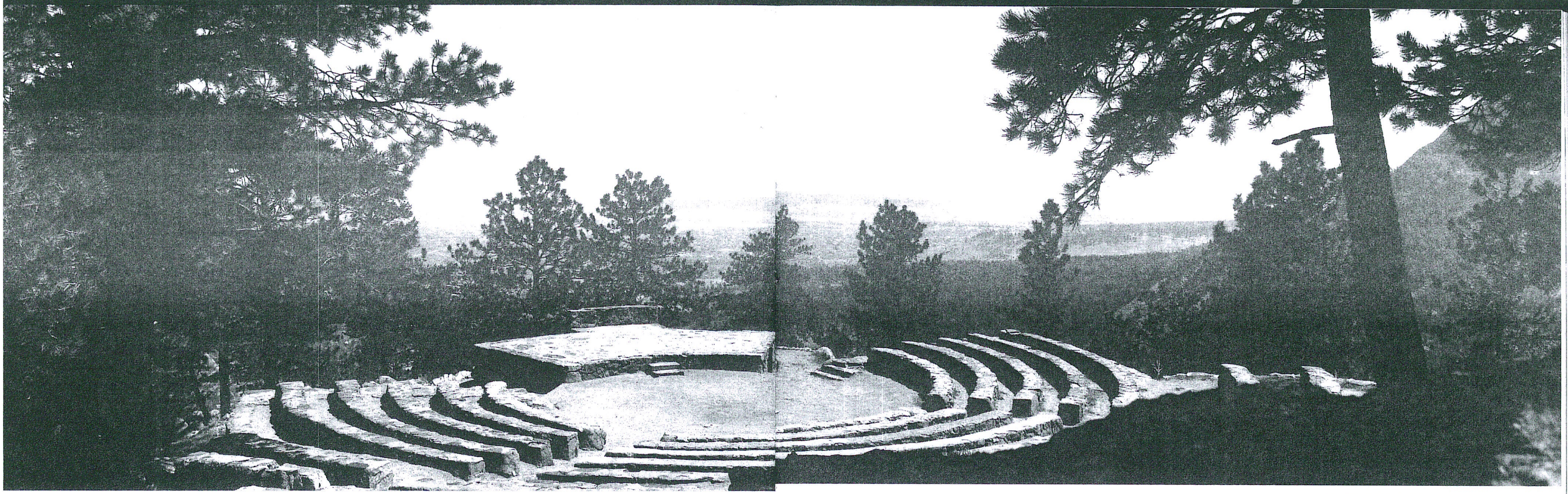
[Fig. 6] The Bohemian Grove Theater (c. 1890), an example of Cheney's "nature theater" treats the performers a part of a redwood covered slope. Photograph reprinted from Cheney, Open Air Theaters, 8. Photograph by Gabriel Moulin.

[Fig. 7] At Los Angeles's intact Anson Ford Theater (1931), the seating was designed to be architecturally distinct from the surrounding landscape while the stage merges into the mountainside. Photograph courtesy of Security Pacific National Bank Photograph Collection/ Los Angeles Public Library

[Fig. 8] The stage and landscape merge into one at the Anson Ford Theater where the mountainside was utilized for stage processions in 1930s Pilgrimage Plays. Photograph courtesy of Security Pacific National Bank Photograph Collection/Los Angeles Public Library

his 1918 book, Sheldon Cheney described both "nature theaters" that visually became a part of the landscape and "architectural theaters" that contrasted with the landscape. Two examples of architectural theaters, the Point Loma, California Theosophical Society Greek Theater [fig.4] and Berkeley's Greek Theater [fig.5], required minimal reconfiguration of the topography because the original concave land forms were specifically selected for the circular shapes of the theaters. Like its classical Greek precedents, the Point Loma theater was sited for its view from the theater rather than the view to the theater. Nevertheless, its contrasting white geometric form draws attention to the adjacent rugged ravine.

The stage of Bohemian Grove Theater [fig.6], illustrated in Cheney's book as an example of a "nature theater," intertwines with a redwood covered hillside to make the structures, performers, and audience a part of the scenery. Similarly, at the Mountain Theater, indigenous stone seats merge into the original topography rather than terminate in the end-walls typical of classical theaters. However, the different elements of some theaters relate to the landscape in different ways. At Los Angeles's Anson Ford Theater, the seating area is architecturally distinct from the surrounding landscape [fig.7] while the stage, once used to depict the descent of Christ from a mountain top in pilgrimage plays [fig.8], disappears into the mountainside.



4 *Design a spatial sequence based on the visitor's movements*

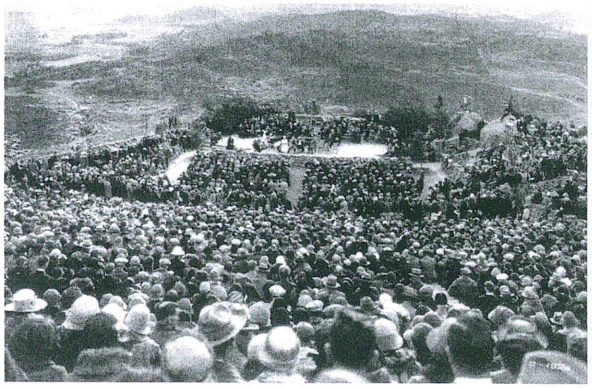
With rare exceptions, the aesthetic benefits of landscapes can only be understood by moving through them, rather than from a few well-chosen views. Through the subtle manipulation of views, reshaping of topography, modification of vegetation, and the careful introduction of architectural elements, early theaters created sequential experiences that enhanced the rituals of arriving and gathering. They not only moved people gracefully through the theater spaces, but they often engaged the landscape beyond to connect both performers and patrons to a world larger than the one on-stage.

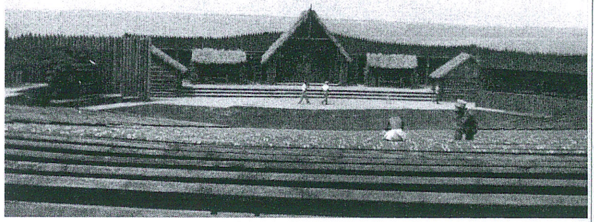
At Boulder's Flagstaff Sunrise Circle [fig.9], Mount Helix Nature Theater east of San Diego [fig.10], Red Rocks, and the Mountain Theater, the distant vistas provide stunning backdrops to events on stage. But at other theaters, including Berkeley's Hearst Theater and Manteo, North Carolina's Waterside Theater [fig.11], distant landscapes can only be seen when entering from the top rows of seating. At Waterside, visitors arrive over a sand dune and then descend into an enclosed "fort" that is a part of the stage set. The elevated arrival point provides a glimpse of water beyond the stage backdrop, making the later appearance of distant sailing ships all the more believable.

[Fig. 9] The Flagstaff Sunrise Circle (1933–34), built by the Civilian Conservation Corps, captures a stunning vista. Photograph by Anton Grassl

[Fig. 10] The Mount Helix Nature Theater (1924) relies on a spectacular vista as a backdrop to events. Photograph courtesy of San Diego Historical Society, Photograph Collection

[Fig. 11] At Manteo's Waterside Theater (1937), a distant view of the water is captured as patrons enter the theater over a sand dune. Photograph courtesy of North Carolina Division of Archives and History





5 Modify the parti to accommodate landscape features, including those that are revealed during the construction process

Most historically significant gardens and parks did not take their finished form from a set of construction drawings but evolved over time in response to site conditions. Although the initial designs of many theaters began as a simple symmetrical geometry, these "perfect" forms were modified to address the particulars of the site. Some of these site-determined adjustments were made in drawings, but significant changes were often made during construction when schemes were refined to reflect newly exposed stones, vistas revealed by cleared vegetation, or the reality of accurate tree locations.

Landscape architect Emerson Knight and architect Richard Requa initially proposed a symmetrical, fan-shaped plan for the Mt. Helix Nature Theater atop a mesa with a spectacular view. Their auditorium design was long and narrow to minimize the amount of fill required to counter the conical shape of the mesa. But the design of the upper seating was changed substantially when they discovered that the survey had inaccurately located rock outcroppings, and the construction revealed bedrock just below the surface. Requa visited the site several times a week, overseeing field adjustments to these unexpected conditions. The original design's consistent 1:3 slope was steepened in the upper tiers to avoid bedrock, thus giving the theater's profile a distinctive bend. The central aisles were diverted around rock outcroppings which were made into picturesque box seats. These "distortions" of the original symmetrical proposal highlight the rugged, spiritual character of the site while avoiding any compromise to its usefulness as a theater.

6 Celebrate the unpredictability of landscapes

Outdoor theaters, like all landscapes can be noisy, messy, cold, hot, windy, or buggy. Still, members of an audience often treasure their memories of dramatic clouds, colorful sunsets, or the unexpected appearance of a bird or a plane. Rather than capitalize on these natural spectacles, contemporary theater builders go to considerable effort and expense to transform outdoor sites into the controlled, predictable environments of interior theaters. Bugs are eradicated, walls are built to deflect wind, canopies hide the sky, and sometimes mechanically cooled air is even pumped into the open air. The provision of such amenities often results in the obliteration of vistas, the destruction of native topography, and the removal of significant vegetation and natural drainage ways. Designers of early outdoor theaters never attempted to match the controlled environments of interior theaters. Instead, they allowed the unexpected to be a part of the outdoor experience. At the Mountain Theater, the south facing seats can sometimes become quite hot during June performances. But rather than adding a covered canopy, Mountain Play Association volunteers circulate through the seats spraying patrons with cooling water. At San Diego's Starlight Theater, the airport directed flights directly over the 1930s theater. Undeterred, the production company has developed a system of lights that signals performers to "freeze" just before a plane passes overhead. At the nearby New Globe Theater, Shakespeare is often accompanied by a background of animal screeches from the San Diego Zoo. At other theaters, patrons watch fireflies, listen to crickets, and accept cooling summer showers as a part of being outdoors.

7 Evaluate the impact of minor programmatic requests on the landscape

Influenced by television sound bites, computer generated images and cinematic special effects, audiences today expect every entertainment event to provide an audiovisual spectacle as well as the comfort of their own living room. Although the contemporary audience's desires cannot be ignored, the designer can make clear to clients the potential impact of each decision on the health and aesthetics of the landscape. The color of seating, the type of lighting, or the placement of equipment structures can either enhance or destabilize the fragile aesthetics and natural patterns of a landscape. In nearly half of the theater case studies I examined, the thoughtless additions of canopies, lighting structures, service parking, accessible ramps, and other "updating" have compromised the original serenity of the older theater landscapes. Although many of these improvements were necessary for the theater to function successfully today, they have been added without regard to their impact on drainage, vegetation, views, or other amenities. Even at Red Rocks, the necessity of providing a canopy to protect valuable musical instruments from rain and sun was met with a strictly functional solution—a clumsily proportioned metal roof that cuts unceremoniously across the view of Stage Rock [fig.1].

Summary

Modernism's 50-year legacy of separating architecture and the landscape still haunts much of contemporary design. A resurgent interest in the landscape by writers, theorists, and historians has created an encouraging trend for artists and architects to look to the landscape for conceptual inspiration when proposing innovative structures. But most such projects respond to the landscape symbolically rather than to a site's particular aesthetic attributes or its biological functions. On the other hand, landscape architects still struggle with finding ways to creatively intervene in a landscape without compromising their ecological commitment. Consequently, there are few projects designed by either discipline that respond to the particulars of a landscape while also creating a memorable place.

These early outdoor theaters are evidence of a time when landscapes and architecture routinely worked together to create inspirational settings that reflected the specifics of a site. However, landscapes with the spectacular natural features of Red Rocks are seldom available today, and it is a mistake to base contemporary designs on these theaters. Designers can, however, use the strategies listed above to make the landscape's voice more effective in any new project, whether it is located in a national park, an urban center, or a derelict brownfield.

The landscape is more than a place to put buildings; it is where intimate contact with earth, sky, and vegetation remind us of our own connection to nature. Each landscape has positive attributes; if we build projects that both respect and enhance these attributes, we shall foster public and entrepreneurial support for a landscape that contributes more to our daily lives than its value as real estate.

The tree which moves some to tears of joy is in the eyes of others only a green thing that stands in the way.[3] William Blake

The above essay is an excerpt from a forthcoming book on American Outdoor Theaters. Partial funding for the exhibition and book was provided by the National Endowment for the Arts, The Graham Foundation, the Hubbard Fund and by the University of California Committee on Research and the Department of Landscape Architecture's Farrand Fund.

Notes

[1] "1990 Concert Industry Award Winners," *Pollstar, The Concert Hotwire* (February 4, 1991): 2.

[2] Elizabeth K. Meyer, "The Expanded Field of Landscape Architecture," in *Ecological Design and Planning*, ed. George F. Thompson and Frederick R. Steiner (New York: John Wiley & Sons, Inc., 1997): 45–79.

[3] Blake to Dr. John Trusler, Lambeth, 23 August 1799, *The Letters of William Blake*, ed. Geoffrey Keynes (London: Rupert Hart-Davis, 1968): 29–30. This quote was used on a T-shirt designed by the Berkeley student ASLA chapter in 1996. The T-shirt designers were participants in a joint architecture/landscape architecture studio.

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Stone and Concrete Bollards

By Linda Jewell

Bollards are a popular solution to many functional and visual problems in the urban/suburban landscape. They are used to prevent vehicles from entering pedestrian zones, to separate and direct traffic flow, to define boundaries, to protect monuments and to provide a scale of reference in open plazas. In recent years, however, bollards have become so prolific across our landscape that they frequently detract, rather than contribute to the overall quality of our urban environment.

History of Use

The term "bollard" has nautical origins and has long applied to the mooring posts used for tying ships and boats at piers and docks. Today the term refers primarily to free-standing vertical posts used to prevent or direct vehicular traffic. This land-based bollard has probably existed in some form for as long as there have been wheeled vehicles, although the exact evo-
ıtion of today's bollard and the related ɔollaster remain vague. The bollaster is a bollard which has been integrated into a structure to protect it, most typically at the corner of a building or monument.

There is clear evidence that stone bollards similar to contemporary versions have been used since the early 17th century. Fifteenth and sixteenth-century European paintings of urban plazas often show thin post and rail fences surrounding fountains and monuments, presumedly to protect them from horses pulling wheeled carriages. As recorded in numerous ːngravings, free-standing posts and thick ɔosts connected by thin rails began to re-
lace the protective fencing in 7th-century Italy, France, England and ermany.

The use of bollards to delineate and ɑrate large open plazas from traffic ɔ appeared in the same period. Medi- paintings and engravings of the za del Campo in Siena, Italy, some- s indicate fencing rather than the famous bollards separating the car- vay from the main plaza. However, ɔllards surround the central plaza in entury prints. Temporary fencing aced, as it still is today, between the s for major events such as the ɔrse race.

: bollards may have set the nt for demarcating central plaza ı many Renaissance squares. gravings (c. 1630) of London's Covent Gardens show a long progression of bollards separating the central rectangular space from carriage traffic. Piranesi prints (from 1740-1778) also indicate that bollards linked with chains were used to prevent access to ramps and passageways.

Contemporary Applications

Although historic bollards have usually been replaced and even modified during urban renovations, the more successful designs and locations have endured. Today we might benefit from looking more carefully at these early installations, when more generous time schedules allowed each bollard to be carefully selected for both visual and functional reasons. In contrast, the need to restrict vehicular access in the contemporary urban landscape has often made the bollard a cumbersome barrier for pedestrians as well as vehicles.

Because the intent is to prevent passage of even the smallest car (approximately 5′ wide), the small clearance between bollards results in a continuous evenly-spaced row of identical bollards. The outcome can be a virtual forest of bollards. When they are large and light in color, they appear as too many pieces of furniture in a small room. The pedestrian then must weave and dodge around these mini-monuments. And when small bollards are used in large open spaces, even a considerable number can appear lost and insignificant in the landscape.

Traditionally, however, different sizes and spacings of bollards were often used in the same location. Each one seems designed and located to allow the bollard to "claim" the visual territory which it demands. The larger the bollard, the larger the territory. This points out the shortcomings of the "standard" bollard for all uses and locations on one project.

At St. Peter's, four different sizes occur. The largest are at the corners of the obelisk. In the outside circle, two smaller sizes separate the traffic from the central plaza. At the Boston Public Library, two bollards, both almost identical in size and design to the two larger-sized bollards at St. Peter's, are placed on differing centers. Although the more than 18′ spacing would obviously allow a car to intrude upon the sidewalk, the large 5′-high bollards command a presence that discourages jumping the curb.

Choosing the proper height and dimensions is particularly important at exposed corners where often a quite sturdy bollard is needed. However a cluster of smaller bollards between corners may be less obtrusive and less expensive. Particular care should obviously be taken that tall bollards are used to protect turning radii and other spots where a driver might not see a low bollard. The "low bollard" (Illustration 33 from Orly Airport) can be an effective directional guide because a clear view prevents the driver from backing over it. A similar version is popular in many fast food restaurants across America. A sequence of these small bollards is also useful at night when headlight reflections off the light-colored surfaces delineate the roadway.

Shape

Early bollards were usually round or nearly round. They were never square as square bollards require a specific orientation, and appear differently from changing viewpoints. A large-diameter square bollard also appears more imposing than a round one of the same size because the corners "stop" the eye. The early bollards were often smaller at the top than at the bottom, particularly if they were tall. Hand-scaled articulation encouraged touching. Many of these tall bollards were flat-topped cylinders; others were bell-shaped (Illustrations 2 and 4).

In England, the bell-shaped tops were also prevalent, but many traditional bollards derived their shape from cannon barrels, which were once recycled as street bollards. A few actual cannon barrels from the Napoleonic era can still be found upended on London street corners.* Later a more geometric metal bollard became common throughout London. The sturdy square base of this slender black bollard narrows into a less imposing octagonal shape at the top, resulting in a physically strong but visually modest bollard. They are still placed along sidewalks and other narrow spaces where a large stone bollard would be inappropriately obtrusive. The stone version (Illustration 40) is also relatively unobtrusive, but the light stone color is more noticeable than the original black metal.

Contemporary bollards have taken every shape imaginable and occur in steel, wood, plastic and a wide range of other materials. Many incorporate light fixtures which, in stone, often result in rather large and awkward forms. However the strength and durability of stone, particu-

* C. Forehoe, "History of the Bollard," *Architectural Review*, S...

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History of Use

The term "bollard" has nautical origins and has long applied to the mooring posts used for tying ships and boats at piers and docks. Today the term refers primarily to free-standing vertical posts used to prevent or direct vehicular traffic. This land-based bollard has probably existed in some form for as long as there have been wheeled vehicles, although the exact evolution of today's bollard and the related bollaster remain vague. The bollaster is a bollard which has been integrated into a structure to protect it, most typically at the corner of a building or monument.

There is clear evidence that stone bollards similar to contemporary versions have been used since the early 17th century. Fifteenth and sixteenth-century European paintings of urban plazas often show thin post and rail fences surrounding fountains and monuments, presumedly to protect them from horses pulling wheeled carriages. As recorded in numerous engravings, free-standing posts and thick posts connected by thin rails began to replace the protective fencing in 17th-century Italy, France, England and Germany.

The use of bollards to delineate and separate large open plazas from traffic also appeared in the same period. Medieval paintings and engravings of the Piazza del Campo in Siena, Italy, sometimes indicate fencing rather than the now-famous bollards separating the carriageway from the main plaza. However, tall bollards surround the central plaza in 17th-century prints. Temporary fencing was placed, as it still is today, between the bollards for major events such as the Palio horse race.

These bollards may have set the precedent for demarcating central plaza spaces in many Renaissance squares. Early engravings (c. 1630) of London's Covent Gardens show a long progression of bollards separating the central rectangular space from carriage traffic. Piranesi prints (from 1740-1778) also indicate that bollards linked with chains were used to prevent access to ramps and passageways.

Contemporary Applications

Although historic bollards have usually been replaced and even modified during urban renovations, the more successful designs and locations have endured. Today we might benefit from looking more carefully at these early installations, when more generous time schedules allowed each bollard to be carefully selected for both visual and functional reasons. In contrast, the need to restrict vehicular access in the contemporary urban landscape has often made the bollard a cumbersome barrier for pedestrians as well as vehicles.

Because the intent is to prevent passage of even the smallest car (approximately 5′ wide), the small clearance between bollards results in a continuous evenly-spaced row of identical bollards. The outcome can be a virtual forest of bollards. When they are large and light in color, they appear as too many pieces of furniture in a small room. The pedestrian then must weave and dodge around these mini-monuments. And when small bollards are used in large open spaces, even a considerable number can appear lost and insignificant in the landscape.

Traditionally, however, different sizes and spacings of bollards were often used in the same location. Each one seems designed and located to allow the bollard to "claim" the visual territory which it demands. The larger the bollard, the larger the territory. This points out the shortcomings of the "standard" bollard for all uses and locations on one project.

At St. Peter's, four different sizes occur. The largest are at the corners of the obelisk. In the outside circle, two smaller sizes separate the traffic from the central plaza. At the Boston Public Library, two bollards, both almost identical in size and design to the two larger-sized bollards at St. Peter's, are placed on differing centers. Although the more than 18′ spacing would obviously allow a car to intrude upon the sidewalk, the large 5′-high bollards command a presence that discourages jumping the curb.

Choosing the proper height and dimensions is particularly important at exposed corners where often a quite sturdy bollard is needed. However a cluster of smaller bollards between corners may be less obtrusive and less expensive. Particular care should obviously be taken that tall bollards are used to protect turning radii and other spots where a driver might not see a low bollard. The "low bollard" (Illustration 33 from Orly Airport) can be an effective directional guide because a clear view prevents the driver from backing over it. A similar version is popular in many fast food restaurants across America. A sequence of these small bollards is also useful at night when headlight reflections off the light-colored surfaces delineate the roadway.

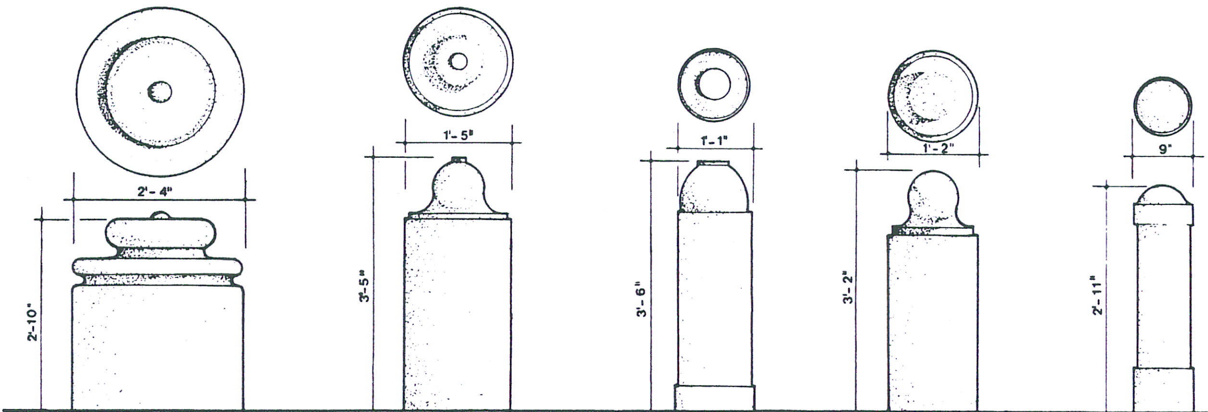
Shape

Early bollards were usually round or nearly round. They were never square as square bollards require a specific orientation, and appear differently from changing viewpoints. A large-diameter square bollard also appears more imposing than a round one of the same size because the corners "stop" the eye. The early bollards were often smaller at the top than at the bottom, particularly if they were tall. Hand-scaled articulation encouraged touching. Many of these tall bollards were flat-topped cylinders; others were bell-shaped (Illustrations 2 and 4).

In England, the bell-shaped tops were also prevalent, but many traditional bollards derived their shape from cannon barrels, which were once recycled as street bollards. A few actual cannon barrels from the Napoleonic era can still be found upended on London street corners.* Later a more geometric metal bollard became common throughout London. The sturdy square base of this slender black bollard narrows into a less imposing octagonal shape at the top, resulting in a physically strong but visually modest bollard. They are still placed along sidewalks and other narrow spaces where a large stone bollard would be inappropriately obtrusive. The stone version (Illustration 40) is also relatively unobtrusive, but the light stone color is more noticeable than the original black metal.

Contemporary bollards have taken every shape imaginable and occur in steel, wood, plastic and a wide range of other materials. Many incorporate light fixtures which, in stone, often result in rather large and awkward forms. However the strength and durability of stone, particu-

* C. Forehoe, "History of the Bollard," *Architectural Review*, Sept. 1953.



1 Via Piebiscito
Rome, Italy marble bollaster

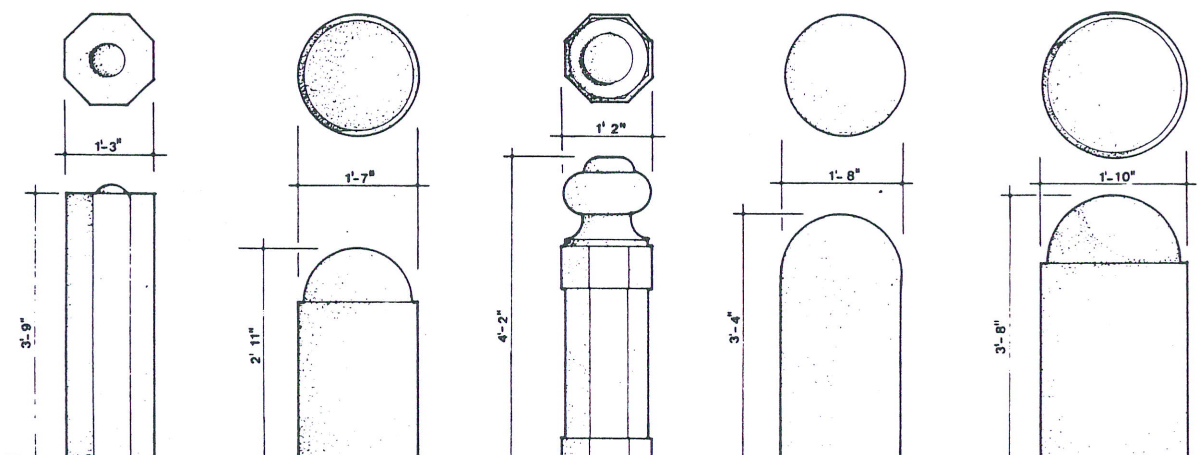
2 Government Building
Rome, Italy

3 Via dei Fori Imperiali
Rome, Italy

4 Fountain Bollard
Assisi, Italy

5 Street Bollard
Assisi, Italy

The dimensions shown are taken from field measurements and may vary slightly from the dimensions on a particular bollard.



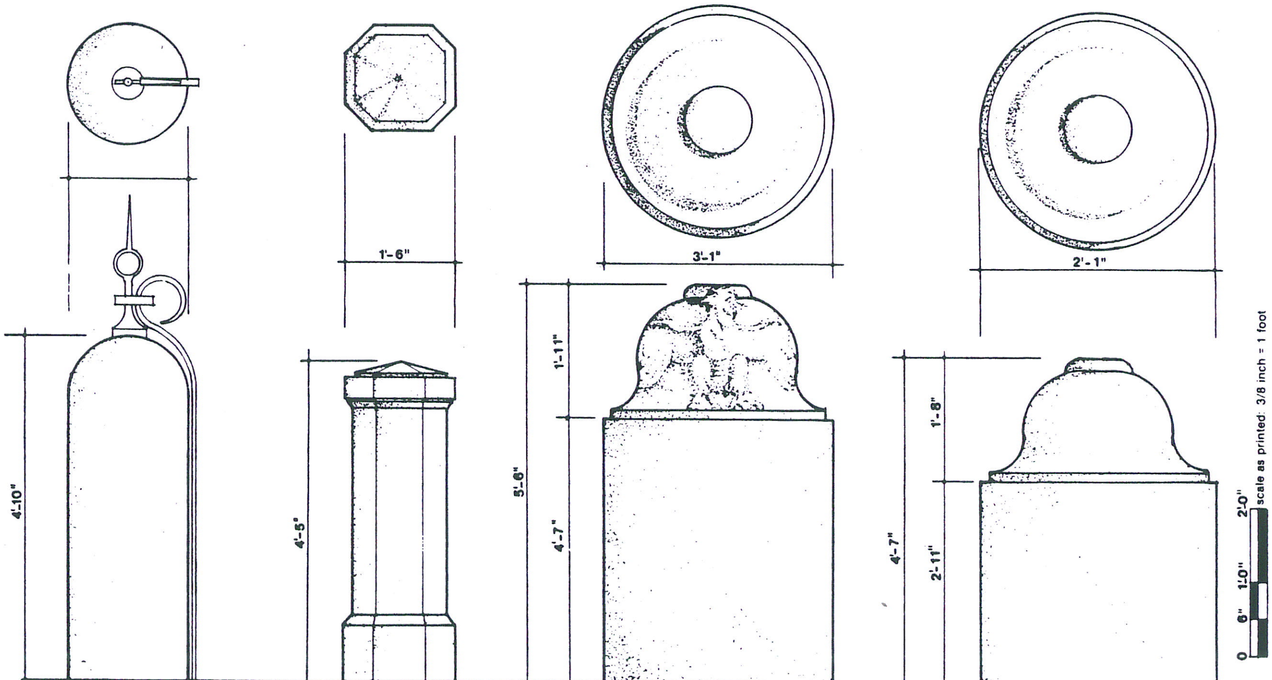
6 Piazza Sordella
Mantova, Italy marble

7 Piazza Navona
Rome, Italy granite

8 Monastery Entrance
Pavia, Italy marble

9 Piazza at St. Peter's
Rome, Italy granite

10 Piazza at St. Peter's
Rome, Italy granite

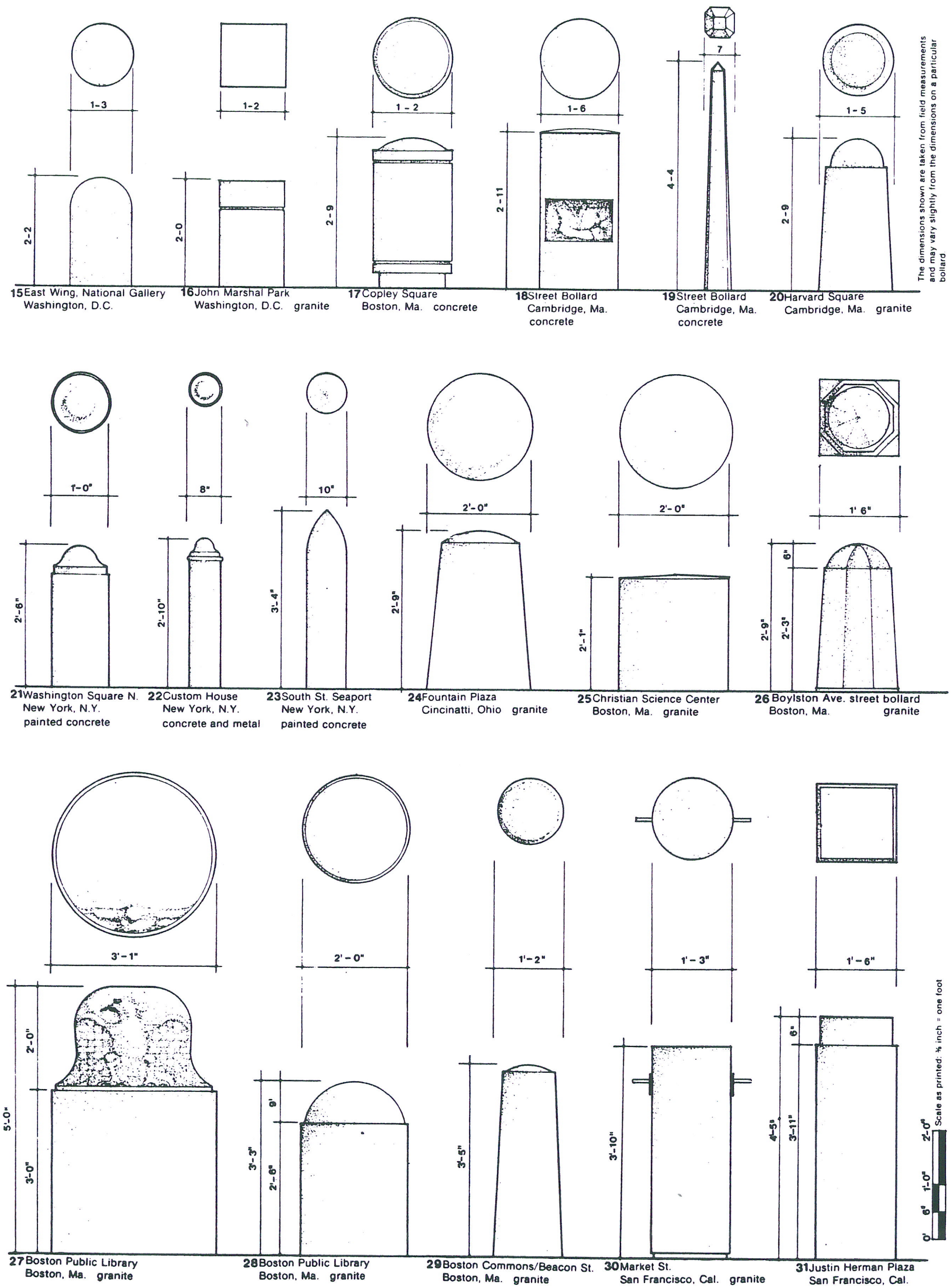


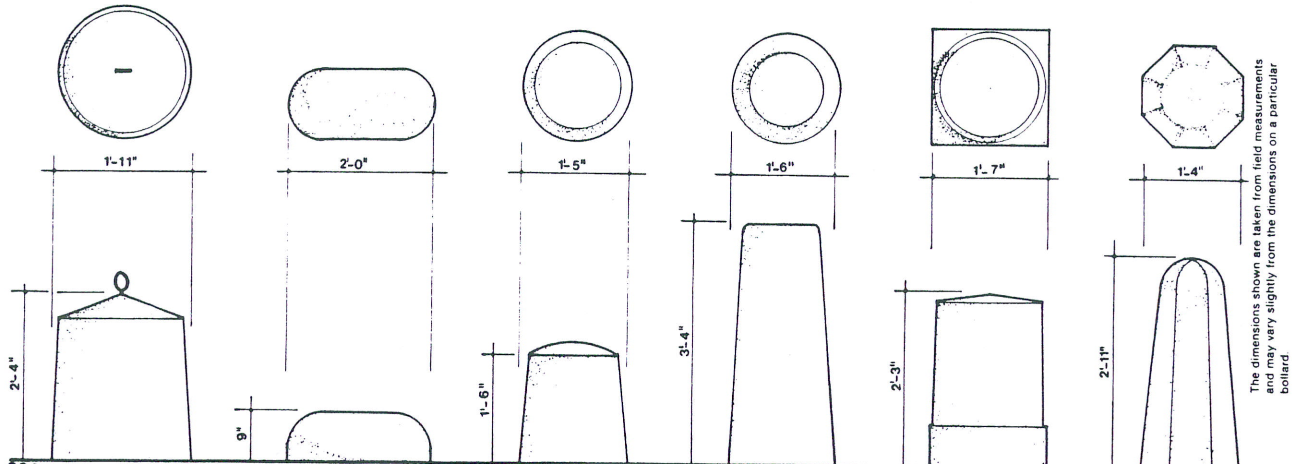
11 Piazza del Popolo
Faenza, Italy concrete

12 Piazza del Campo
Siena, Italy

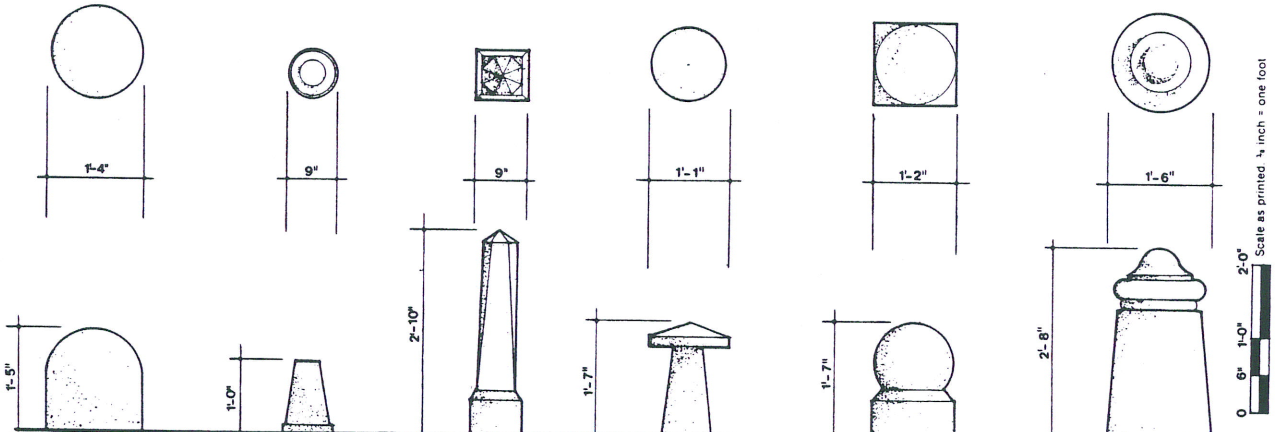
13 Piazza at St. Peter's
Rome, Italy granite

14 Piazza at St. Peter's
Rome, Italy granite


15 East Wing, National Gallery Washington, D.C.
16 John Marshal Park Washington, D.C. granite
17 Copley Square Boston, Ma. concrete
18 Street Bollard Cambridge, Ma. concrete
19 Street Bollard Cambridge, Ma. concrete
20 Harvard Square Cambridge, Ma. granite
The dimensions shown are taken from field measurements and may vary slightly from the dimensions on a particular bollard
21 Washington Square N. New York, N.Y. painted concrete
22 Custom House New York, N.Y. concrete and metal
23 South St. Seaport New York, N.Y. painted concrete
24 Fountain Plaza Cincinatti, Ohio granite
25 Christian Science Center Boston, Ma. granite
26 Boylston Ave. street bollard Boston, Ma. granite
27 Boston Public Library Boston, Ma. granite
28 Boston Public Library Boston, Ma. granite
29 Boston Commons/Beacon St. Boston, Ma. granite
30 Market St. San Francisco, Cal. granite
31 Justin Herman Plaza San Francisco, Cal.
Scale as printed: ⅛ inch = one foot
0' 6" 1'-0" 2'-0"



32 Street Bollard, Paris, France, granite
33 Orly Airport, Paris, France, concrete
34 Bridge at Invalide, Paris, France
35 Palace Entry Court, Versailles, France
36 Palace Entry Court, Versailles, France
37 Grand Trianon Courtyard, Versailles, France



38 Kew Gardens, London, England
39 Greater Dixter, East Sussex, England, concrete
40 Street Bollard, London, England
41 Roadside Bollard, Buckinghamshire, England
42 Blenheim Place, Woodstock, England, granite
43 St. Paul's Cathedral, London, England, granite

larly granite, makes it ideal for bollards. Due to the high costs of stone, both pre-cut and *in situ* concrete are popular bollard materials, but their surfaces frequently show the abuse of vehicular impact. The denser, harder surface of cast stone is a viable, but not always inexpensive, alternative.

Costs

The bollards illustrated here would vary from approximately $150 to almost $2000 each if constructed in a light-colored granite. This would not include shipping and installation costs. A dark fine-grained stone, such as a black Pennsylvania granite, could almost double the costs of the more intricate designs which are difficult to cut in the harder, darker granites. The least expensive shapes are the flat-topped squares and cylinders. A spherical top (Illustration 9) would add approximately $100, and an indentation (Illustration 10), another $50.

Illustration 1 would probably be the most expensive due to both its large diameter and number of indentations. Because some manufacturers' lathe equipment cannot accommodate a larger-diameter cylinder, larger diameters are hand-cut, increasing the costs. Some quarries may have a standard size of core cylinders as a by-product of the quarry operation. Using these cylinders can result in substantial savings. Of course, the taller the bollard, the higher the costs, but usually not as high as the costs of handwork.

A negligible economy is realized by specifying a great number of identical bollards in granite because each one is manufactured separately. However there can be considerable savings in a sizeable order for a particular precast or cast stone bollard. A few precast bollards of simple shapes are available from furnishing suppliers at very reasonable prices.

Precast concrete, particularly with exposed aggregate, is difficult to form into the complex shapes of most bollards. Cast stone can effectively accomplish many of the illustrated shapes. It is made from fine aggregates and colored portland cement that consolidate under intense vibration (the topic of a future column).

The bollards illustrated on these pages have been drawn from field dimensions collected in the past five years. Ideally each would also have an accompanying contextural shot with an evaluation of their appropriateness. They are not presented for imitating, but for thinking about the variety of size and shape possible. Although metal bollards are not included, they offer an additional range of possibilities which should be considered. Each may be the perfect solution for some locations, but totally inappropriate for others. Look for and remember the effective usage of these and other bollard sizes and shapes. It is time that we take notice of when bollards are a positive addition to the landscape and curtail our indiscriminate applications of this delightful and functional urban furnishing. ■

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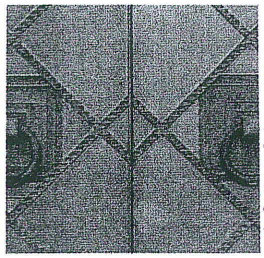
(Continued on page 112)

ORNAMENTAL METALS

Cast Bronze, Brass, Lead and Aluminum ☐ Iron is the metal most frequently cast into landscape architectural ornaments and furnishings, but castings in bronze, brass, lead and aluminum offer appropriate alternatives for many installations. Although all metal products are heated at some point in their manufacture, cast metals are those that are heated to a molten state and then poured into molds to achieve their final shape. They are cast in permanent molds, sand molds, die molds or by the lost-wax method.

Casting has been used successfully since ancient times to produce both utilitarian and decorative artifacts. Today, metal casting presents untapped opportunities for introducing a rich variety of ornament into our landscapes.



MICHAEL SELIG

Opposite and above: Cast aluminum doors at the Department of Justice, Washington DC

BY LINDA JEWELL

Cast Bronze and Brass

The use of these copper-based metals dates from at least 3000 B.C. in Egypt, where they were used in utensils, coins, weapons, statuary and even drainage pipes. Although the terms "bronze" and "brass" have been used interchangeably throughout history, bronze is defined as an alloy of copper and tin, while brass is an alloy of copper and zinc. Bronze is generally more expensive than brass, but its fluidity and ability to retain an impression from intricate molds make it a better choice for sculptural casting than brass. Ancient bronze contained 67 to 97 percent copper, with small amounts of zinc and lead in addition to the tin. "True" bronze, a term popular in the 1930s, designates an alloy with approximately 90 percent copper and 10 percent tin. Today, most bronzes are not "true," but contain zinc, lead and traces of other elements.

The recent development of numerous copper alloys has further blurred precise definitions. Commercial bronze, naval brass, Muntz metal, clock brass and architectural bronze are just a few of the names one might encounter when investigating copper alloys. The Copper Development Association has developed a nomenclature system that defines "brass" as any copper alloy in which zinc is the main alloying element and "bronze" as any copper alloy in which the predominant alloy is any metal other than zinc or lead. "Nickel silvers" are alloys that have a mixture of copper, nickel and zinc. "High brass" and "high bronze" indicate that the alloy contains 94 to 99.3 percent copper.

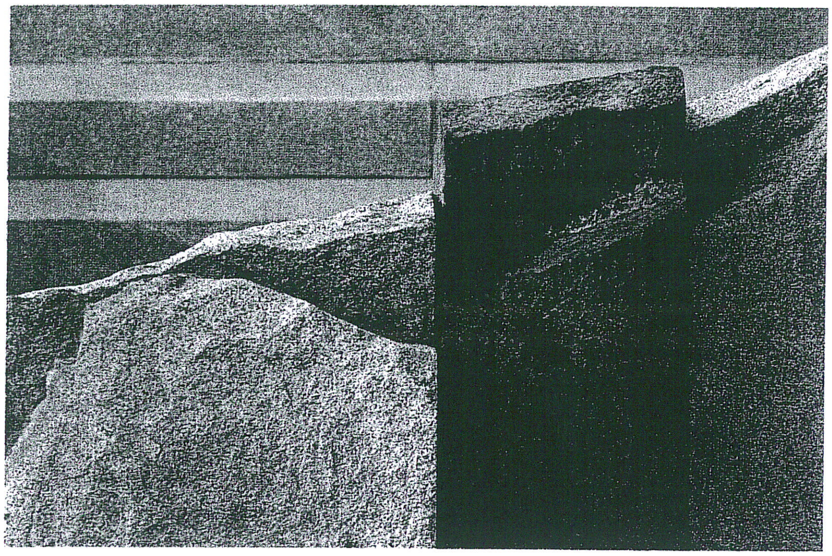
The American Society for Testing Materials (ASTM) has designated arbitrary numbers to some alloys and specified their precise matallurgic contents. One frequently used, "statuary bronze," contains 91 percent copper, 5 percent zinc, 3 percent silicon and 1 percent tin. Another "statuary bronze" is a metal containing 97 percent copper, 2 percent tin, and 1 percent zinc. The addition of zinc produces a sharper casting with fewer occurrences of "blow holes" from small gaseous bubbles popping through the surface during the pour. Lead makes a casting easier to cut and nickel makes it tougher. Because of these different casting characteristics, foundries vary in their preferences for one alloy over another.

Color and durability, rather than a detailed understanding of the metallurgy, are the concerns of the designer, who should rely on samples and in-place examples rather than on names or metallurgy. Bronze varies in color from reddish in alloys of mostly copper to orange-yellow in those with less than 90 percent copper. Brasses vary from silvery whites and light yellows to golden browns. The oxidation process of bronze and brass results in a coating that turns greenish brown, then black. This patina offers protection from further corrosion, but it can be destroyed by chemically polluted rainwater, bird droppings, snow removal salts and other urban pollutants.

Brass may contain from 5 to 95 percent copper and from 5 to 45 percent zinc. Alpha brasses are typically 95 percent copper and 5 percent zinc; Beta brasses are 55 to 65 percent copper and 35 to 45 percent zinc. Leaded brasses are Alpha and Beta brass to which lead is added to increase fluidity while decreasing its strength. Number 6A leaded yellow brass contains 72 percent copper, 24 percent zinc, 30 percent lead and only 1 percent tin. "Architectural bronze" is actually a leaded brass containing 57 percent copper, 40 percent zinc and 3 percent lead.

Nickel silver contains at least 50 percent copper, 5 to 30 percent nickel, and 10 to 35 percent zinc. During the 1920s and 30s, nickel silver (or "white brass") and nickel bronze were two of several copper alloys popular for Art Deco castings of doors, grills, elevator doors, light fixtures and other metal ornament. A broad range of colors was produced by varying slightly the constituent metals to produce striking combinations of pale yellow, silvery-green, light blue, and pink-toned metals. Unfortunately, today only a white-colored alloy of nickel silver is readily available for casting.

Bronze and brass are usually cast either in sand molds similar to cast iron or by the *cire perdue* or lost-wax method. Brass is sometimes die cast—a method by which metal is forced under pressure through a die, resulting in a smooth surface. The lost-wax method, used since ancient times, is preferred when a casting requires numerous small undercuts or intricate detail. It continues to be the method used by most artists producing single pieces.



ANTON GRASSL

Bronze inset in a stone sculpture at Porter Square in Cambridge, Massachusetts, demonstrates green patina of bronze.

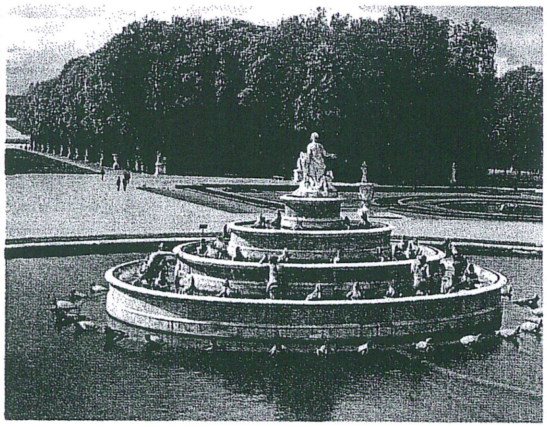
In the lost-wax method an original model of sand, clay or plaster is fashioned slightly smaller than the desired final casting. Next, a thin layer of wax is applied and shaped over the original model. A moist mixture of plaster of Paris and brick dust, fired plaster or other heat resistant material is applied over the wax. This larger mold is then fired and hardened in a kiln. The heat melts the wax and leaves a void between the original model and the outside plaster. Molten bronze (at approximately 1700° F) is poured through a spout to fill the voids (typically 1/8 to 3/8 inch thick) left by the melted wax.

Bronze cools quickly. If the form were poured in a solid mass, it would cool unevenly, resulting in an unpredictable finish. A high-quality casting should therefore be no thicker than structurally necessary so that it hardens quickly (usually in less than 10 minutes). Unfortunately, modern foundries tend not to cast as thinly as the great foundries of the past. The well-known Roman statue of Marcus Aurelius is only 1/8 inch thick.

Today a landscape architect can work either with a bronze foundry that specializes in sculpture for artists or with an industrial foundry that produces everything from motor parts to decorative plaques. An industrial foundry produced the beautiful spigot-fountain for Seattle's Occidental Square, designed by Ilze Jones, ASLA, of Jones & Jones. For this casting, the landscape architect first completed full-scale drawings of the proposed spigot in sections and elevations. From the drawings, a pattern maker crafted a wooden model that was then modified by the designer before the final pattern was produced. Although the project was handled through a normal bidding process, the front-end investigations into local foundries by the designer provided the general contractor with the background information necessary for economical pricing.

Cast Lead

"Bronze is the metal of the grand manor, a fitting substance for kings. Lead has a lower place, but can take on a gentle dignity and simplicity...it has a gentle unobtrusive quality which harmonizes with the domestic air of gardens." —Sir Lawrence Weaver, 1909, in *English Leadwork: Its Art and History*



INT'L STOCK PHOTOGRAPHY

Fountains at Versailles feature lead statuary.

Lead is the heaviest of the common metals (786 lbs. per cubic foot), but it can be dented with a fingernail. Lead's malleability, frequent and accessible deposits, and low melting point (62° F) has always meant that it is more easily cast than other metals. In fact, small figures can be cast with heat from a kitchen range. Lead typically does not have the sharpness of bronze, but it possesses an inherent softness in color and form that can be advantageous for many applications. The finest lead work produces objects that reflect its malleable quality, as though they were designed in soft clay rather than carved in stone.

An Egyptian statuette dating from 1600 B.C. attests to the permanence of cast lead. Historical records indicate that the floors in the Hanging Gardens of Babylon were covered in lead, and the Chinese used lead as money in 2000 B.C. The Romans used lead for water piping systems, and the English continued its use in decorated down spouts, leader heads and cisterns. Artisans who built the decorative piping systems became known as "plumbers" (from the Latin *plumbum* for lead). In the 19th century, however, concern over lead poisoning terminated the continued use of lead for cisterns and pipes.

Cast lead is probably best known for its use in garden statues, vases and planters. It is as durable as bronze but much less expensive. Resistant to corrosion, it does not require painting, and weathers to a silvery-gray patina, an excellent color for gardens. A high point of its use in the landscape was in the garden sculptures at Versailles, including the statues and vases at the Basin of Neptune. Much of the Versailles lead work was originally gilded, but it later weathered to the natural surface of lead, which many consider an advantage.

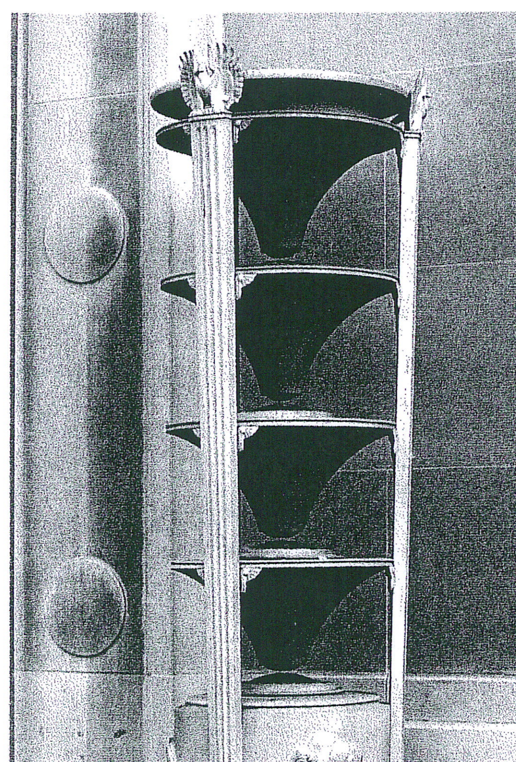
It is the English who have consistently produced the greatest variety of high-quality lead garden ornaments and statues since the 17th century. Significant English gardens, including Hampton Court, Castle Hill and Rousham, included stock patterns of full-size figurative sculptures from the 18th-century sculpture yard of John Van Nost. Lead copies of gladiators, Greek gods, lions, deer, the Sphinx, gigantic vases and even full-size cows were reinforced by iron supports or a plaster base, due to the low tensile strength of lead and its tendency to sag under its own weight. From 1739 to 1787, noted artists John Cheere and Sir Henry Cheere took over the Van Nost yard and produced such beautifully crafted lead sculptures as the memorable River God at Stourhead.

Fewer significant examples of English lead were produced during the 19th century, when cast iron became popular. However, W. R. Leathaby's 1883 book *Leadwork Old and Ornamental and For the Most Part English*, as well as several articles in *Country Life* magazine, revived interest and insured production into the 20th century. Small-scale English lead works continue to produce high-quality ornaments that are available from a number of American suppliers and distributors.

Historic pieces serve as precedents for most of the ornament available today. Because new patterns are easily made from existing castings, the original model might well have been sculpted several hundred years ago. Therefore, the same cupid or frog is often produced by several manufacturers, although the quality might vary greatly due to the care in producing the pattern, the quality control of the the casting, and the finishing. Florentine Craftsmen of Long Island City, New York, has been manufacturing quality lead ornaments since the 1920s. Their catalog

INT'L STOCK PHOTOGRAPHY

Statues and vases at the Basin of Neptune (Versailles) represent a high point in the use of lead in the landscape.



MICHAEL SELIG

Aluminum lamp at the Department of Justice

JONES & JONES

includes hundreds of urns, vases, cupids, ducks, dolphins, falcons, frogs, lions, Greek gods and other traditional sculptures similar to those produced in the 18th century. Southern Statuary of Birmingham, Alabama, also offers a diverse inventory of ornaments. Both companies are willing to work with designers to develop new patterns, although the costs are often prohibitive unless a number of copies are to be made.

Today lead ornaments are most frequently cast in permanent molds of aluminum or bronze, although at least one manufacturer is experimenting with elastomer-lined fiberglass—a possibility due to lead's low melting point. Because pure lead is so easily dented by handling, 5 to 7 percent antimony is usually added to the raw metal for greater hardness. Lead can be soldered with a blowtorch and the joint easily hidden by filing. This technique allows the casting of small sections that can then be quickly assembled into the final piece, avoiding the difficulty of handling large quantities of molten metal and the uneven cooling of large pours.

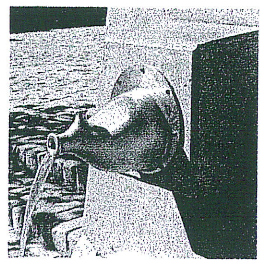
Lead is toxic if ingested in vapor or dust form. Most of the lead used for casting has been recovered from scrap metal, particularly from car batteries, because concern for its toxicity prevents it from disposal in landfills. Both air-quality legislation and OSHA standards maintain careful controls for ventilation systems and safety procedures. Landscape architects should avoid using the material in environments where children might play on lead objects and risk ingestion of this toxic metal. Lead is stable, so its risk of contaminating the adjacent environment is negligible. The lime used in Portland cement, however, can cause lead to disintegrate, so lead castings should not come in contact with uncured concrete or mortar.

When a lead casting emerges from its mold, it is a bright silver color. Today many new lead castings are painted quickly, to give the figure an image of age. Allowing the lead to oxidize to achieve its natural patina takes better advantage of its inherent beauty. Although a few months in the open air put lead well on its way to a weathered patina, methods such as dipping in acid, burying in soil or tea leaves, or any exposure to moisture will hasten this natural process.

Cast Aluminum

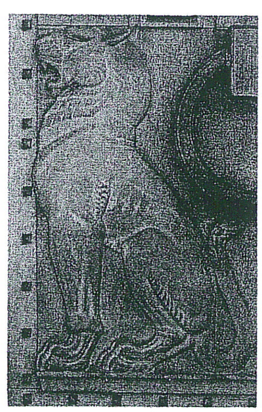
Aluminum is one of the most abundant elements on earth, but it was considered a rare metal when a 100-ounce triangular casting of it was placed on the tip of the Washington Monument in 1884. It was available only in minute quantities until 1886, when an efficient method of separating it from mineral compounds was developed. It was still not used extensively for architectural components until the 1920s, when ornamental railings, cast spandrels and grill work began to appear. Only a few of the numerous aluminum alloys are used for casting architectural ornament. These generally are more than 90 percent aluminum

MICHAEL SELIG



Bronze spigot designed by Ilze Jones, ASLA, was produced by an industrial foundry

Detail of aluminum relief at the Department of Justice



and contain either silicon or magnesium or both.

The raw metal for aluminum casting is more expensive than cast iron, but the lighter weight means lower shipping costs and easier on-site construction. A typical aluminum light pole would weigh 150 lbs. in cast aluminum and 450 lbs. in cast iron. This lighter weight means that the fixture can be installed without a crane or other heavy equipment. It also enables the pole manufacturer to paint or finish the fixture before it arrives on the site, since there is less chance of surface damage during installation. Recent shipping of aluminum castings from Mexico has also made aluminum fixtures more competitive with iron for some ornaments.

Die casting is used for small, smooth-surfaced aluminum objects such as hardware and fasteners. Sand molds are usually used for casting aluminum into figurative ornaments and furnishings, which are often produced by cast-iron foundries. However, an aluminum casting requires only 1200 to 1400° F rather than the 2700° F required for iron.

The light weight of aluminum has made it a particularly logical replacement for traditional iron outdoor furnishings. Although the weight of an iron bench is a distinct advantage to insuring that the bench remains where placed, tables and chairs usually benefit from the light weight of aluminum. Unfortunately, most manufacturers are continuing the same traditional designs intended for cast iron, rather than developing new ones for the lighter metal.

Aluminum is more corrosion-resistant than iron, but it is susceptible to deterioration from salt and some air pollutants. Because it is more difficult for paint to adhere to aluminum, the metal must be acid-etched or treated before it is painted. Although aluminum does not need to be painted for protection from corrosion, some finish is usually desirable, as the bright silvery color is quite harsh for most applications.

Aluminum castings can hold sharper and more intricate detail than iron. It is easy to file or mechanically finish aluminum after casting to achieve very smooth or textured surfaces.

Future Design Opportunities

The applications for cast metal in landscape architecture should include more than the occasional location of a lead ornament or the routine specification of a standard light fixture and drainage grate. We should experiment with new ways to use off-the-shelf stock items, as well as investigate the feasibility of new castings with images that convey a spirit of our time.

At Atlanta's Rio Development, Martha Schwartz, ASLA, found an unusual application for an off-the-shelf cast concrete frog. (The same frog is available in cast iron and lead and is modeled from a Versailles frog.) She has placed 350 of the frogs on a grid, with each one oriented toward a gigantic vine-covered orb. The result is a rather spiritual reverence for the green globe, and a new role for this ubiquitous garden ornament in a commercial landscape.

With the notable exception of the machine-age ornaments of the 1920s and 30s, we continue to rely primarily on recycled 17th-century ornament in our built environments. Although a respect for history is admirable, we should more frequently take our cues from projects like Occidental Square, which benefited more from the identity of its bronze spigot than it would have from a Roman lion's head spitting water.

Manufacturers are usually willing to work with designers and artists to create new artifacts, particularly when multiple copies are needed. However, it takes commitment, time and persistent investigation to develop alternatives to the Louis XIV frog or the Victorian lamppost. ■

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Next month LANDSCAPE ARCHITECTURE looks at the design and planning challenges posed by botanic gardens and arboreta; reports on important recent work in zoo design; and highlights urban design and landscape reclamation in France.

PRODUCT NEWS

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CONSTRUCTION

By LINDA JEWELL

Alternatives to Channelization

Almost every city and town has miles of creeks that have been channelized or buried in culverts. But channelization is environmentally damaging and extremely expensive. The economical alternative — stream restoration — reduces flooding and minimizes stream bank collapse. Restored urban creeks also provide visual and ecological advantages.

Stream geomorphology

Water in natural alluvial streams has both a primary, forward flow and numerous secondary flows which vary in direction and velocity. Obstructions constantly redirect these secondary flows, causing banks to scour. *Meanders* occur at lengths approximately seven to ten times the channel width, reducing the stream's velocity and erosion.

Under normal conditions, a meandering stream alternates between riffles and pools. *Riffles* (high areas) collect sediment at high flow and are scoured at low flow. *Pools* are located at bends and are scoured at high flow and collect sediment during low flow. Sediment deposits on the inside of meanders are called *point bars*. Equilibrium is maintained as natural streams alternately erode and deposit their beds. Cross-sectional changes are significant.

This equilibrium is disturbed by channelization and increased run-off in urban areas. Banks erode, pool sediments increase, and riffles scour. The pool-riffle sequence is lost. This limits the diversity of water velocities and aquatic habitat. The channel becomes shallower and wider — as much as three times its original width.

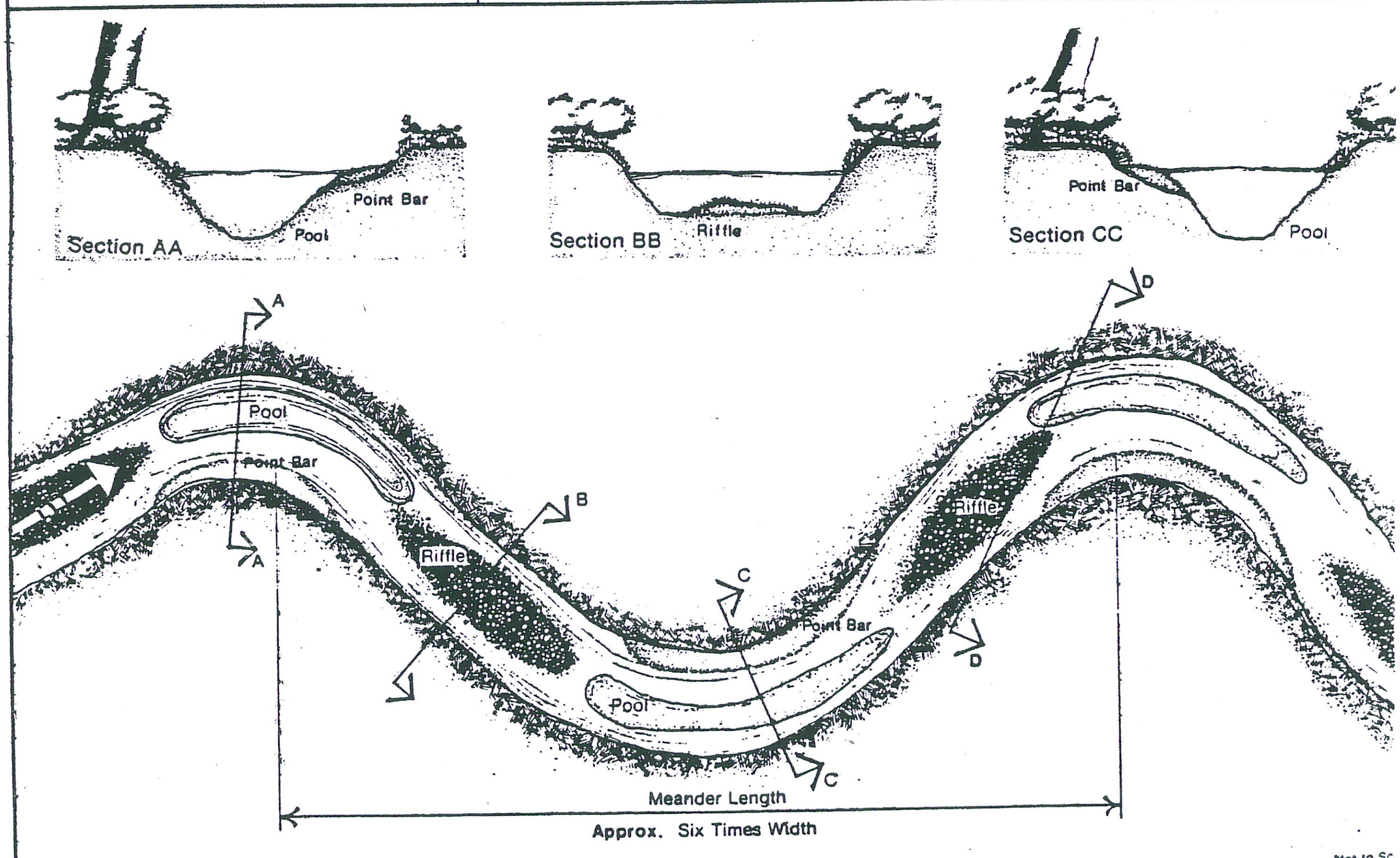
Case study

North Carolina's Mecklenburg County began to restore its streams in 1975. Since then, 9.5 miles of disrupted streams have been restored at a cost of $4-25 per linear foot. When possible, existing stream alignment, bed slopes, and vegetation are preserved as banks are reshaped and stabilized. Despite several heavy rains — including a 10-year storm — restored sections have experienced few significant bank failures.

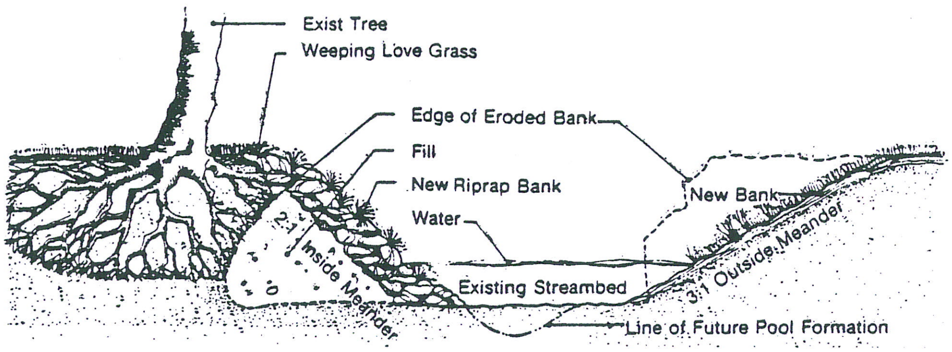
Mecklenburg County's procedures were developed by Nelson Nunnally of the UNC-Charlotte Department of Geography and Earth Science. The procedure (1) determines expected land use; (2) locates structural protection for banks in areas of potential scour; and (3) preserves existing trees and specifies new vegetation to stabilize banks.

Cross section

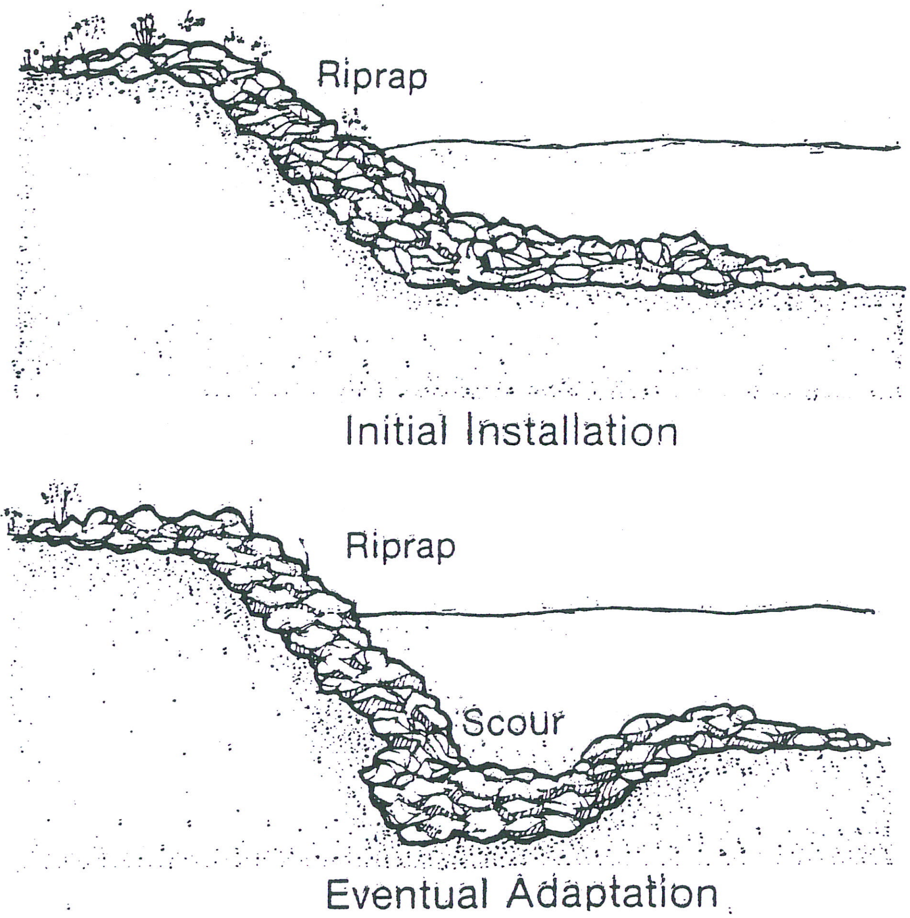
Unstable banks on straight reaches and outside meanders are adjusted to a 2:1 slope; a 3:1 slope is used for inside meander banks. The cross-sectional area



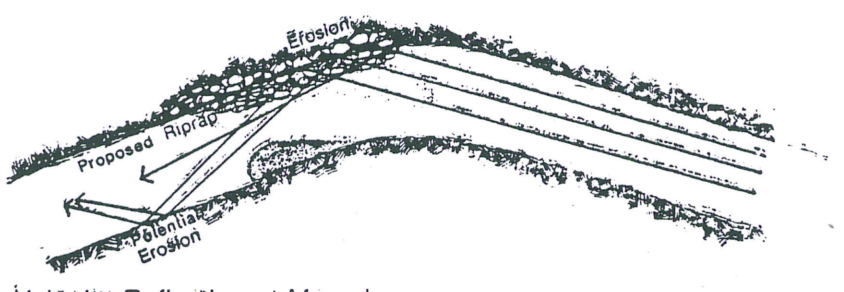
Natural Stream Meander and Sections



Meander Fill Slope at Tree



Toe Slope Protection



Velocity Reflection at Meanders

Not to Scale

advantages of using geomorphic processes in stream improvements. Most banks have remained stable, and annual surveys have revealed only slight changes in the geometry of cross sections. In one 2000-foot reach of stream with no previous pools, 15 new pools formed at intervals similar to natural streams. Visual quality and bank erosion problems have also been improved.

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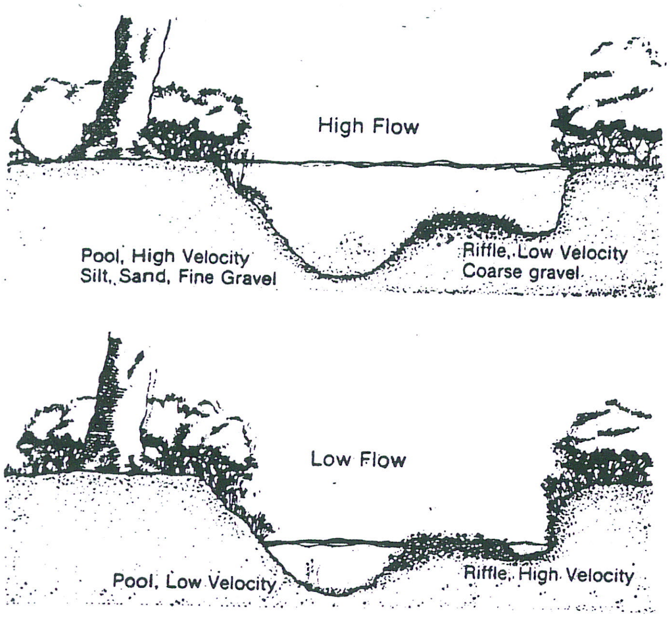
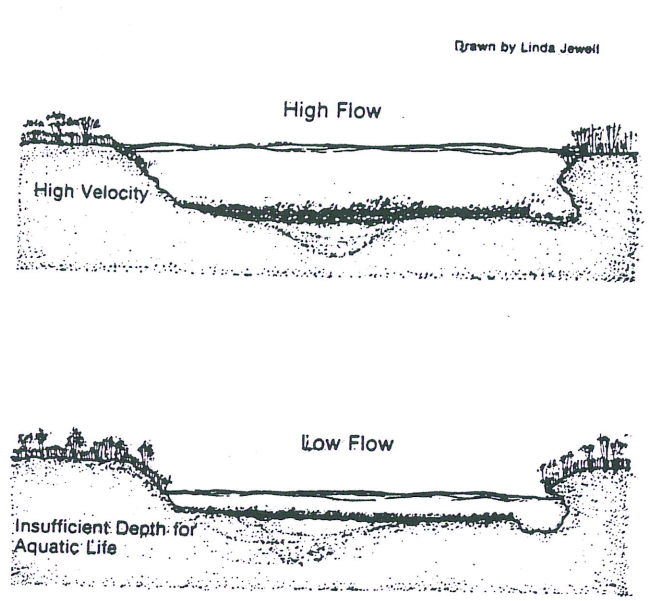


Natural Stream Sections DD



Urban and/or Channelized Stream Sections

Not to Scale

'A) is determined for expected and use; width is adjusted for A ınd the 2:1 side slope (larger vidths for meanders). When ɔossible, existing depth and banks remain.

..though there are no totally eliable equations which deternine cross-sectional areas, the ɔllowing method can be sucessfully employed. First, the tream's existing cross-sectional reas are measured; three other ross-sectional areas are estiıated from data on the stream's xisting morphology. The largest these four cross sections is ıen used in restoration.

stimating A

ethod 1 assumes that the domiınt flow which forms stream ctions is the bankfull event hich recurs every 1.5 to 2 ars. Therefore the discharge) of a two-year storm is timated for the expected land e. The channel cross section) is related to Q in an equation sed on data (Dunn and opold) on the relationship beeen bank-full discharge (Q) d the cross-sectional area of isting streams.

$$A = .86Q^{.81}$$

..od 2 uses data (Hammer d Dunn) on the relationship of ınage areas (D_a) to the cross-sectional areas (A) of urban streams. An approximation of the required cross section can be determined by the following.

$$A = 51.2D_a^{.44}$$

Method 3 uses an enlargement ratio (R) [illegible]d on data on stream enlarg[illegible]t from different land uses (Hammer). This ratio is used to modify the relationship of rural stream cross sections (A) to the drainage area (D_a). (Enlargement ratios are usually 1:3.)

$$A = R24.5\ (D_a)^{.66}$$

Structural protection

Bank sections exposed to erosive shear stresses should be protected by structural methods: riprap, woven vegetative mats, gabions, or lattice block. A.D. Taylor wrote (1929) that "Riprapping...lends itself particularly to the control of bank erosion in streams." Riprap has also been Mecklenburg County's choice.

Several studies of velocity distribution indicate protection from scour is needed on the outside bank of a meander. Sometimes opposite banks of a sharp meander also need protection.

Yet costs and aesthetics limit the use of riprap. Rather than protect a vulnerable toe slope with the costly method of extending riprap below the streambed, layers of riprap are extended into the stream. This riprap becomes buried as the bed and bank are scoured during high discharges.

The standard procedures for sizing riprap required stones of up to two feet in diameter. Smaller stones (usually 6-12 inches) have been found to be more stable, even in high discharge areas (1500 CFS for two-year storms). Smaller stones are also easier to install and cover with vegetation, and can be replaced by hand.

Vegetation

Since the roots of hardwood trees can protect a length of bank approximately five times the diameter of the tree, careful field surveys determine whether a tree remains. Rather than remove a tree, banks are often built out into the stream: although these fill slopes require immediate riprapping, they remain stable. Exposed banks and floodplains are quickly stabilized with weeping love grass or tall fescue. Maintenance of seeded areas and the removal of fallen trees is an important part of the program.

Assessment of techniques

The Mecklenburg County program has demonstrated the

'Keeping the boys busy':[1] Outdoor theatres of the Great Depression: On-site, incremental design gives form to the complex relationship of site and structure

LINDA JEWELL and STEVE RASMUSSEN CANCIAN

In most cases today, every detail of new construction in public landscapes in the United States, from the location of walls to the joints in pavement and the size of bolts, is drawn and specified on computer screen or paper before ground is broken. Building contractors then construct the project from the designer's detailed drawings. During construction, the designer's role is limited to attending periodic job meetings where they attempt to insure that their original intentions are realised.[2] This separation of design and construction is a twentieth-century phenomenon. Throughout history, designed landscapes have been created through an incremental and interactive process of design, construction, observation and re-design. As construction progressed, both the partially completed improvements and the emerging intricacies of a site, such as an unexpected exposure of bedrock or a newly revealed vista, informed designers how to craft the relationship between the site and the design intervention. Variations of this process underlie our most influential landscape designs, from the great gardens of Italy, France and England to more recent icons such as Central Park and Dumbarton Oaks.[3]

While pursuing a study of American outdoor theatres, we discovered that park facilities built by the Civilian Conservation Corps (CCC), a work programme developed in the 1930s, were created through a process of concurrent design and construction. We found that these landscapes, developed under the extreme limitations of the Depression, are more engaging than most contemporary public landscapes. Our initial investigations suggested that the CCC's cyclical system of design and construction influenced the final form of these remarkable theatres. We wondered what role this concurrent design-build process had played in creating landscapes that produced such memorable experiences. To investigate further, we began by examining the origin and character of the CCC design-build process.

The Civilian Conservation Corps supply designers with an army of labourers

The CCC was one of two major job creation programmes enacted in response to the Great Depression of the 1930s. While the Works Progress Administration (WPA) employed skilled adults in many professions, the CCC employed mostly unskilled, young single men to perform a wide range of tasks. Franklin Delano Roosevelt's administration created the CCC at a time when 25% of Americans were unemployed and 50 million acres of once fertile land had been degraded by unsustainable farming practices. FDR intended that the CCC immediately put the maximum number of people to work conserving and restoring the natural environment, including the nation's parks.[4] In the words of Landscape Architect William Penn Mott, former Head of the National Park Service and alumnus of the CCC staff, the primary goal was 'to keep the boys busy'.

To get the boys working as quickly as possible, Roosevelt enlisted existing federal departments. The Labor Department selected and enrolled the men

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and the Defense Department set up a system of 150 — 200-person military-like camps near the work projects. The Departments of Agriculture and Interior, which included the National Park Service (NPS), chose the camp locations and projects, developed the plans and supervised the work. The work projects were approved and administered in six-month periods. Enrollees signed up for one six-month period at a time and, if allowed an additional enrollment period, were often assigned to a different camp. Middle-aged World War I veterans with skills as masons or carpenters made up 10% of the enrollees, while 90% were unmarried 'boys' between 17 and 23 possessing no particular skills. All enrollees were paid US$30 a month, US$25 of which went home to support their families. Local carpenters, masons and builders, known as Local Experienced Men (LEMs), trained enrollees at the work site with guidance from National Park Service and Forest Service supervisory personnel. From March of 1933 through June of 1942, the CCC enlisted 3 612 000 men as enrollees. At its peak in 1935, up to 28 000 supervisors operated in 2000 camps at any given time.[5] During the eight years of the programme, the recruits and supervisors together planted 2 billion trees, constructed 5 million erosion control dams, laid 122 000 miles of roadways, and built 45 000 bridges, 11 000 toilets and 4334 sewer systems.[6]

The CCC programme provided the Interior and Agriculture Departments with thousands of housed, fed labourers ready to fulfill their plans and visions. National Park Service (NPS) designers were particularly well positioned to take advantage of this opportunity. Through the 1920s, landscape architect Thomas Vint had built the NPS's Office of Planning and Design into a powerful administrative division, which created master plans and designs for national parks across the country.[7] This bureaucratic experience had prepared the NPS designers to use FDR's new federal programmes to implement their design visions. In 1933, when FDR created the CCC, Vint's office and the generation of designers it had trained were poised and ready to lead a massive design/build programme. With the skill of hundreds of thousands of labourers at their disposal, these designers created the structures and facilities symbolic of the park experience in the United States, including 1477 cabins, 16 897 acres of campgrounds and 7432 miles of park roads.[8]

Led by landscape architect Conrad Wirth, a group of designers established a separate structure (known as the State Park Program) within the NPS to oversee CCC work in all state and local parks. To supervise the massive number of simultaneous projects, Wirth divided the country into districts with each district overseeing the projects of approximately 50 camps.[9] He then devised a decentralised structure that allowed many timely design decisions to be made on site as the recruits worked. Aided by high levels of unemployment among design professionals, the state park programme recruited hundreds of well-trained landscape architects, architects and engineers to serve in three different capacities: (1) staff designers in district (later regional) offices who selected work projects, developed master plans, and designed and managed the projects; (2) senior design professionals who were hired as consultants to supplement the design work of the district offices and travel to sites as Project Inspectors'; and (3) Landscape and Engineering Foremen who worked with the recruits at the project sites on a daily basis.[10] All three groups were expected not only to provide design services, but also to maintain a constant flow of proposals for park improvements, so that enrollees always had work.

The Project Inspectors traveled from park to park, visiting each worksite once or twice a month for a day or two. These Inspectors, who were experienced and often well-known designers, worked directly with the more junior CCC Landscape Foremen who made day-to-day design decisions while supervising construction. Detailed monthly reports filed by the NPS Landscape Inspectors indicated that they were typically in the field more than 60% of their time and spent the balance of their days providing design services to the district office.[11] The reports identified design projects that needed further study and described the progress of construction, often with photographs.

Each park project was assigned a Landscape Foreman, an Engineering Foreman, and a Forestry Foreman to direct the recruits. The job description for a Landscape Foreman required that: 'The candidate must have graduated with a professional degree in architecture or landscape architecture from a school of recognized standing', although 'two years of practical experience may be substituted for two years of college work'. Duties included 'assist(ing) in the planning of the work by attendance at the staff meetings of the Landscape Architect in charge and by the preparation of such grading and planting plans as may be necessary for the proper execution of the work. Drafting room activities may be undertaken when the weather prohibits out-of-door work.'[12]

The seasoned NPS designers wanted the newly hired Inspectors and Foremen to become familiar with the tradition of park structures designed to harmonise with their sites.[13] To aid the new designers, Wirth's office oversaw the production of references depicting existing park construction 'in harmony' with their site in this tradition. Relying on examples from early CCC projects and older state and national park projects, Dorothy Waugh compiled the first two: *Portfolio of Comfort Stations and Privies* and *Portfolio of Park Structures*.[14] Waugh presented the examples in simple dimensioned drawings assembled in a loose-leaf binder.[15] In 1935, NPS Architect Albert Good published a more sophisticated and larger bound volume, *Park Structures and Facilities*, illustrated with photographs and beautiful ink drawings of each structure in dimensioned plans and sections. The initial 2000 copies were immediately in use by the Inspectors and Foremen. In 1938, the NPS published a more extensive 3 volume set: *Park and Recreation Structures*.[16]

Although the NPS design leadership wanted to maintain a consistent design approach where structures harmonised with their landscape in the national parks, the State Park Program allowed greater design latitude while addressing a broader range of recreation-based facilities.[17] These parks did not typically have a backlog of design proposals awaiting construction as did the National Parks. Consequently, the imperative to begin work immediately and keep people busy meant that construction on State Park Projects often began with no more than a conceptual diagram.

As the CCC programme matured, local agencies retained their own design staff and consultants to develop design proposals, but they were still required to apply for new funding every six months. Because approval for a new six-month period of construction was often not finalised until the end of the previous period, agencies frequently postponed the start of detailed design drawings until just before beginning construction.[18] This usually led to an incremental design-build process. To obtain approval, a district inspector or a local designer generated a conceptual proposal or a design for an initial element such as a road, a stage or the rough grading of the site. Upon approval, the CCC Landscape Foreman would then direct enrollees to begin basic work, including the collection of local stone, timber and other at-hand materials for use in the projects. As materials were collected and construction progressed, the Foreman would adjust the original proposal in the field or, if necessary, would draft proposed changes at the camp's office. The district inspector would visit the site once or twice a month to review progress with the foremen and workers, give them direction on design and then report any concerns about the quality of design or workmanship to designers in the district office. As completion of a six-month funding period approached, the cycle would begin again on another portion of the project.

On complex projects or on projects identified as having design problems, the inspector or a designer from the district office might develop more detailed design drawings to be implemented by the Foreman. After 1936, when much of the design work for CCC projects was shifted to local agencies, a local design consultant, rather than the NPS employee, would usually prepare additional construction drawings as needed by the foremen and submit them for NPS approval. In either situation, the funding-and-construction process dictated that the designers develop schemes incrementally as construction progressed. By the time a project was complete, detailed construction drawings would either have been created piecemeal or have become moot.

CCC outdoor theatres: A classic typology modified by onsite design

Although the state park's programme allowed more design flexibility than National Park projects, it primarily built functionally defined structures — roads, walls, fire towers, fireplaces and picnic facilities.[19] However, if a park plan included an outdoor theatre, it often presented senior designers with the opportunity to apply their previous experiences in designing theatres for estates and civic spaces. These theatres from the 1910s and 1920s had been based on Beaux Arts era studies of classical precedents and had nearly always been symmetrical expressions of a theatre's distinct spatial form — a performing space that must be seen and a gathering space where one can see and hear the performance. When these same designers worked within the NPS directive to harmonise with the local landscape and utilise nearby materials, they proposed schemes that adapted the theatre's classic geometry to reflect a site's natural features and geographic locale. Then, as the theatres took shape, the Foremen, with guidance from the Inspectors, made field adjustments to accommodate ravines, rock formations, vegetation and topography. As a result, each theatre varied significantly in configuration and materials to become place-specific variations on the earlier Beaux Arts models.

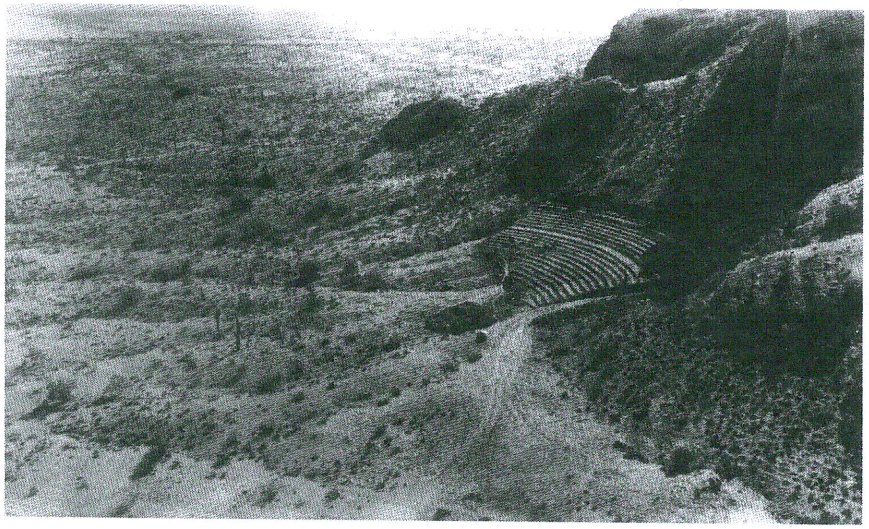

FIGURE 1. *Arizona's Papago Park Theater (National Archives, NA).*

FIGURE 2. *Berkeley's John Hinkle Park, constructed in 1933 (Anton Grassl).*

FIGURE 3. *Boulder's Flagstaff (Sunrise) Theater (L. Jewell).*

Examples of CCC theatres begun early in the CCC programme include: Arizona's Papago Park Theater (figure 1); Berkeley, California's John Hinkle Park (figure 2); and Boulder, Colorado's Flagstaff Theater (figure 3). The NPS inspector's reports indicate that these theatres were constructed from quite abbreviated drawings and utilised materials gathered from nearby sites.[20] Native stones were collected for Papago and Flagstaff, but the Berkeley theatre, located in an urban neighbourhood, was constructed from concrete rubble salvaged from an old roadbed. The schematic plan completed by S.R. DeBoer for Flagstaff Theater (figure 4) is representative of these design proposals. DeBoer, a landscape architect best known for his contributions to Denver's classically inspired, City Beautiful improvements, worked as an inspector for NPS in 1933–1934.[21] While designing a road for Boulder's Flagstaff Mountain Park, he decided that the top of Flagstaff Mountain needed a destination feature,[22] a classically symmetrical amphitheatre that was eventually built from rugged local stone (figure 5).

DeBoer's drawing delineated a semicircular plan, but it included no dimensions, no section, no detailed topographic changes or an indication of seat heights. Although DeBoer later prepared an illustrative section for Good's book, our field measurements indicate that both DeBoer's plan and

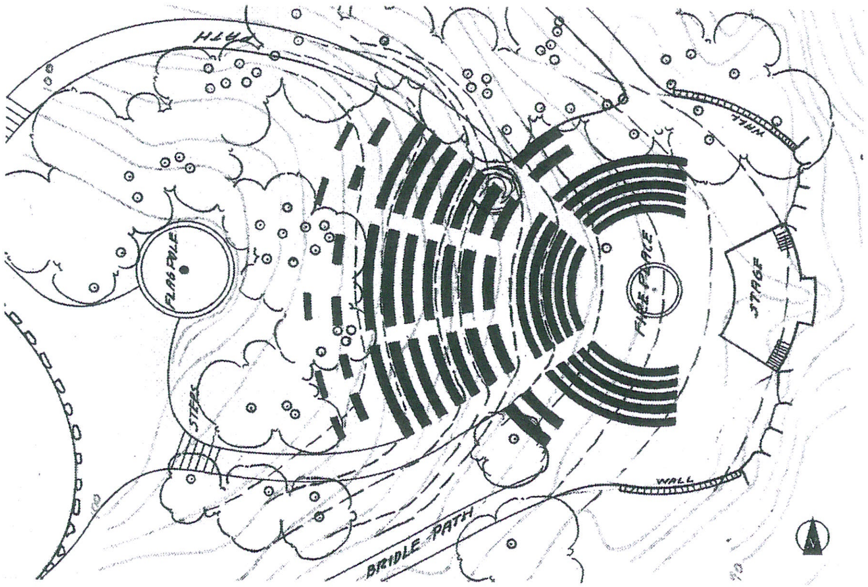

FIGURE 4. *S.R. DeBoer's schematic for Boulder's Flagstaff Theater (Denver Public Library, DPL).*

FIGURE 5. *Enrollees mortar local stone at Flagstaff (NA).*

Good's published drawings differ from what was actually built. Freestanding seats became retaining walls; the back rows were built at a steeper rake than the front and a portion of the original semicircular seating plan was eliminated to avoid steep slopes. The inspector's reports indicate that these design decisions were made in the field with no additional drawings.

In 1934, the CCC also began construction of the 6000-seat Mt. Tamalpais Mountain Theater (figure 6) designed by San Francisco landscape architect Emerson Knight.[23] Knight, who became a NPS inspector in 1934, had generated a conceptual plan drawing for the theatre in 1924, and in 1929 he oversaw construction of a single row of seats at the site. Knight, working in the field with the CCC Foremen, realigned his proposed geometry without additional drawings.[24] In contrast, Denver, Colorado's Red Rocks Theater (figure 7) was constructed from more than 125 sheets of schematic studies and detailed construction drawings, but, unlike today's method of completing drawings before beginning construction, the Red Rock drawings were produced piecemeal from December 1935 until early 1941 while the theatre's construction progressed.[25] In 1935, Burnham Hoyt produced a schematic design for the 10 000-seat facility to obtain CCC funding.[26] Then, a more junior architect, Stanley Morse, produced the detailed drawings incrementally as each six-month funding period was approved. Morse, on Denver's payroll while working under Hoyt's direction, visited the site each morning and returned to his city office to produce study sketches and construction drawings for immediate use on the site.[27] In Morse's words: 'The layout plan for the entire theater was not actually completed until the construction was completed. A work sheet at scale 1′ = 20′ contained most basic information and designs developed by me for the project, and was finally traced when the project was nearing completion.'[28]

Mount Tamalpais and Red Rocks were two of the prime examples of the complex and engaging landscapes created by the CCC's cyclic design-build process. Fortunately the NPS inspector's reports and the papers of the designers provide a substantial written and photographic record of how these landmark landscapes developed.

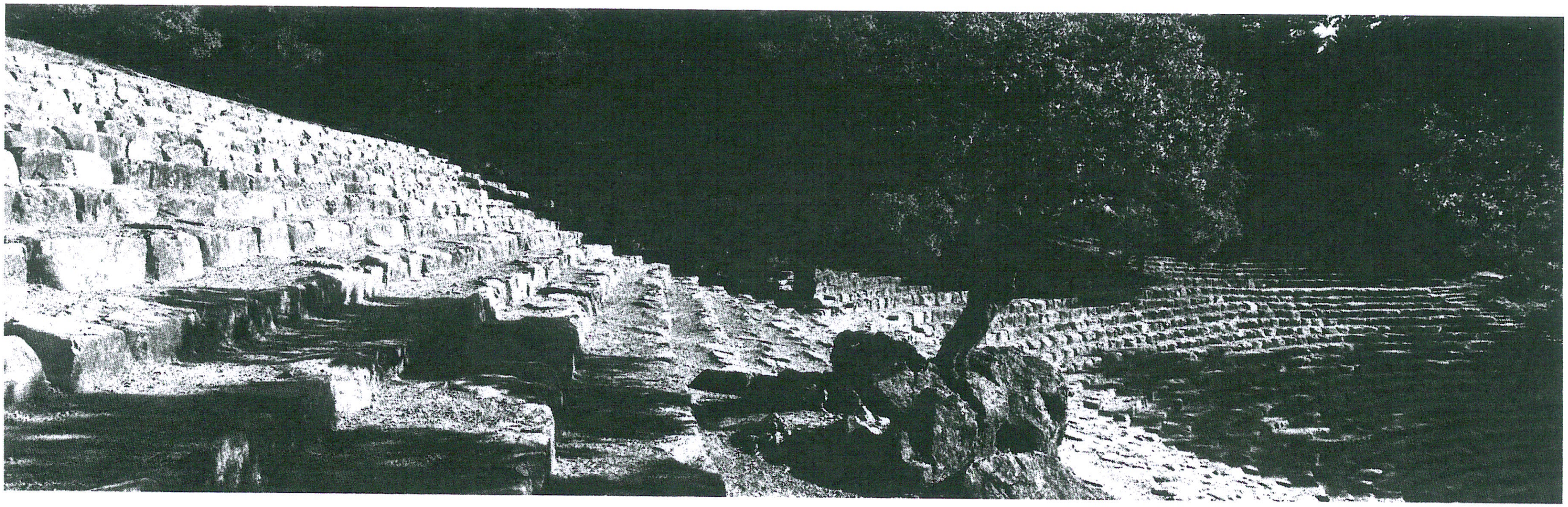

FIGURE 6. *Mt. Tamalpais Mountain Theater today (Anton Grassl).*

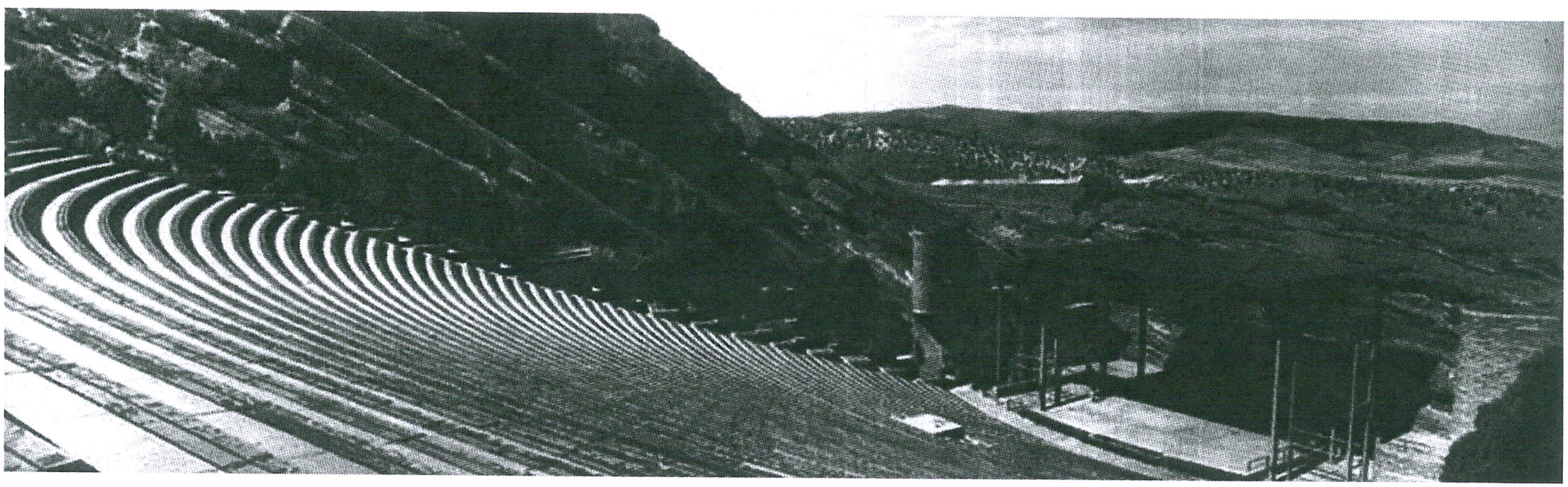

FIGURE 7. *Red Rocks theater today (Anton Grassl).*

Constructing the Red Rocks Theater

Nestled above the plains in the Front Range of the Rocky Mountains, Red Rocks Theater provides a 200-mile panorama of the surrounding landscape and an inspiring view of the Denver skyline. Featuring exceptional acoustics, this 60-year old theatre remains one of the most popular performance venues in America among artists and audiences.[29] The space was first created more than 200 million years ago when volcanic movement forced enormous sandstone ledges up through a prehistoric ocean floor to form the 'walls' of the theatre. Sightseers began visiting the site in the 1870s. By 1910, developers proposed a grand theatre between the sandstone formations and sponsored musical events on a wooden stage (figures 8 and 9).[30] Famed soprano Mary Garden sang amongst the rocks in the 1910s and commented:

> Never in an opera house, the world over, have I found more perfect acoustic properties than those under Creation Rock. . . . I predict that someday twenty thousand people will assemble there to listen to the world's greatest masterpieces.[31]

FIGURE 8. *1910. Through the 25 years before construction, supporters of building an amphitheatre arranged testing of the natural acoustics, such as the 1910 demonstrations depicted in these two photographs (DPL).*

FIGURE 9. *The topography and the surrounding rock formations carried sound from stage rock to the top of the site 1000 feet away. During construction, workers monitored the acoustics by spinning a coin on stage and checking if its fall could be heard at the top of the theatre (DPL).*

In the 1920s, the City of Denver acquired the site and George Cranmer, Denver's Manager of Parks, took up the cause to create a spectacular theatre between the two towering rock walls — Creation Rock to the north and Ship Rock to the south (figures 10 and 11).[32] Cranmer toured Europe visiting classical theatres for inspiration and hired Burnham Hoyt, a local architectural star, to produce a schematic design (figure 12) that he used to get CCC funding.[33]

In his schematic design, Hoyt — considered an early advocate of modernism — made the form and texture of the theater intentionally distinct from the site. He introduced a clean-lined plane to contrast with the rugged angularity of the majestic red sandstone walls. Consistent with the modernist's binary view of architecture as culture and the landscape as untouched nature,[34] the scheme presented the Red Rocks site and the theatre as opposites juxtaposed to accentuate each one's attributes. The results were a balanced composition of two contrasting, but equally powerful, entities: site (nature) and structure (culture).

FIGURE 10. *1929. An aerial view shows the scenic road built to the site to boost the idea of constructing an amphitheatre. Compare this view with the post-construction aerial, figure 26 (DPL).*

During the five years of construction, however, Hoyt's binary diagram evolved into a built landscape where the interplay of site and structure became more complex. Because Morse made daily site visits, he could continuously respond to unexpected revelations of both the emerging structure and the site that was being reshaped to support Hoyt's singular gesture. As the two architects watched the theatre take shape, they sometimes allowed the structure to reshape the site (i.e., by moving thousands of cubic yards of earth), while in other situations the site reshaped the structure (the realignment of the plan to compensate for a previously hidden rock ledge). By compiling a dated sequence of the 125 sheets of drawings, project correspondence and photographs, we discovered an intriguing record of how the designers developed this 'give and take' between structure and site without compromising Hoyt's original concept.[35]

FIGURE 11. *A closer view of the site before construction shows the significant scale of the rock features and boulders that were removed to build the seating. Also note the distinct form of the native junipers that later became a key element in the design (DPL).*

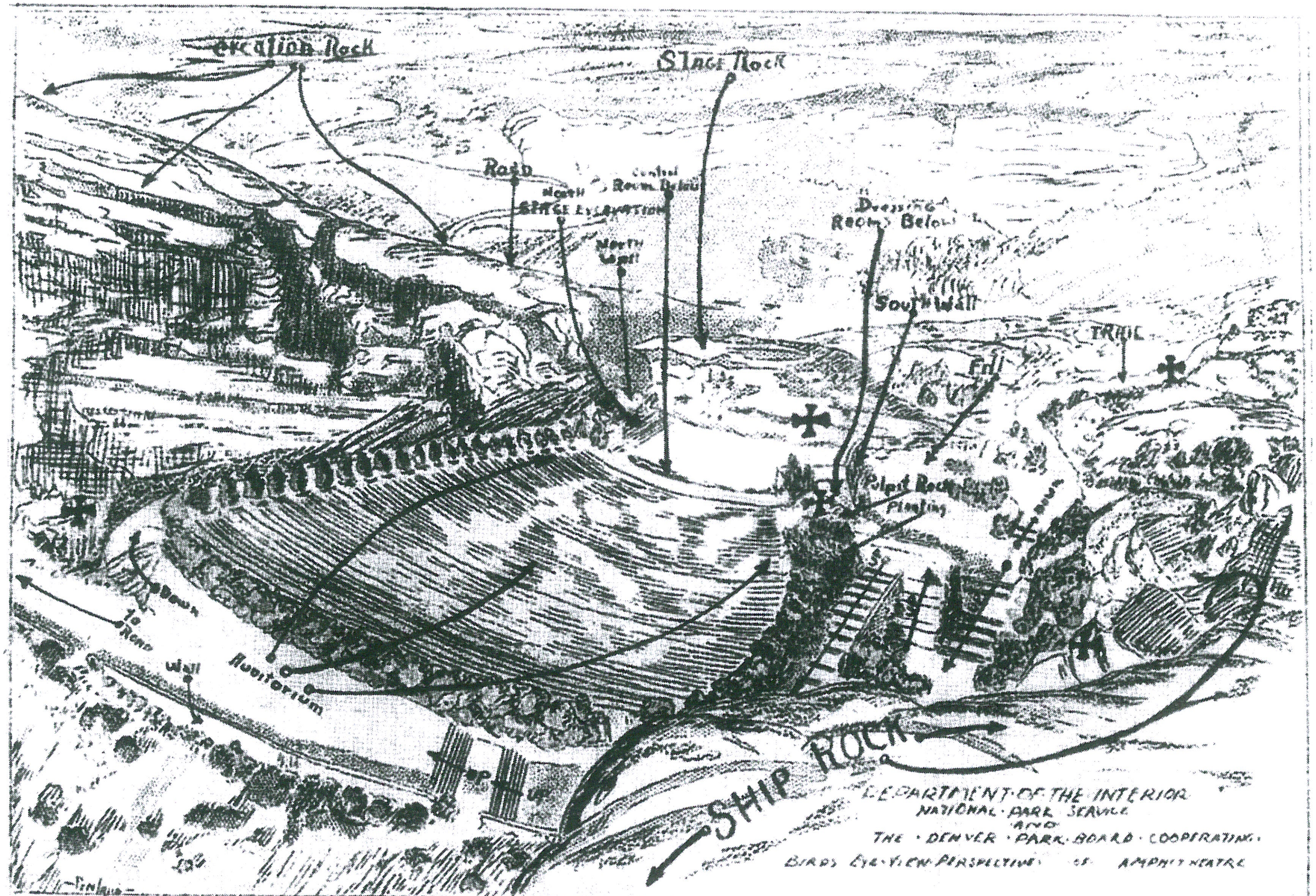

FIGURE 12. *November 1935. Director of Parks and Recreation George Cranmer commissioned Burnham Hoyt to produce this bird's-eye perspective as part of the application for CCC funding. NPS Superintendent John Harris then used this drawing as a base map for his August 1936 report on the initial construction of the theatre. The 'X' at the centre of the drawing marks the location of figure 14 (NA).*

FIGURE 13. *May–July 1936. Before the theatre was designed, enrollees built the stage, first cutting and filling the area around stage rock by band (NA).*

FIGURE 14. *1936. The CCC recruits seldom had access to heavy earthmoving equipment but instead relied on the limited mechanical resources shown in these photos. (NA).*

With only sketches of the future theatre for guidance, in April 1936, CCC enrollees began foundations for the dressing rooms on the eastern edge of the site, beside the rock formation known as Stage Rock (figures 13 and 14). Meanwhile, Morse began drawings of the stage to be constructed above the dressing rooms. On one of his morning visits, he literally drew a chalk line onto the face of Stage Rock to establish the finished elevation of the stage (figure 15). Then, once enrollees completed the basement dressing rooms, Morse used their roof as a mock-up of the stage. He then decided to reposition his original field-determined stage location by drawing a revised stage elevation in black pen on a photograph of the completed basement (figure 16). The revision placed the stage where it would mostly visibly intertwine with the layered strata and undulating protrusions of the Stage Rock backdrop.

After the stage was completed (figure 17), the workmen began the rough grading of the seating (figures 18 and 19). Creating Hoyt's deceptively simple, sloped plane required a radical change in the topography between the two rock formations. Huge stone boulders were cleared with dynamite and the northwest end of the site was excavated to a depth of 28 feet, with similar depths of fill placed in the southeastern end. Morse's drawings indicate that

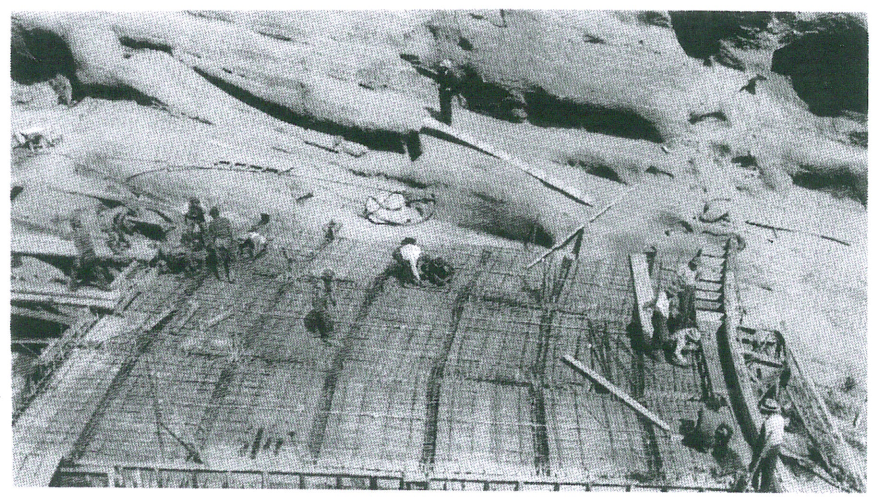

FIGURE 15. *October 1936. Enrollees proceeded on the below-stage formwork through the fall. In the background of this photograph, you can see the chalk line that Morse drew across stage rock to mark his finish elevation of the stage (NA).*

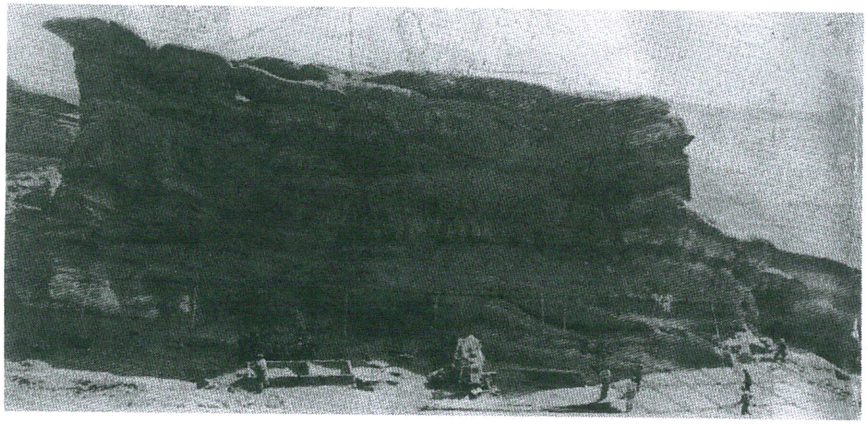

FIGURE 16. *December 1936. Two months later, Morse, on one of his daily visits, reset the stage elevation drawing an ink line across this photograph below his previous chalk line (DPL).*

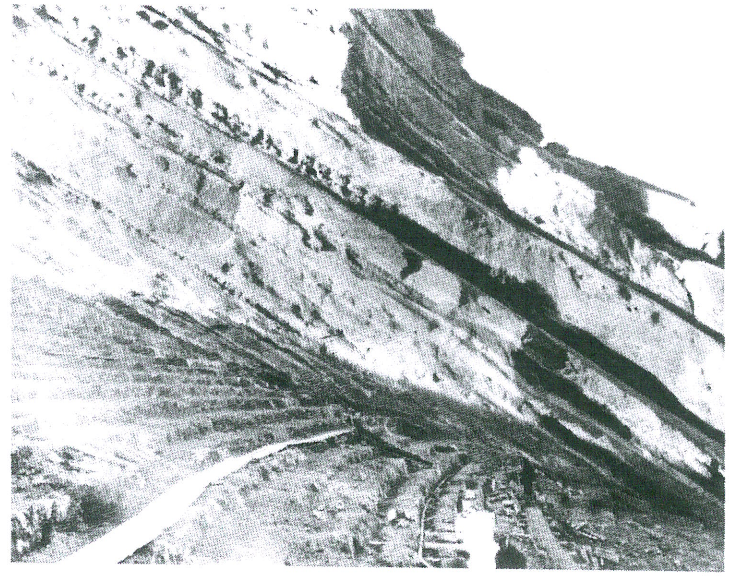

FIGURE 18. *Mid-1937 Rather than maintain a traditional level elevation along the seating rows, Hoyt and Morse sloped the entire theatre 3.33% from north to south in line with the rock strata underlying the entire landscape (NA).*

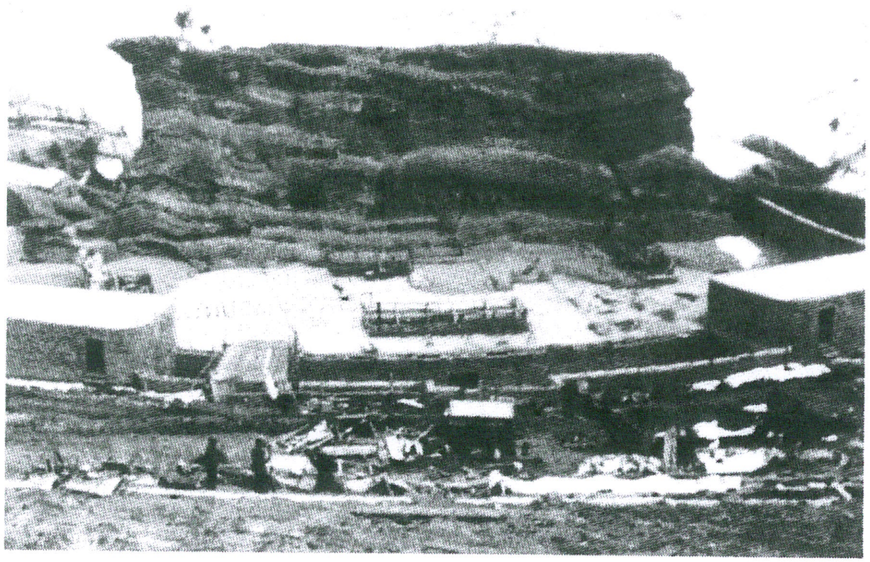

FIGURE 17. *Mid-1937. The full story basement, stage and auxiliary buildings are now complete. The stage follows the striations of stage rock at the elevation Morse marked on the previous photograph (Buffalo Bill Memorial Museum, BBMM).*

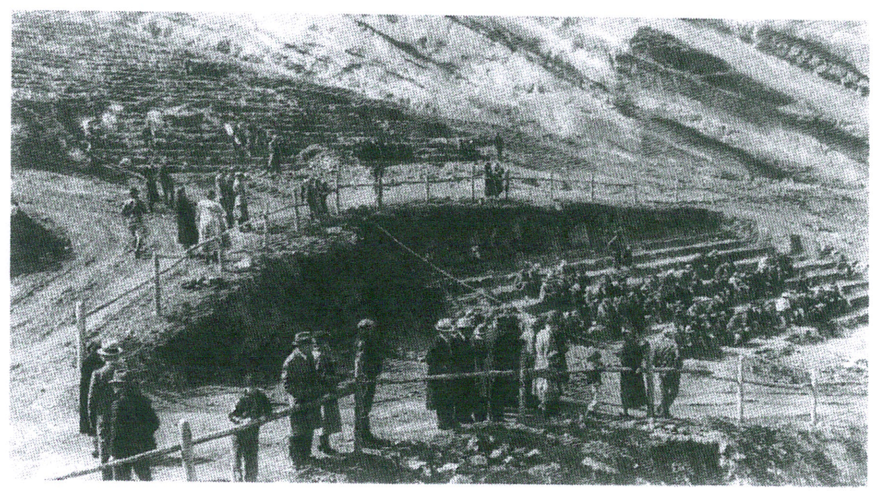

FIGURE 19. *1937. In the middle of grading the seat rows and throughout construction, Cranmer organised periodic performances at the theatre to sustain interest and support (BBMM).*

FIGURE 20. *1938. Like the planters, the seating was designed by sketching, building an in-place prototype, and then adjusting and drawing the detail. Here enrollees form the gutters that carry storm water along the 3.33% slope across each row of seats (DPL).*

he retained a remnant of the pre-existing north to south cross slope of the theatre by tilting the entire auditorium at a 3.33% slope crosswise towards the south. This unusual alignment[36] gives the finished auditorium a sense of the seats sweeping upward with the natural lay of the land. The tilt also allows rainwater to drain in a shallow gutter (figure 20) below each row of seats, thereby maintaining the natural north to south drainage pattern of the site.

As enrollees excavated the north of the site along Creation Rock, they uncovered protruding rock ledges beneath the soil (figure 21). Rather than removing the ledges to precisely build their original diagram, the architects modified the seating plan. The original auditorium scheme had organised the radial geometry of the seating along a visual centreline that Hoyt had established between the two massive rock walls. Because the already completed stage was aligned with this centreline, moving the centreline would have compromised its geometric relationship with the stage. Morse instead shifted the northern peripheral stairway to the south to avoid the newly exposed ledges (figure 22). This repositioning of the stairway sliced away a portion of the proposed seating to create an asymmetrical plan (figure 23).

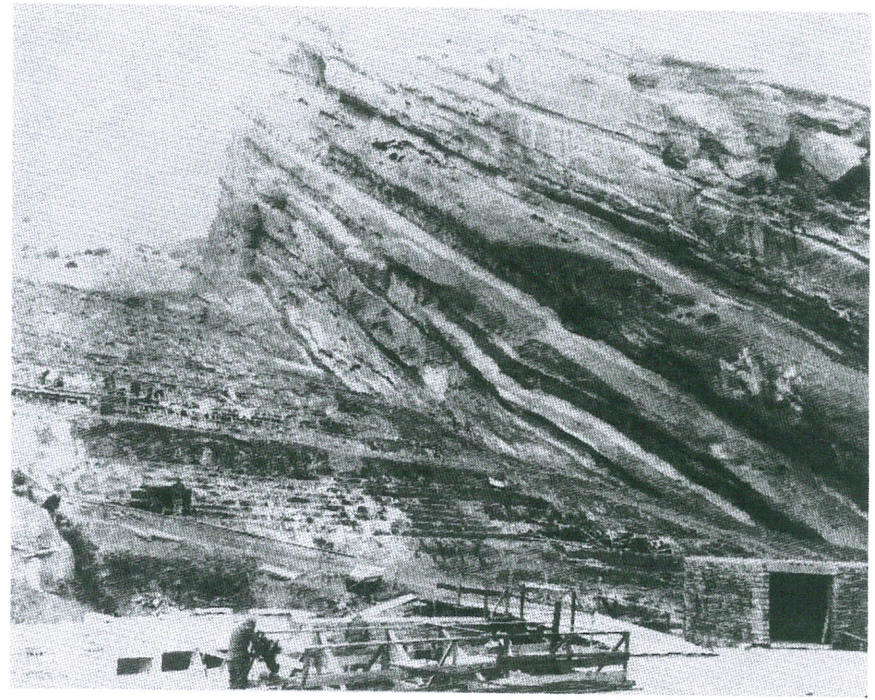

FIGURE 21. *Mid-1937. To create the auditorium, enrollees cut as much as 28 feet from the apper north side, revealing a protruding ledge. Rather than try to blast away the ledge, Hoyt and Morse realigned the theatre breaking with the original symmetrical plan (BBMM).*

To insure that the auditorium read as a smooth consistent surface, Hoyt avoided the visual clutter of individual seats or intermediate aisles. Rather than move through the seating on feeder aisles, patrons move vertically on wide peripheral stairs that are separated from the auditorium seating by plantings of native junipers. They then move horizontally across 240–300-foot long, four-foot wide rows of backless benches (figure 24) to reach their seats. Deferring to the NPS tradition of harmonising with the surrounding landscape, Hoyt initially specified local red sandstone for both the auditorium seat walls and walks. However, after viewing an onsite mock-up, a visiting CCC administrator proposed concrete for the walks instead.[37] This change not only emphasises a contrast of the walks with the

FIGURE 22. *1938. To mesh the theatre and the newly revealed ledge, enrollees did not pour the seats all the way out to the northern edge until the north stair and planters were built hugging the exposed ledge of Creation Rock. Seating was built from the middle (left to right in the photograph) and the stair out from the rock wall (right to left) to eventually meet. The stair planters were similarly test built to fit (DPL).*

textured irregularity of the rock walls, but the light colour of the concrete highlights the geometric arcs of the shadows cast by the seats. The final step in the design of the auditorium was the addition of redwood bench slats on the concrete supports that protrude from the seat walls (figure 25).

Unfortunately, renovations, including lighting towers, expanded dressing rooms, and a canopy over the stage have somewhat undermined the elegant form of the theater as it existed at its completion in 1941. Nevertheless, these more recent additions have not destroyed either Hoyt's intention to highlight the beauty of Red Rocks through juxtaposition (figures 26, 27 and 28) or the structure's complex interface with the landscape that was crafted during construction. *Architectural Forum* recognised the visual power at Red Rock's Theater in 1945.[38]

> For a setting of weird natural beauty, Burnham Hoyt has designed an outdoor theater which in sheer dramatic structure is unrivaled. ... Hoyt preserved the original flavor of the majestic setting — restraint which for once, admits nature as a full collaborator. ... With a minimum of architecture per se, Red Rocks Amphitheater is unquestionably an architectural triumph.

Constructing the Mt. Tamalpais Mountain Theater

A classical theatre was also the inspiration for the Sidney B. Cushing Amphitheater, also known as the Mt. Tamalpais Mountain Theater. The theatre's story actually began in 1913 when 1200 people hiked the south slope of Mt. Tamalpais, located 11 miles north of San Francisco, to view a play at the naturally bowl-shaped site. While the audience sat on the steep slopes around a ravine, Rattlesnake Gulch, (figures 29 and 30) actors performed at the lower 'stage' end of the bowl. In 1924, the Mountain Play Association (formed in 1914 to produce the annual play) commissioned Landscape Architect Emerson Knight to design a permanent theatre for the site. Knight's original scheme, based on the Greek theatre at Segesta, Sicily, required significant topographic change to create the stage (figure 31), but Knight, a dedicated naturalist who had committed his career to the preservation of California's native landscapes, preserved the vegetation along the sides of the theatre and retained existing oaks and rock outcrops located in the midst of the seating. He also elongated the semicircular geometry of the classical theatre into an elliptical form to taper into the land.

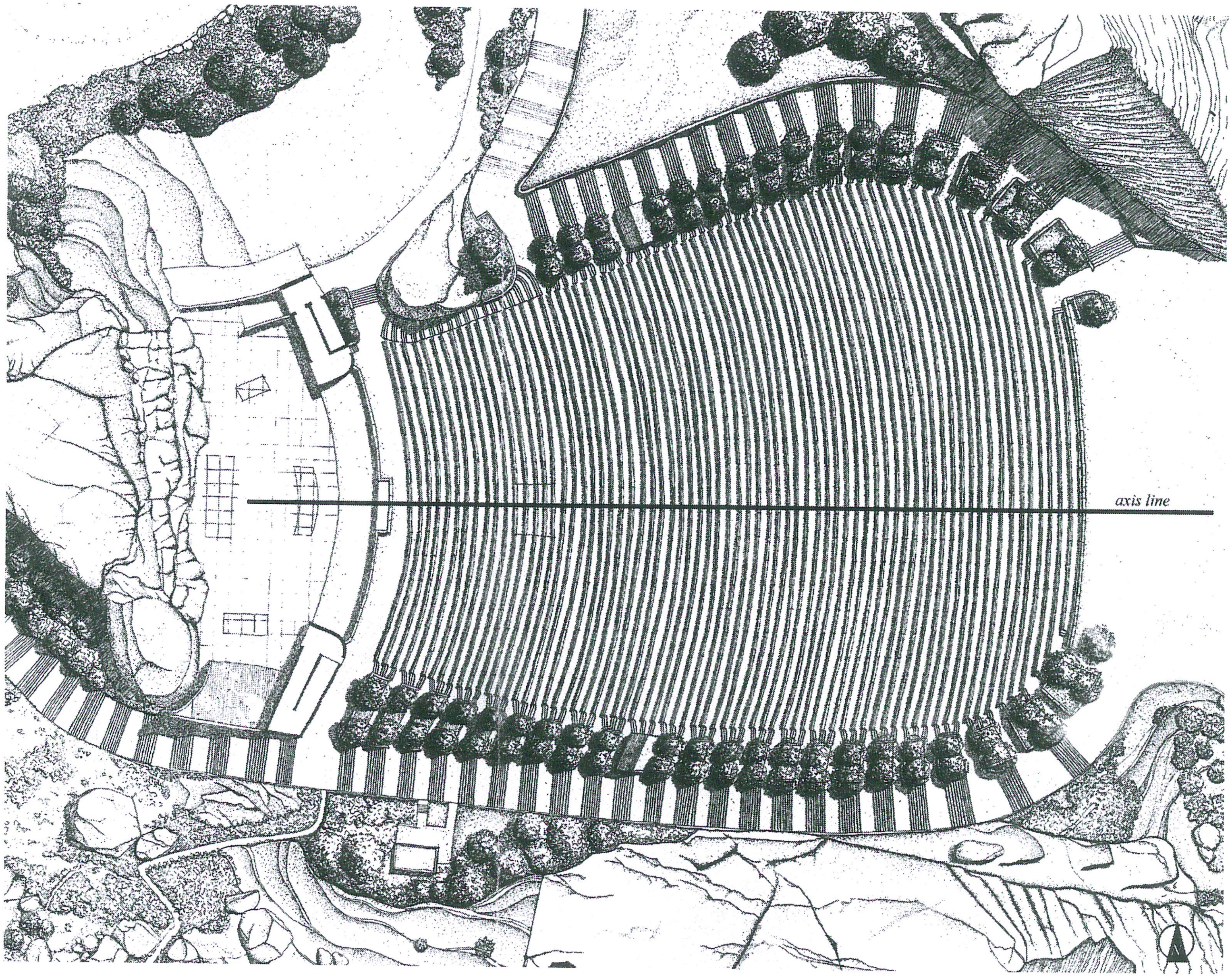

FIGURE 23. *'As built' plan of Red Rocks Theater (drawing by C. Wilson and L. Jewell).*

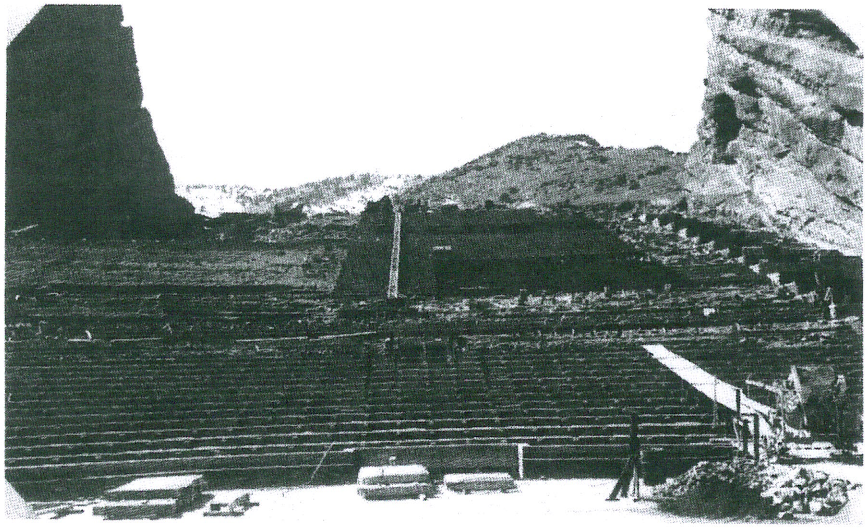

FIGURE 24. *1938. Looking up from the stage, one can again see how the enrollees built seats out from the middle and the stairs out from the ledge to meet each other. Note the gap of unpoured rows in the upper righthand corner of the theatre (DPL).*

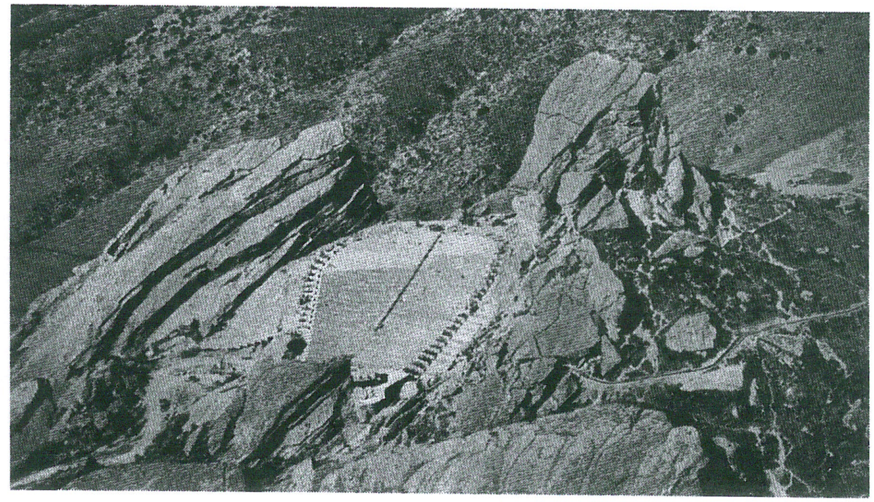

FIGURE 26. *1941. An aerial view taken just before completion shows the construction conveyor still in place down the centre of the theatre highlighting the final asymmetrical form and illustrating how it reflects the distinct gestures of the two rock walls (The American City, March 1944).*

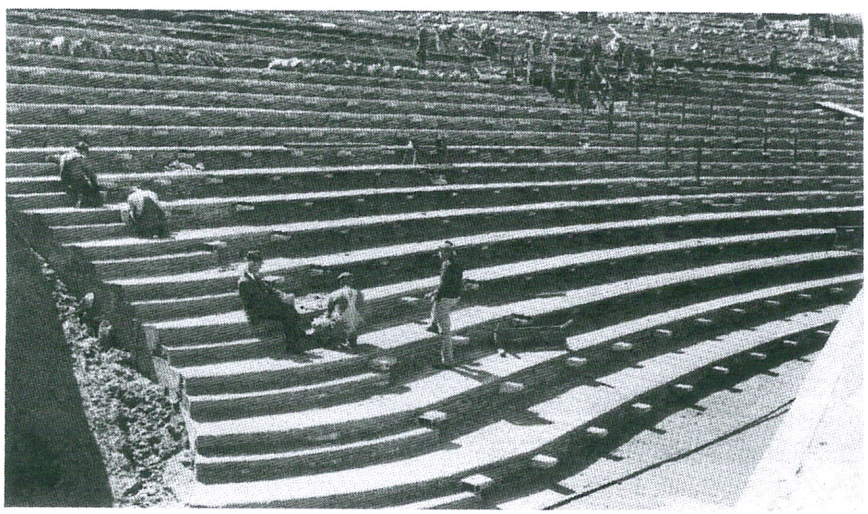

FIGURE 25. *1938. The contrast between the sandstone face of the risers and the bright, smooth concrete of the aisles was an onsite decision made in response to an observation by a traveling CCC inspector (DPL).*

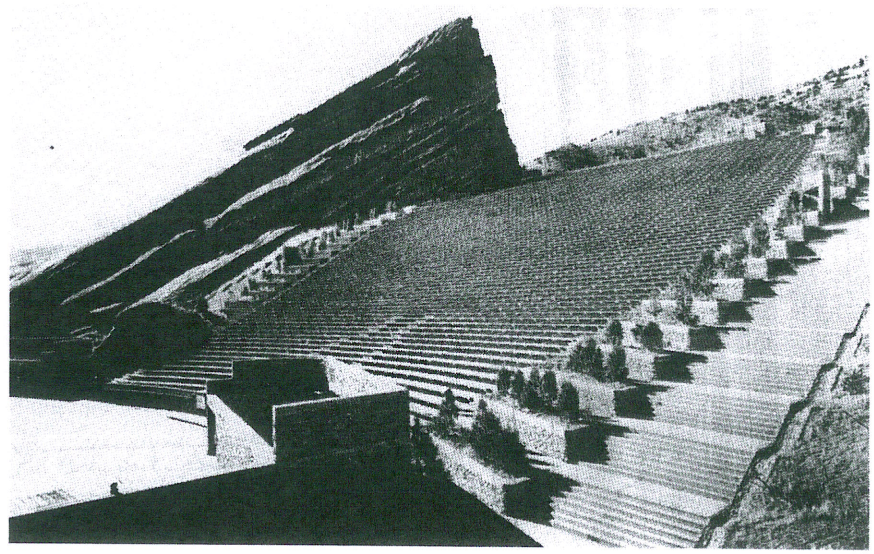

FIGURE 27. *The finished theatre in the 1940s before the addition of lighting towers and an overhead canopy (DPL).*

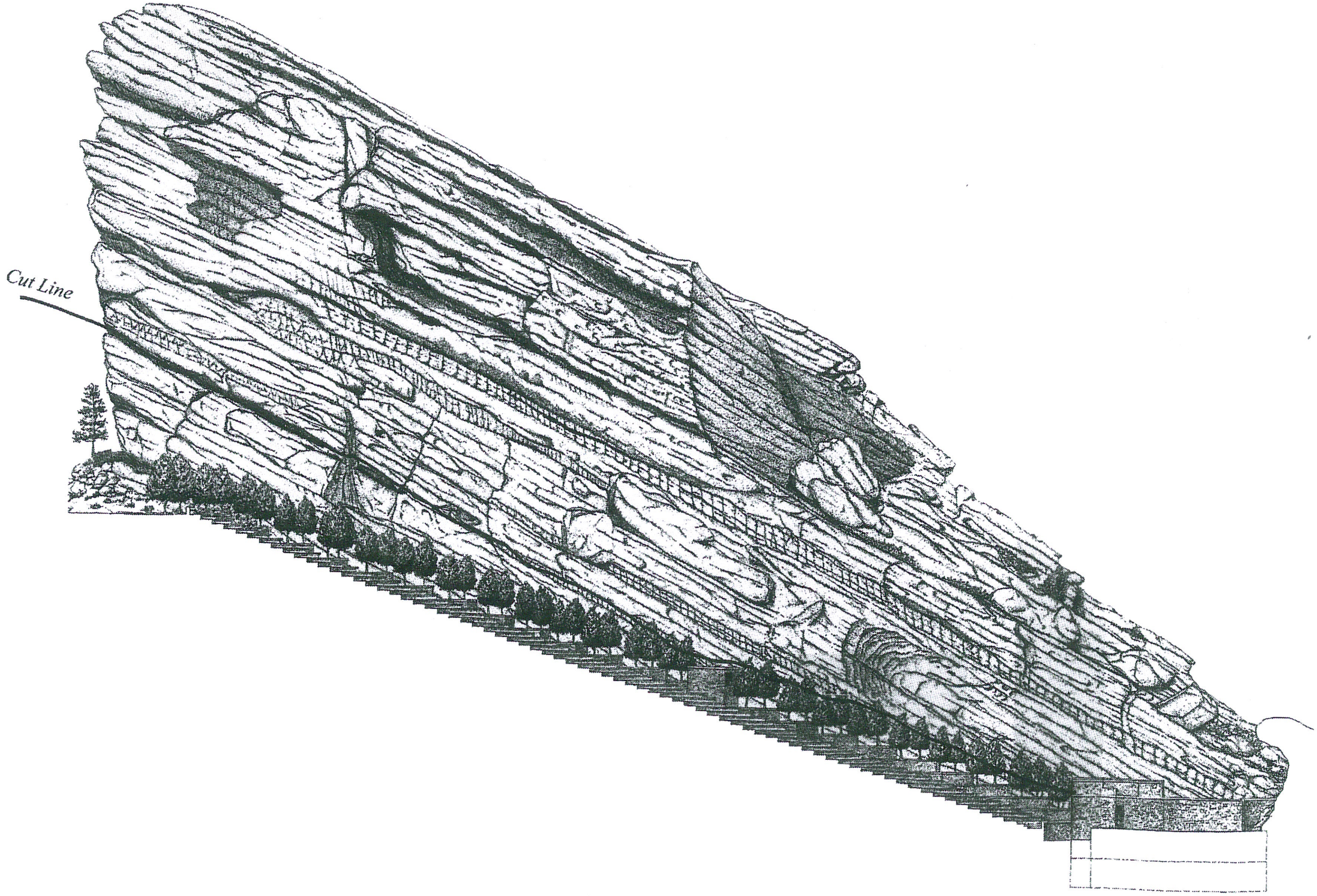

FIGURE 28. *Section indicating of the cut line at Creation Rock (drawing by C. Wilson and L. Jewell).*

FIGURE 29. *Mt. Tamalpais Mountain Theater c.1913. At early performances, audience members sat on the ground of the natural bowl, avoiding 'rattlesnake gulch' (Marin Historical Society, MHS).*

In 1929, under Knight's guidance, the Mountain Play Association began construction of Knight's 1924 plan with volunteer labour. They partially filled Rattle Snake Gulch and delineated the stage with the placement of the front row of stone seats (figure 32).[39] Perhaps due to a lack of heavy equipment, or perhaps by design intention, the alignment of this row departed significantly from Knight's original scheme. Rather than follow the symmetrical configuration that defined the stage in the drawing, Knight and his volunteers placed stones along the natural sweep of the topography, further distorting the geometry of a classical theatre.

In 1934, under the direction of Knight, now a CCC inspector, CCC Company no. 1920 continued construction of the theatre. In spite of the diagrammatic nature of his 1924 drawing, Knight apparently did not make any additional drawings. Measurements of the existing theatre (figures 33 and 34) verify, however, that Knight continued to make field changes to his original scheme. Although the finished theatre followed the 1924 organisation of three horizontal and three vertical aisles, the diagrammatic nature of Knight's scheme left the decisions on exact row alignment, seat widths, seat heights and the vertical slope to be made onsite by Knight and the Foremen.[40]

Knight did, however, give the CCC staff very clear verbal design directives describing his vision for the theatre and how the selection of materials and construction should support that vision. Knight was adamant that the workmen should gather intact stones from the area and he directed them not to cut them so that a 'character of age-old ruggedness was maintained'.[41] He nevertheless specified that each selected stone should have two weathered surfaces perpendicular to one another to provide a distinct

FIGURE 30. *Pre-1929. View to north showing the cluster of oaks and the rock outcrops beyond Rattlesnake Gulch. After performances, the site was littered with newspapers used to provide a dry seat (MHS).*

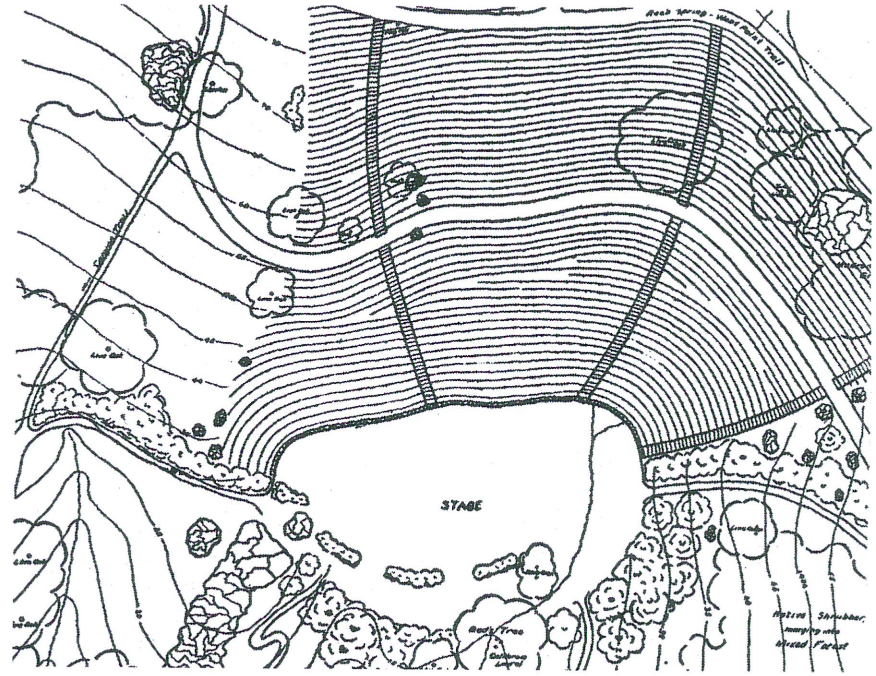

FIGURE 31. *Proposed 1924 design of the Mountain Theater on Mt. Tamalpais. Plans by Emerson Knight, landscape architect.*

edge for the front of the seat rows. He also specified that the workmen not use any cement binder and place more than half of the stones' bulk below grade 'to give the feeling that the structure will remain secure and intact for centuries'.[42]

The CCC enrollees, under the direction of Landscape Foreman Paul Holloway first began by constructing a flat stage, an improvement deemed useful even if additional funding periods were not approved (figures 35 and 36). The topographic changes to create the stage required retaining walls up to 10 feet high (figure 37) and the only use of earthmoving equipment during construction. The workers also used this equipment to rough-grade some of the earthen terraces for the future stone seats, following the alignment of the front row constructed in 1929. Given that the earthmoving equipment was now available to easily implement Knight's original symmetrical stage, the asymmetrical alignment seemingly was an intentional adjustment.

The enrollees next constructed the lower and midway horizontal aisles at a constant elevation along their entire length (figures 38 and 39). This constant elevation of the two aisles provided vertical datum for the location of the 20 rows of seats between them and, in early 1935, construction on the stone seats began. Because the horizontal distance between the bottom and the middle aisles varied from one end of the theatre to the other, Holloway varied the depth of the terrace along each row. To accomplish this task, he devised a system of wooden templates (figure 40) to equally subdivide the distance between the aisles and to establish a constant elevation along the entire length of each row. By May 1936, 9 rows had been completed in time for the annual play (figure 41). By September, fourteen and one-half rows of stone (4350 linear feet) had been completed. Throughout 1937, construction progressed slowly due to Knight and Holloway's commitments to other projects and a decline in enrollees assigned to the theatre. A foreman with marginal design credentials began supervising the stone construction,

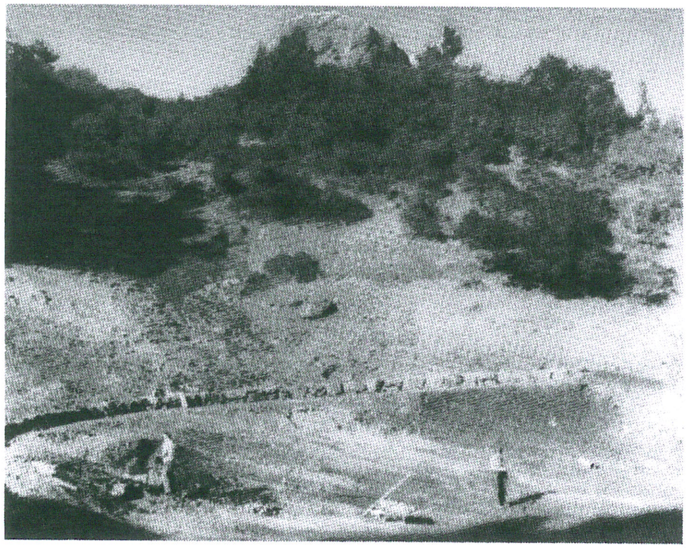

FIGURE 32. *1929. Under Knight's direction, the Mountain Play Association filled in the ravines and built the first row of stone seats. This row set the geometry of the final amphitheatre (Mill Valley Public Library, MVPL).*

resulting in a stone placement judged unsatisfactory by Knight and the Mountain Play Association. NPS officials eventually agreed that a more qualified designer, Landscape Foreman Howard Cox, should oversee the theatre full time to insure that Knight's design intent was maintained.

In 1938, productivity increased (figures 42, 43 and 44) and Knight changed the design of the upper 20 rows of seats (figure 45). He decided that the seating surface of these upper rows should move up and down vertically with the existing knolls and ravines instead of grading to maintain a constant elevation along the rows, as had been done in the lower 20 rows. However, accommodating such varied elevations along the rows, while also creating functioning aisles, required precision. So Knight worked with a surveyor in the field to approve grade hubs at every third seat. The result is an intriguing image of the monumental stone seats seemingly being pushed up and down by the native knolls and ravines of the site (figure 46).

How did the CCC design process help designers create exceptional landscapes?

At first glance, it is the thoughtful design concepts, hand labour and use of durable materials that explain the visitor's memorable experience of moving through the Red Rocks and Mountain Theater landscapes. Yet a closer examination reveals that it is also the numerous unexpected events that occur where the structures interact with their sites. The designers did not follow a singular position to contrast at Red Rocks or to merge at Mt. Tamalpais, but instead, at every point where the theatres and landscape abut, the designers re-evaluated the extent that the site should push the intervention or the intervention should push the site. Each decision changed the context for the next creating a subtly complex interaction. This exponentially increasing set of choices would have been difficult, if not impossible, to anticipate or manage from a distant drawing board before construction began. And; since each decision was literally set in stone or concrete as it was made, the finished theatres capture the unpredictable interaction between site and intervention that occurred as the theatres were built. The CCC's design process itself provided the following tools for designers to create such a continuous dialogue between designed and natural beauty.

First, the process allowed designers to recognise and respond to the less apparent, or even hidden, intricacies of each site. Landscape information on any site is so vast, multi-dimensional, subtle and continuously changed by construction that it can only be fully understood while on the site over time. Although Knight's 1924 drawing for the Mt. Tamalpais Theater had proposed altering the form of the classic theatre to reflect the site's topography, it was not until Knight worked on the site, placing stones with volunteers, that he derived the theatre's defining geometry from the graceful sweep of the site's topography. And while Knight's original drawing indicated rock outcrops and vegetation within the seat rows, it was only after the terraces had been rough-graded to reveal the full extent of the outcrops that he and the foreman determined the size and shapes that would most effectively challenge the precision of the stone rows. Likewise, at Red Rocks, the protruding ledge of Creation Rock was not discovered until more than a year after construction began and yet it shifted the entire geometry of the theatre into a more dynamic configuration.

Second, the CCC process allowed designers to evaluate their proposed interventions at full scale in their eventual setting. The design of any physical

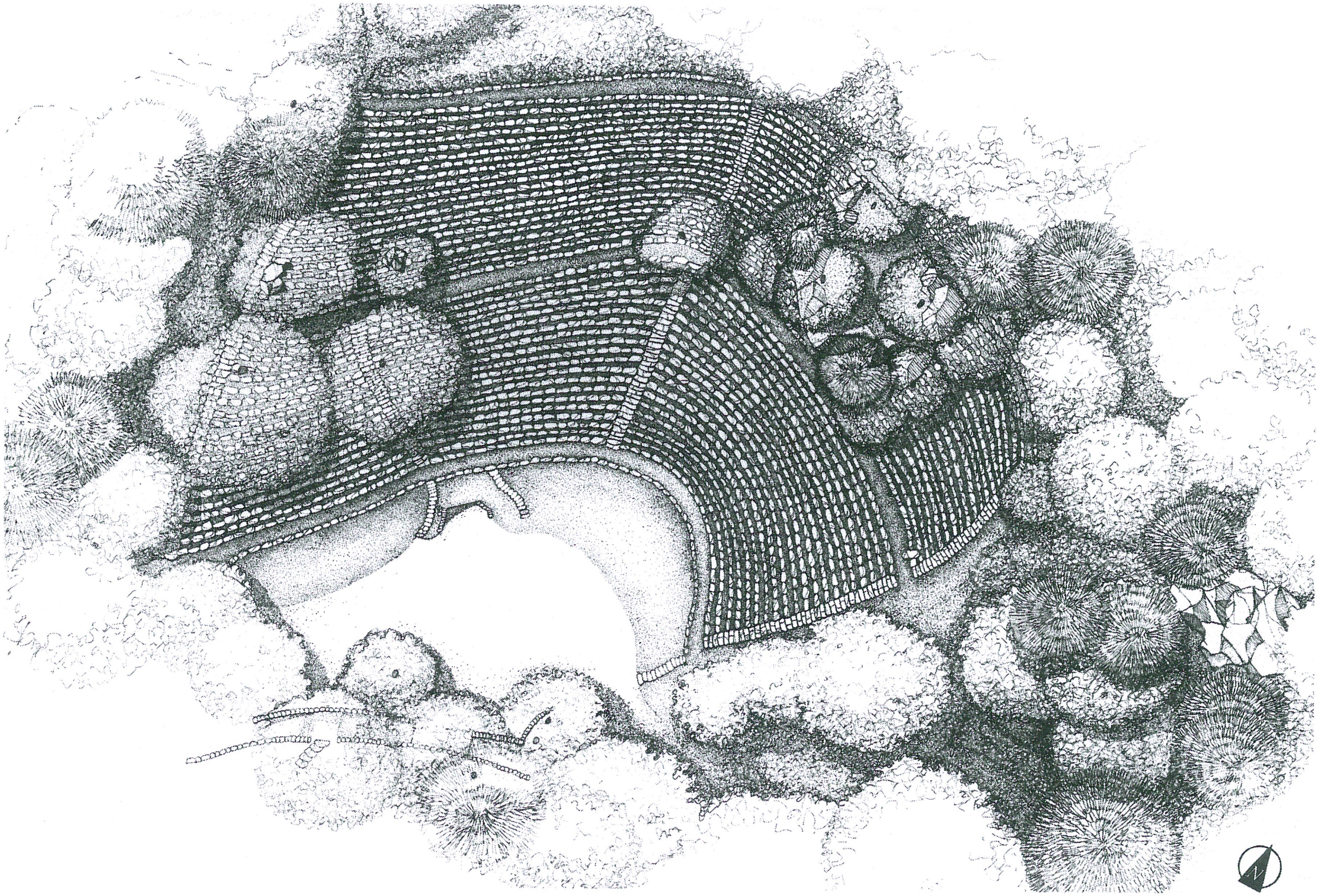

FIGURE 33. *The as-built plan of Mt. Tamalpais Theater (drawing by L. Jewell).*

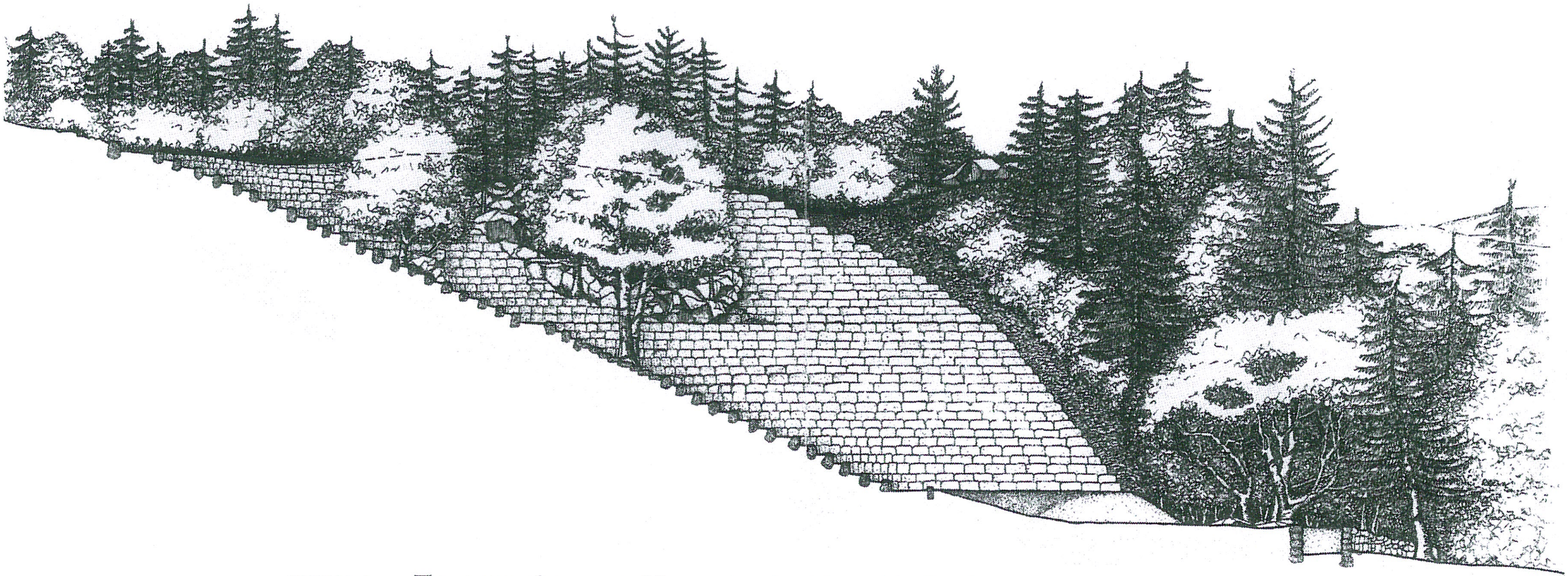

FIGURE 34. *The 40 rows of stone seats fall approximately 46 feet at Mt. Tamalpais Theater (drawing by L. Jewell).*

entity — whether it is a booklet, a teakettle or a building — improves during an open-ended cycle that allows full size trials, evaluation and modification. However, the size and complexity of landscapes present challenges to portraying an accurate, full-size mock-up or portrayal of a scheme in drawings, models and other simulations. The daily involvement of junior designers and the frequent visits by the senior designers at Red Rocks and Mt. Tamalpais encouraged the use of full-scale mock-ups that were considered in their permanent locations. In fact, the consistent presence of designers allowed every newly constructed element to be built as a trial effort before the designers committed to its final form. Furthermore, each completed element served to inform the design process for elements to be built later.

At Red Rocks, Morse's daily visits to evaluate 'mock-ups' on the site were key to determining the interplay of the human-made and nature-made. Hoyt's original concept had imagined the platform stage running right up to Stage Rock, but the early drawings had not spelled out the abutment of the two. Only after the excavation for the dressing rooms exposed the base of Stage Rock did Morse strike his chalk line onto the rock's face to designate an elevation for the stage floor. He also took the opportunity to further refine this line when he used the roof of the completed dressing room as a mock-up of the stage. By terracing the proposed rows into the earth before completing their details of the seats and aisles, Morse and the NPS staff could observe a range of lighting conditions when determining whether to use concrete or stone for the seat-walls and aisles. Morse could have constructed a mock-up bench in Hoyt's studio, but it could never have simulated the experience of moving along the nearly 300 hundred foot-long rows with the vast rock formation as a backdrop. Once the rows were roughed in, the terrace walls cast striking shadows that provided the context for Morse's development of the sweeping geometry of the concrete supports for the seats. Likewise, at Mt. Tamalpais, only after observing the completed lower rows did Knight recognise the opportunity to align the upper rows to follow the topography in elevation as well as in plan. He then spent days at the site

FIGURE 35. *In April 1934, construction began. With the only earthmoving equipment ever used on the site, enrollees re-graded the stage, installed drainage and water supply lines and began the rough terracing of the lower seats, following the alignment of the existing 1929 row (MVPL).*

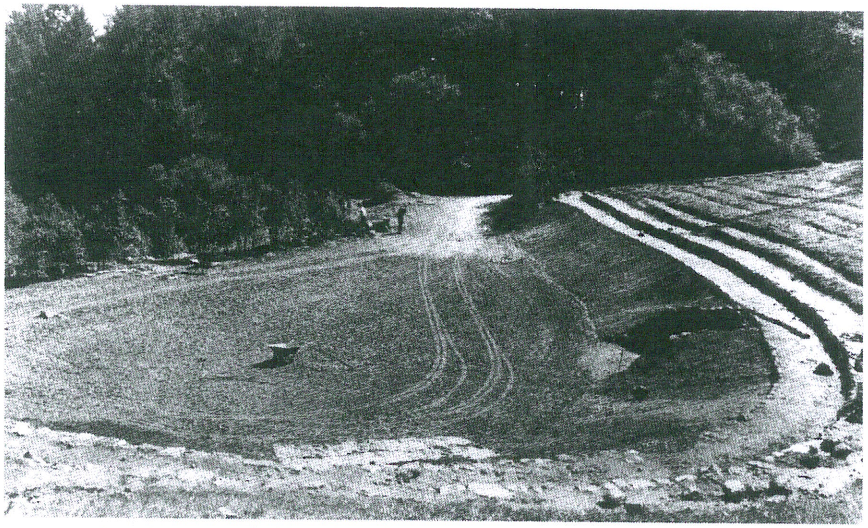

FIGURE 36. *A screen of chicaquin oaks was planted as a backdrop to the stage. The embankment between the stage and auditorium was high enough to accommodate the prompter's box shown above (NA).*

FIGURE 37. *Stone retaining walls supported the 12 feet of fill in the revine that once crossed the stage. These walls also allowed actors to move from stage left to stage right without being seen (MHS).*

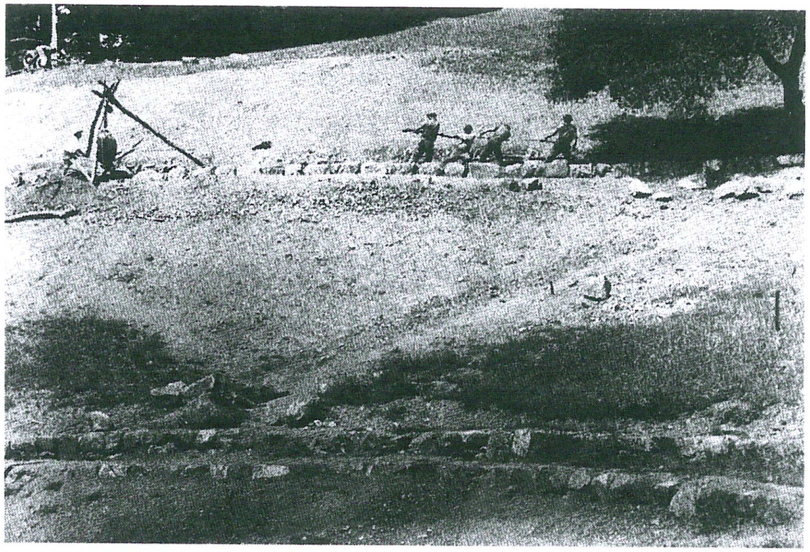

FIGURE 38. *April 1934. The enrollees first built the lower and midway horizontal aisles, before laying out the seats between the two (NA).*

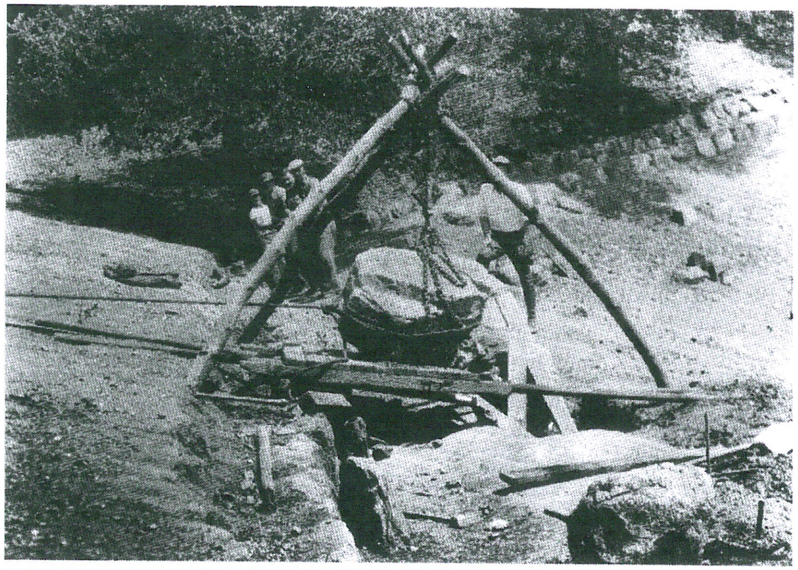

FIGURE 39. *1934. Initially, tripods of onsite timber were utilised to move the 1000–4000 pound stones. Note the NPS foremen in his regulation hat and jodhpurs (NA).*

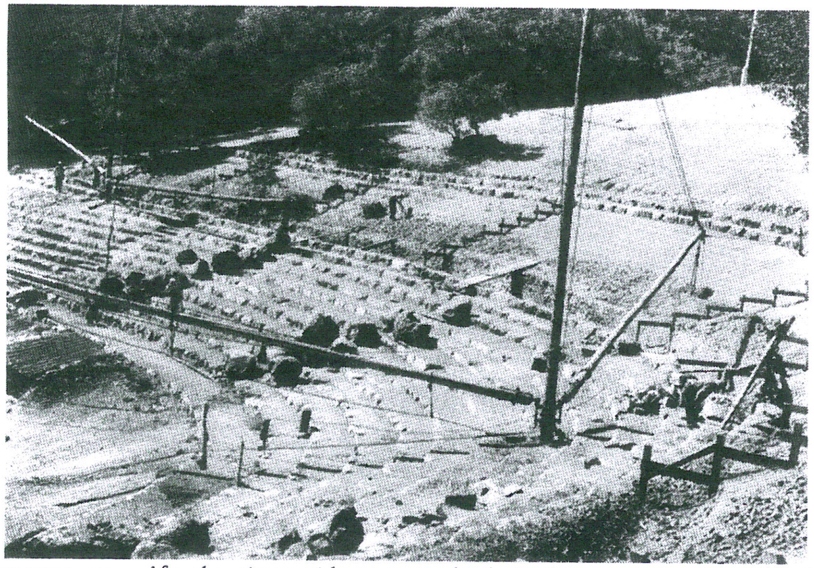

FIGURE 40. *After the primary aisles were completed, the foremen constructed a series of wood templates that divided each distance from aisle to aisle into 20 rows, resulting in shorter row-to-row distances in locations where the aisles were closer together (MHS).*

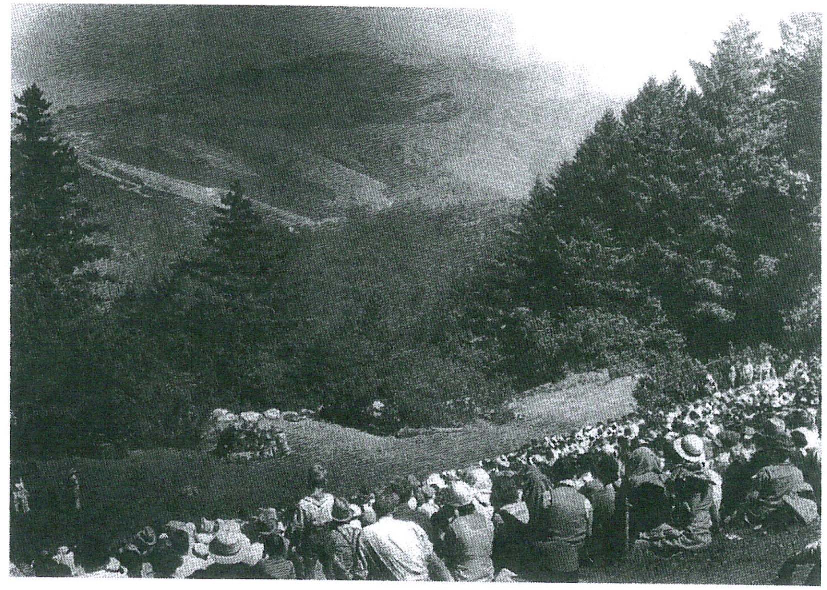

FIGURE 41. *In May of 1936, the annual play was performed with nine rows of stone seats completed (University of California College of Environmental Design Archives. UCCEDA).*

setting grade stakes to mock-up the undulating elevations of each upper row, returning regularly to fine tune these elevations with the landscape foreman who made the daily design adjustments.

Most importantly, these opportunities to incorporate a site's intricacies and to build in-place mock-ups enabled — and at times forced — the CCC designers to give form to the tensions between site and structure that unfolded as the theatres were constructed. At both theatres, the designers began with clear, thoughtful — although completely different — conceptual approaches to incorporating large interventions into natural settings. Neither completed theatre became a perfect, tidy rendition of its conceptual diagram with every detail resolved under its original premise. Rather, the open-ended design process recorded how and where the intervention and the landscape prevailed on each other in a manner that intensifies the visitor's experience of both the original gesture and the character of the site.

At Red Rocks, if the protruding ledge on the north wall had been discovered in a pre-construction site analysis, Hoyt would likely have

FIGURE 42. *c. 1937–1938. Upon completion of the lower 20 rows, the 80-foot high booms were relocated to the top of the theatre and a track rail was installed along the middle aisle to distribute stone across the site more quickly (UCCEDA).*

FIGURE 43. *1937. Per Knight's instructions, workers selected stones with two surfaces at right angles to provide a flat top and vertical riser without compromising the weathered look of the stones by cutting them (NA).*

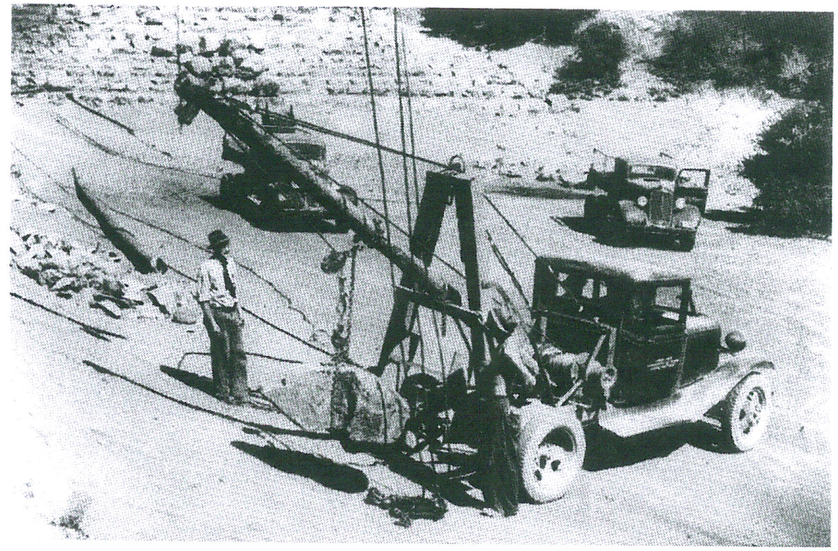

FIGURE 44. *c. 1937. New equipment, like this hoist mounted on a truck, was introduced to the site. The man wearing a hat and tie was likely a designer from the district office (NA).*

reconciled the seating rows and ledge to preserve the auditorium's symmetry. Or, if the theatre were constructed today under a conventional-contract, the contractor might well have destroyed the ledge to make the completed theatre match the designer's drawings. Instead, because the completed stage had set the centreline of the auditorium, the 'perfection' of the original diagram was 'compromised', though in a way that does not compromise the conceptual intent. The intrusion of the rock formation into the symmetrical geometry of the auditorium makes visitors more conscious of both the imposed geometry and the imposing rock. Today, the tension remains as visitors experience the intended contrast between ninety parallel benches and the jagged rocks, and then ultimately sense that the rock formation has pushed its way into the theatre to reclaim territory from the intruding rows of seats.

Similarly, at Mt. Tamalpais, Knight's original concept of a harmonious merger of theatre and landscape is highlighted by how visitors attention is alternatively captured by the massive natural stones and carefully crafted edge of the rows. Knight's directive to introduce only right-angled edges along

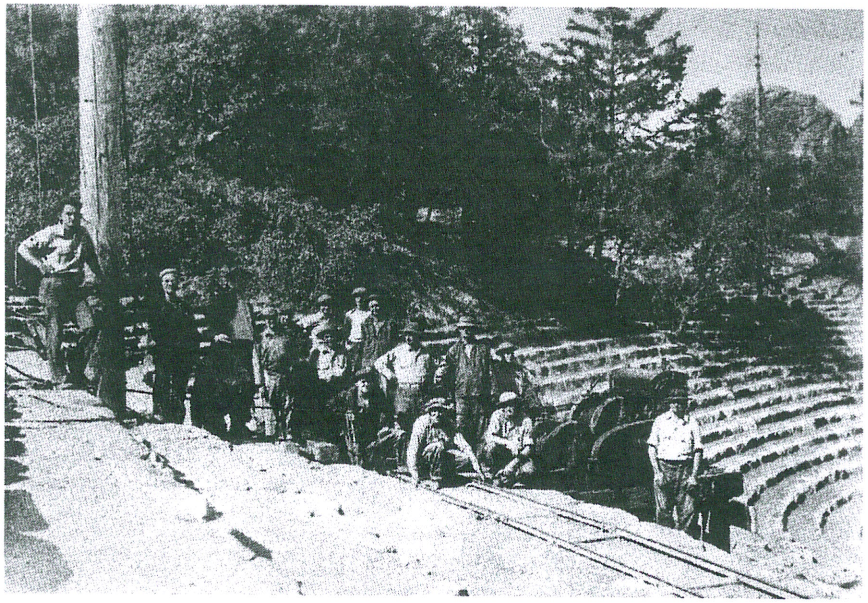

FIGURE 45. *1939. With the theatre nearing completion, enrollees pose at the mid-aisle cart tracks (MHS).*

the face of the rows, while also merging the stones into the earth, required constant design judgment. When a foreman without the trained design insight of Holloway placed the stones, the results were a clumsy arrangement of awkward edges and misplaced shapes that were eventually rejected by the client and the NPS. In contrast, Knight, Holloway and Howard Cox utilised careful selection and meticulous positioning of natural elements, in a manner similar to contemporary environmental artist Andy Goldsworthy, to underline the role of the human hand while also highlighting the unique and unpredictable character of the juncture of the earth with each stone's irregular edges.

If Knight and the landscape foremen had not been on the site continuously, they would not have had the opportunity to create the dynamic undulations of stone that record, not only the original topography, but the careful positioning of stones orchestrated by the designers and builders. The rock and vegetation protruding into the rows, the sweep of the rows along the native topography and the undulating seats leave a permanent record of the complicated push and pull between the human-made and the nature-made that occurred each day during construction. The results remain evident today as one enters the top of the theatre and looks down. From above, the irregularly sized stones appear disorganised and a part of the

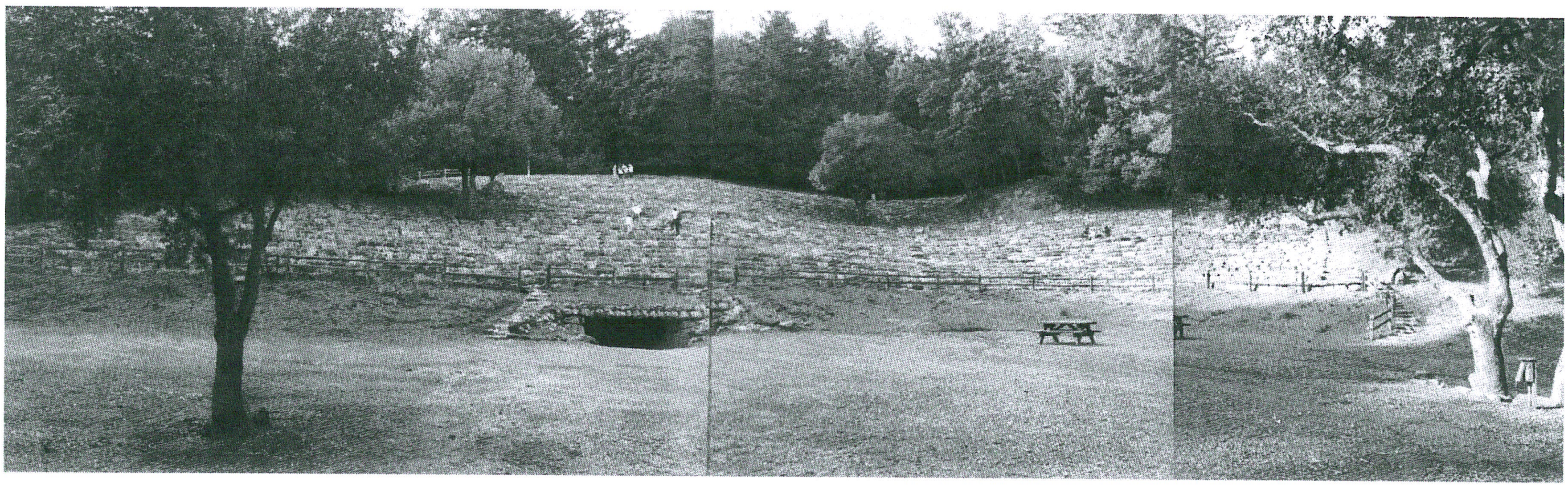

FIGURE 46. *From the stage, the viewer can easily discern the varying elevation of each of the upper rows that were laid out to follow the topographic undulations (L. Jewell).*

mountainside, but then, when moving through the seats, the sweeping arcs of the terraced rows provide a sharp, clearly human-made contrast to the rugged natural terrain. Upon reaching the bottom of the theatre, the view back uphill is to an imposing stack of irregularly sized stones that moves up and down in response to the original ravine and knolls of the site.

This choreography between the human-made and the landscape was not accidental or imagined abstractly in the mind of the designer. It is a result of a long series of individual decisions made by the designers as they evaluated and responded to the particulars of each condition that arose as the theatres were built. When allowed to develop over time, the interface of these structures and their sites, like the relationship between humans and nature, became more complex than simple contrast or harmonious merger. It developed into a multifaceted assemblage of individual interactions where the dominant voice continuously shifts from site to structure and back again. Designers can best, and perhaps can only, achieve such a vigorous complexity by incrementally completing their designs onsite.

Is it possible to use on-site, incremental design today?

The current separation of design and construction in the United States evolved during the latter half of the twentieth century to accommodate the American approach to competitive bidding, budgeting, code review and litigation. Today, to facilitate budgeting, comply with regulatory and approval processes and diminish their liability, most clients in the United States seek final detailed drawings prior to beginning construction. In this context, it is easy to quickly dismiss onsite, incremental design as an historical relic.

However, examples of designing, at least parts of projects, with incremental onsite processes still exist. Unfortunately, the methods of designing and building a landscape are infrequently discussed in a design press that focuses on finished work rather than on the delivery systems that create landscapes. Small projects on campuses, botanical gardens and public parks, residential design-build projects, estates with unlimited budgets and public art projects often allow a trial-and-error method of developing a design while constructing it from a schematic drawing. To facilitate shorter construction time, developers, local governments and institutions are increasingly turning to alternative project delivery methods that allow concurrent construction and design with incremental code and budget review. Digital technology has opened new possibilities for onsite design through instantaneous images of changing site conditions, global positioning records of field changes and Internet sites with digital drawing files that are immediately accessible to review agencies and clients.

Unfortunately few landscape architects or architects are actively incorporating concurrent design and construction into their design process. Perhaps, it is because the potential benefits of designing during construction seem to be outweighed by the risks. Or maybe it is because design education emphasises the ability to propose and develop landscape designs in drawings almost to the exclusion of studying and evaluating proposals on the ground. Yet, as Mt. Tamalpais and Red Rocks demonstrate, using onsite incremental design is well worth the risk. Designing on site during construction is not just a means of reclaiming lost craftsmanship and connection to site, but also a particularly effective method for including the unexpected in designed landscapes. Today, many design theorists are calling for more open-ended design proposals that can incorporate the constant change and multiple perspectives of today's unsettled world. Many design practitioners are focusing on digital technology as the means to include this contemporary complexity in their work. The CCC history suggests that another way to capture living, unpredictable relationships in designed landscapes may lie, not in anticipating every possibility on screen, but in responding to unexpected possibilities as they take shape on the site.

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NOTES

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1. The necessity to 'keep the boys busy' was expressed by retired National Park Service inspector William Penn Mott in a 1992 interview with Jewell. Mott, who worked for the NPS during the 1930s as both a Landscape Foreman and a District Inspector, was warning Jewell that she should not expect to find

many finished drawings of CCC-built projects. He explained that the first priority was to keep the recruits busy building, often leaving little time to develop detailed designs on paper before construction began.
2. Typically only 10–15% of a landscape architect's fee is assigned to construction administration for design input after construction has begun. On the other hand, 50–65% of the fee is assigned to the production of design development and construction documents. The construction documents are legal documents describing on paper precisely what the building contractor will build for the client.
3. Newton and other landscape history writings have referred to the incremental evolution made in English and Renaissance gardens. In his personal papers, Olmsted described his daily field supervision of Central Park; see NORMAN NEWTON, *Design on the Land* (Cambridge, MA, 1971), pp. 99–130, 207–220, 267–289.
4. NANCY E. ROSE, *Put to Work: Relief Programs* (New York, 1994); JAMES J. MCENTEE, *Now They are Men* (Washington, DC, 1940).
5. Wirth and other authors provide detailed accounts of the number of enrollees in the CCC. Because enrollees served distinct terms of six months, numbers are reported for each term, which can total 3 612 000. This is the best number available, though it does double count men who served multiple terms. In contrast, less detailed information is reported on the number of supervisors, leaving us to extrapolate from available data. Wirth reports 14 915 supervisors serving in September 1933, when there were 1520 CCC camps. At the CCC's peak in late 1935, there were 2916 camps. If the supervisorial ratio stayed the same, that would make for 28 613 supervisors overall at the CCC's peak (CONRAD LOUIS WIRTH, *Parks, Politics and the People* (Norman, UK, 1980).
6. WIRTH, *Parks, Politics and the People.*
7. ETHAN CARR, *Wilderness by Design* (Lincoln, NB, 1998; LINDA FLINT MCCLELLAND, *Building the National Park* (Baltimore, MD, 1998).
8. WIRTH, *Parks, Politics and the People.*
9. WIRTH, *Parks, Politics and the People.*
10. Civilian Conservation Corps, RG 79, National Archives, College Park, MD.
11. We derived this number by compiling the information in 24 periodic inspector reports that we collected at National Archives in College Park, MD; Denver, CD; and San Bruno, CA. In each report, inspectors detail their daily itinerary. Out of 249 total work days covered in the 24 reports, inspectors spent 153 days (61%) in the field and 96 days (39%) in the office. The time spent in the field varied office-by-office. Inspectors from the model Southwest Office, run by Herbert Maier, spent as much as 90% of their time in the field. Although there is no complete set of inspector reports, the National Archives in College Park holds the most substantial number of these reports, under Civilian Conservation Corps, RG79. Some reports can also be found in local libraries and historical societies.
12. Civilian Conservation Corps, RG 79, Records of Conrad Wirth, Job Specification No. 22.
13. A.H. GOOD, *Park and Recreation Structures* (Boulder, CO, 1990); MCCLELLAND, *Building the National Park.*
14. *Portfolio of Comfort Stations and Privies and Portfolio of Park Structures*, 1934. Waugh was the daughter of distinguished Landscape Architecture educator Frank Waugh, mentor to Wirth.
15. Civilian Conservation Corps, RG 79.
16. GOOD, *Park and Recreation Structures.*
17. MCCLELLAND, *Building the National Park*; CARR, *Wilderness by Design.*
18. Civilian Conservation Corps, RG 79; WIRTH, *Parks, Politics and the People*; Arthur Blake, Papers, Marin County Historical Society (California); Stanley Morse, Papers, Denver Public Library.
19. MCCLELLAND, *Building the National Park.*
20. Civilian Conservation Corps, RG 79.
21. For more information on S.R. DeBoer, see *Pioneers of Landscape Architecture*, eds. CHARLES A. BIRNBAUM and ROBIN KARSON (New York, 2000).
22. DeBoer's inspector reports in the National Archives describe his contemplation of the Flagstaff site. The drawing of the proposed theatre is in DeBoer's papers in the Denver Public Library.
23. For more information on Emerson Knight, see BIRNBAUM and KARSON, *Pioneers of Landscape Architecture.*
24. This history is recounted in the papers of Arthur Blake, the president of the Mountain Play Association, found in the Marin County Historical Society in San Rafael, CA; Emerson Knight papers, University of California, Berkeley College of Environmental Design Archives; E. KNIGHT, 'Mountain theater on Mt. Tamalpais', *Landscape Architecture Quarterly* (October 1959), pp 5–9; Civilian Conservation Corps, RG 79.
25. Stanley Morse, Papers, Denver Public Library.
26. George Cranmer, Papers, Colorado Historical Society, Denver, CO.
27. Martha Morse, widow of Stanley described Morse's routine to Jewell in a telephone interview in January 2002. Although Mrs. Morse was not married to Stanley during the Red Rocks construction, they were married during his 1950s renovation of the theatre stage. She indicated that he often spoke of his daily routine of visiting the Red Rocks site during construction.
28. Stanley Morse, Papers, Denver Public Library.
29. Pollstar, *Concert Industry Awards*, 5(2) (1990).
30. M.E. BERNET, *The Incomparable Red Rocks from Dinosaurs to Rock'n Roll* (self-published, 1962); M.E. BERNET, 'How Red Rock came to be', *Denver Post Empire Sunday Magazine* (4 August 1968), pp. 8–13.
31. This statement indicated to have been made by Garden in 1911 (Red Rocks promotional brochure, Red Rock files, Denver Public Library).
32. There is considerable local debate about which rock is Creation Rock and which is Ship Rock. To be consistent with Hoyt's marked schematic drawing (figure 12), we have assumed that Creation Rock is

the northern rock and Ship Rock is the southern rock.

33. George Cranmer, Papers, Colorado Historical Society, Denver, CO.

34. ELIZABETH K., MEYER, 'The expanded field of landscape architecture' in eds. GEORGE THOMPSON and FREDERICK STEINER, *Ecological Design and Planning* (Chichester, 1997). Here, Meyer discusses the discourse of modern architecture that presents architecture and the landscape as a binary relationship where the landscape is unstructured, irregular and wild in contrast with the geometry and order of architecture.

35. Stanley Morse, Papers, Denver Public Library; Civilian Conservation Corps, RG 79.

36. Typically a theatre's auditorium would be graded without any slope along the length of the row such that a constant elevation would be maintained along a seating surface. Such an alignment requires an undulating ground surface to carry water to drain inlets along the row. By sloping the entire auditorium plane to the south, Hoyt and Morse enabled water to drain from north to south under the seats without undulations or intermediate drain inlets.

37. Civilian Conservation Corps, RG 79.

38. 'Red Rocks Amphitheater' *Architectural Forum*, 5 (1945), pp. 97–102.

39. Arthur Blake, Papers, Marin County Library, San Rafael, CA.

40. Landscape Foreman Paul Holloway oversaw the lower 20 rows of seating between 1934 and 1938 and, between 1938 and 1940, Landscape Foreman Howard Cox provided the day-to-day supervision of the upper 20 rows.

41. 'The Mountain theater on Mt. Tamalpais', *Landscape Architecture Quarterly*, 40(1) (October 1949).

42. 'The Mountain theater on Mt. Tamalpais'.