SUSTAINABILITY WITH STYLE: THE ASLA HEADQUARTERS GREEN ROOF

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Abstract

The American Society of Landscape Architects (ASLA) green roof, designed by landscape architecture firm Michael Van Valkenburgh Associates, Inc., was installed in April 2006. The project was undertaken with the goals of demonstrating the environmental and aesthetic benefits of green roofs, encouraging more widespread use of green roofs locally and nationally, and showcasing the value that landscape architects bring to green roofs. Innovative features of the green roof include two elevated “waves” formed from rigid insulation and covered with a green roof system, and an extensive green roof system covered by an aluminum grating walking surface to maximize both usable space and environmental benefits. Monitoring is in process to track stormwater retention, temperature, water quality, and plant performance. In addition, during the first growing season, light meters were placed in different areas and a number of plants tagged so that data on plant growth and growing conditions could be collected.

Introduction

In 2004, the American Society of Landscape Architects (ASLA) began to investigate the option of installing a green roof on its 12-year-old, three-story headquarters building in the Chinatown section of Washington, D.C. Stewardship of the land and a commitment to sustainable practice are core values of the Society and its members. In undertaking the project, ASLA’s goals were to serve as a demonstration project, encourage greater use of green roofs, and showcase what landscape architects bring to this type of project. A structural engineering study, performed by Silman Associates, Inc., and completed in 2004, showed that the roof had additional load capacity ranging from 50 psf to 75 psf, and could therefore accommodate an extensive green roof. Landscape architecture firm Michael Van Valkenburgh Associates, Inc., (MVVA) was selected in early 2005 as the lead project designer, with Conservation Design Forum as consulting landscape architect. Architectural services were provided by DMJM Design and Robert Silman Associates was retained as structural engineer.
The total roof area is approximately 3,000 square feet. The building’s original roof was a rubberized membrane, which had already begun to develop pinhole leaks. Two six-feet-by-eight-feet HVAC units were located toward the center of the roof; the roof also held three smaller HVAC units. Access to the roof was limited to a wall-mounted ladder and hatches.

As part of the project, an existing stairway was extended to the roof level to provide access for viewing and maintenance. Since the environmental benefits from a green roof were a primary concern, the program called for the designer to “green” the maximum amount of roof area. With this in mind, the original program did not envision significant usable space as an outcome. However, in the course of the design process, MVVA developed a concept that enabled maximum green space and maximum usable space, and adding the benefit of a usable rooftop space as an amenity. The design was embraced by the ASLA Board of Directors, which voted to expand the scope and budget of the project as suggested by MVVA. Funding for the project was provided by ASLA, with support from sponsors and product donors, as well as grants from the Chesapeake Bay Foundation and the National Fish and Wildlife Foundation/U.S. Environmental Protection Agency Chesapeake Bay Program.

Design Features

The roof design includes two 25’-wide elevated “waves,” covered with a green roof system, that rise to 6’2” and 5’4” above the walking surface. The effect of the two waves, which bring the plants up to eye level, is to create an intimate, semi-enclosed space on the roof. The slope of
the waves and the shade cast by the wave forms create a variety of microclimates and growing conditions on the roof. The waves also serve to completely hide the HVAC units, which were relocated as part of the project. The north wave cantilevers over part of one of the larger HVAC units. The second of the two larger units and three smaller ones are hidden behind the south wave.

The wave forms, which have a 2:1 slope, are constructed from layers of extruded polystyrene insulation, with a structural steel skeleton that is anchored to the roof deck. The sides of the waves are clad with galvanized steel decking material to protect the insulation. To ensure that the insulation in the waves cannot blow off in a high wind, a steel cable system that functions like a cargo net stretches over the surface of the insulation below the planting layers.

MVVA conducted extensive sightline studies to ensure that the top edge of the wave plantings would be visible from the street. Since the ASLA roof is a demonstration project, visibility of the green roof was identified as a particularly important—and unusual for a green roof—feature.

A soil stabilization/retention system is also in place on the waves. Soil depths on the waves were calculated to correspond with the roof’s structural capacity in each area. The south wave has four and half inches of soil and is planted primarily with sedums and prickly pear cactus. The north wave, with a deeper soil depth of six inches, is planted with drought-resistant perennials and grasses as well as some sedums.
Another signature element of the design is the use of aluminum grating over sedum for the central area and access path, which not only provides almost total green coverage for the roof, but also creates an area that can be used by the building occupants for enjoyment. Emory Knoll Farms, which donated many of the plants used on the roof, assisted the design team by performing tests of plant growth under grating. The area under the grating has a soil depth of three inches. The grating “floats” three inches above the soil surface; when mature, the sedums planted underneath will grow up through the grating. The action of walking on the grating will trim the sedums back to the height of the grating in high traffic areas. It is anticipated that the sedum growth through the grating will, in effect, show circulation patterns.
The grating used in the project is the 19SGI4 Aluminum I-Bar Series by Ohio Gratings, Inc. The light weight of the aluminum grating reduced the overall weight of the grating on the roof by two-thirds compared to similar steel grating, while its strength-to-weight ratio easily handled the span and loading requirements. The grating is good for a clear span of 48" at 100 lbs per square foot with ¼" deflection; uniform load is 180 lbs per square foot. Because the plants growing up through the grating could cause a slippery surface, Slip-Not abrasive surface was selected to add traction.

Extensive plantings not under grating are also located in the areas directly surrounding the HVAC systems—again, with the intent of “greening” the maximum possible area.

The green roof system used for the project is the Hydrotech Garden Roof assembly, which includes roofing membrane, protection course/root barrier, insulation/air barrier, water retention, drainage/water storage/aeration, filter fabric, and lightweight engineered soils. The roof membrane is a hot, fluid applied, rubberized asphalt produced with a minimum of 25 percent recycled content.

Ipe wood was chosen for the small deck area that abuts the stairwell structure. The ipe used for the project was furnished by Forest World and was certified as sustainably harvested by the Forest Stewardship Council. An exceptionally dense wood, ipe has a class A fire rating, which is the highest possible rating. Ipe is also naturally resistant to rot, decay, insects, and mold, and does not require sealants or preservatives.

**Intensive Areas**

In keeping with the goal of greening as much of the roof surface as possible, MVVA’s design includes intensive plantings above the new stairwell structure and on top of the elevator shaft, both areas that have significant additional structural load capacity. The stairwell structure is covered with 12 inches of soil and is planted primarily with New Jersey Tea and roses (Ceonanathus americanus, Rhus aromatica, and Rosa Carolina). The area over the elevator shaft has a soil depth of 21 inches and is planted primarily with several species of sumac trees. A trumpet vine planted in this area is being trained to grow over the metal trellis that hangs over the deck area. An irrigation system provided by Rain Bird is in place on both the stairwell structure and the elevator shaft to facilitate watering for the extensive plantings. Access to the top of the stairwell structure is via a metal ladder mounted to the south end of the structure.

**Plant Growth**

MVVA has maintained regular monitoring of the plant growth over the first growing season. In addition to tagging individual plants, light and temperature meters have been placed in different areas to gather data on the growing conditions and the success of different plants in the microclimates created by the waves and other design features. As expected, plant performance has varied widely by location.
Overall plant growth on the north mound, the mound with the greater soil depth, and on the grating-covered extensive areas has been excellent. Plant growth on the south wave was significantly less vigorous due to higher temperatures, plant damage from birds, and use of experimental plants. Another zone of lower growth is the flat terrace of extensive planting behind the south wave, a section not covered by grating.

Early recommendations from MVVA’s plant monitoring included increasing the overall density of plants and increasing coverage on the south wave to help counteract the high temperatures. At the recommendation of MVVA, in consultation with Emory Knoll Farms, the supplemental planting completed in the fall made use of more typical green roof sedums and succulents (S. reflexum, S. spurium, Delosperma nubigenum). In the initial planting of the south wave, native species not typically used on green roofs were tried. Plant density has also been increased for greater coverage of the soil surface; high temperatures on the south terrace will decrease with more vegetation.

The grating-covered extensive areas have all had excellent plant growth; in fact, the areas under the grating were the only sections of extensive planting to have significant weed growth. The aluminum grating creates shade that keeps the plants from getting overheated and helps retain moisture. As part of MVVA’s design, the grating is positioned so that the larger openings reflect direct sunlight while allowing indirect sunlight to shine through.

**Roof Performance Monitoring**

Flow meters and rain gauges are in place on the roof to collect data on stormwater retention. Monitoring water flow from the roof turned out to be one of the challenges of the project. The two existing roof drains were relocated as part of the design; more substantial changes to the existing drainage system—to enable collection of runoff in a separate, closed system or container—were cost prohibitive. Therefore, the system for monitoring runoff had to work with the existing roof drains, which connect with the building’s interior plumbing. The solution was fabrication of a weir-type system around the drains and installation of Hach Sigma 950 flow meters. Data collection on stormwater runoff began in early July, after the installation and testing of the flow meters, and after the meters were connected with the existing building controls system. Since the start of data collection on July 6, 2006, through January 8, 2007, the roof has retained 67.71 percent of 20.09 inches of rain, or a total of 17,089.46 gallons. As expected, stormwater retention was greatest during the summer. The roof retained 77.7 percent of 7.57 inches of rain during the July through September period.

Water quality testing began fall 2006. Rain water collected on the roof and runoff collected from the roof drains are being analyzed and compared to determine the effect that the green roof has on water quality. Water quality testing, partially supported by the Chesapeake Bay Foundation, includes analysis of water pH, temperature, suspended and dissolved solids, dissolved oxygen, chemical oxygen demand, nutrients, and heavy metals. Several samples have already been collected, but analysis of additional samples collected over a longer period is needed before any conclusions can be drawn. Temperature sensors also are in place now on the ASLA roof and
on the roof of a neighboring building, which will enable temperature comparisons during the hot months.

**Green Roof Advocacy**

ASLA is maintaining and updating information on the project on the ASLA website, [www.asla.org](http://www.asla.org), which also features a green roof webcam. To increase the value of the roof as a demonstration project, the roof is also open for public tours by appointment. Although the availability of the tours has not yet been advertised, over 1,000 individuals, including design professionals, public officials, members of the business community, and the public, have toured the roof since its completion in April 2006. An exhibit/display on the green roof is under development, along with a workbook/discovery program, targeted toward middle school students, about the ASLA roof and the environmental benefits of green roofs.