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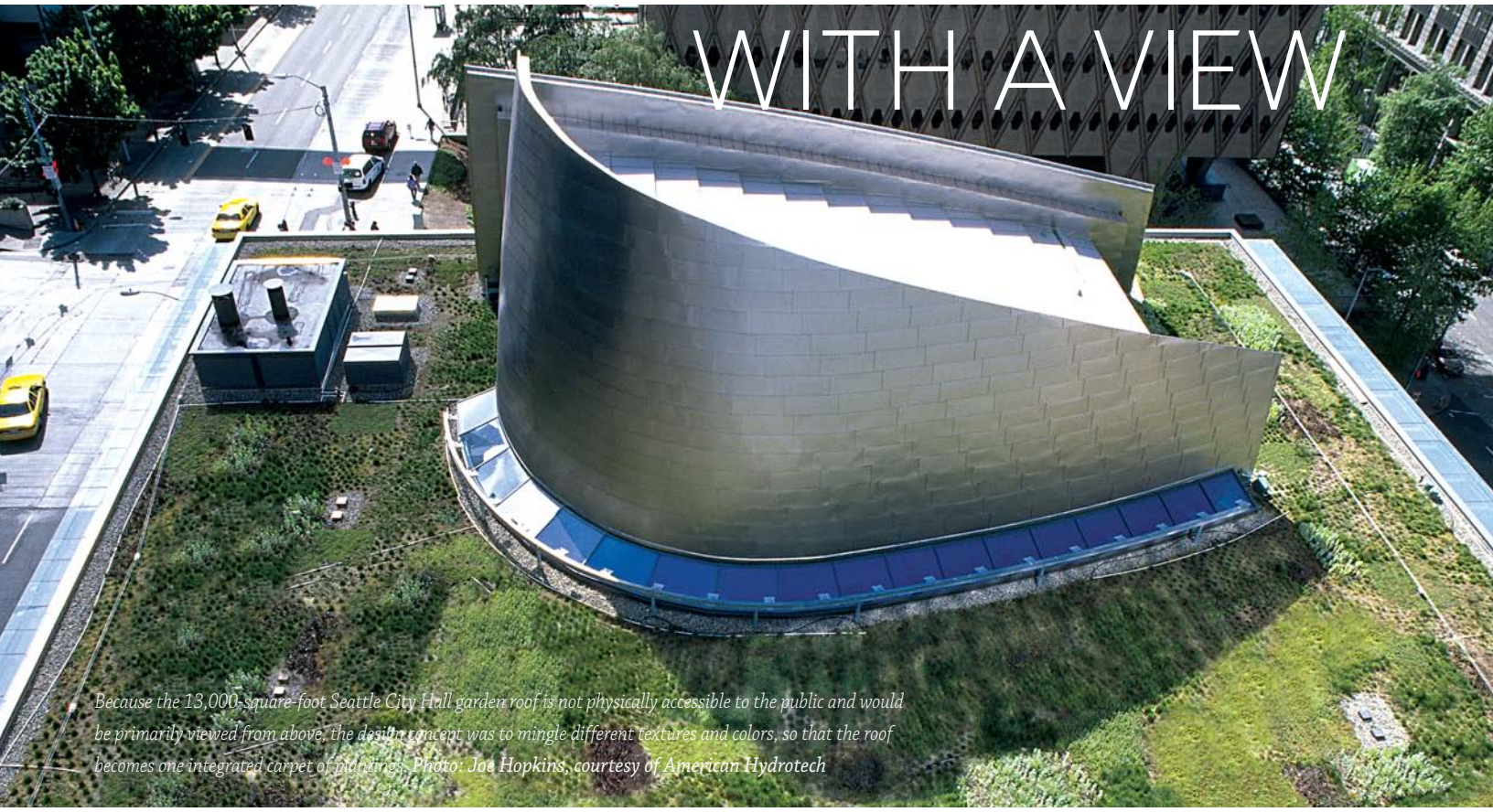
SUSTAINABILITY WITH A VIEW



Because the 13,000-square-foot Seattle City Hall garden roof is not physically accessible to the public and would be primarily viewed from above, the design concept was to mingle different textures and colors, so that the roof becomes one integrated carpet of plantings. Photo: Joe Hopkins, courtesy of American Hydrotech

SEATTLE'S NEW CITY HALL AND JUSTICE CENTER GARDEN ROOFS REPRESENT THE CITY'S ENVIRONMENTAL INITIATIVES.

BY CHARLES CRONENWETH

Visitors to Seattle's new City Hall and Justice Center probably don't spend much time considering the sustainability, energy savings and ecological benefits of these new civic buildings' high profile garden roofs. They're too busy enjoying the views.

Lush grass and succulents surround a gleaming, titanium-clad Council Chamber atop Seattle's new City Hall, creating an evolving garden roofscape as plants change color with the seasons and the reflective metal changes visual qualities in varying daylight conditions. Directly across from City Hall, the 12th floor terrace of Seattle's new Justice Center offers views of its own garden roof, with an intricate planting design guided by an image of sunlight reflected in a shallow streambed.

The garden roofs atop these two new civic buildings do not merely provide a beautiful, natural environment for the viewing public. They represent important environmental and sustainability components in Seattle's new Downtown Civic Campus, a project implemented under the city's new Sustainable Building Policy, as part of the city's Environmental Management Plan.

With the city's endorsement of the new building policy in 2000, Seattle became the first city in the nation to adopt Leadership in Energy and Environmental Design (LEED) rating system's Silver level for any of its own construction projects with over 5,000 square feet of occupied space. Seattle's Downtown Civic Campus, the centerpiece of its LEED projects portfolio, spans three city blocks, incorporating the new Justice Center, Seattle City Hall, and a public plaza on the third block.

The campus bridges the three downtown blocks with a series of plazas and street improvements that establish a cohesive and integrated environment for the new buildings as well as the pre-existing civic buildings adjacent to the site. Above these streets, the new Justice Center and City Hall garden roofs sustain and build upon the central design concepts of the civic campus plaza while promoting sustainability and providing a myriad of energy savings and ecological benefits.

Life-cycle analysis suggests that green roofs will greatly extend the life of the roofs' waterproof membranes by providing protection from ultraviolet degradation, temperature extremes, and mechanical damage. The garden roofs also pro-

vide insulation that lowers cooling costs for the buildings and reduces the "urban heat island effect." Both garden roofs require minimal maintenance and are estimated to reduce annual storm water runoff by 50 to 75 percent. This, combined with both building's extensive water harvesting systems, helps to reduce the impact on local stream watersheds and salmon habitat. The green roofs also contribute to better air quality.

The Justice Center's 8,500 square foot garden roof, completed in 2002, was the first of Seattle's two garden roof projects to be completed and was the first ever green roof system installed in a City of Seattle building. ***Photo courtesy of SvR Design.***

THE TOP CRITERION: SUSTAINABILITY

The Justice Center's 8,500-square-foot garden roof, completed in 2002, was the first of these two projects to be finished and was the first ever green roof system installed on a City of Seattle building. Although it had been an essential element in the Justice Center project from the beginning, the green roof was not thoroughly designed until after the building had gone out to bid.

"Very early on, we were interested in the concept of public occupation — that was always a large part of the overall idea of the building," says Knut Hansen, senior associate for project architect NBBJ Design. "We wanted that to include some important spaces at the top of the roof as well, and this included the publicly accessible garden roof adjacent to the jury assembly room."

As the green roof portion of the Justice Center moved to the forefront, the project's major players — NBBJ Design, SvR Design Company (civil engineer and landscape architect) and the City of Seattle — began reaching a consensus on the design. "In addition to aesthetics," Hansen says, "the other major design and function issues for the design team were sustainability and low maintenance. Sustainability was a top design criterion, along with the ability for the planted roof to retain moisture and slow and reduce storm-water from entering the storm sewer system."

The garden roof could also possibly contribute toward several LEED points for the project — among them, the Sustainable Sites credit for Storm Water Management (one point), the Sustainable Sites credit for Urban Heat Islands (one to two points), and the Materials and Resources credit for Recycled Content (one to two points). Although all these credits had been placed on LEED tracking throughout the project period, only the credit for Urban Heat Islands was ultimately submitted, for reasons unrelated to the green roof.

Across the street is the new 13,000-square-foot Seattle City Hall garden roof, which was completed in 2003, a year after the Justice Center. The building is comprised of two components: a seven-story office tower to the north and a two-story structure containing the council chamber and public meeting room to the south. These are linked by a glazed public lobby spanning the entire ground floor. The green roof covers the lower form and serves as a counterpoint to the glass tower and titanium council chamber roof.

Joint venture architects Bassetti | Bohlin Cywinski Jackson worked with landscape architects Gustafson Guthrie Nichol Ltd. and Swift & Company and the City of Seattle to develop a range of technical criteria for the green roof.

"The original concept for the south roof was not for a green roof, but for it to be all glass and very open," says Gregory Hepp, principal at Bassetti Architects. "Due to costs and other practical issues, however, this was revised to a primarily solid roof with several large skylights (which were custom built by Evergreen House, Inc. of Kirkland, Wash.). With this concept change came the potential for a green roof, which was ultimately included as a bid alternate to an EPDM (Ethylene-Propylene-Diene-Monomer) roof with ballasted pavers. We designed the roof parapets and other intersecting walls and skylights so that they could accommodate either a green roof or an EPDM roof."

Although it would comprise only 39 percent of the cumulative total roof surface, and therefore would not qualify for LEED points, the city ultimately supported the inclusion of a green roof for aesthetics and as highly visible evidence of its commitment to sustainability.

In addition to providing pleasing open spaces, the combined benefits of garden roofs (Seattle City Hall, above) offer particular advantages to municipal governments, such as sustainability, extended durability of a roof's waterproofing membrane, moderating temperatures (thus reducing energy demand), and improved acoustic insulation. But their greatest benefit, particularly for the City of Seattle, is in the dramatic reduction in storm water runoff. ***Photo: Joe Hopkins, courtesy of American Hydrotech.***

Lush grass and succulents surround a gleaming, titanium-clad Council Chamber atop Seattle's new City Hall, creating an evolving garden roofscape as plants change color with the seasons and the reflective metal changes visual qualities in varying daylight conditions. ***Photo: Joe Hopkins, courtesy of American Hydrotech.***

WATERPROOFING AND GARDEN ROOF ASSEMBLY

The designers of both projects decided upon extensive green roof systems, each with a 6-inch soil mix and low-growing hardy plants to create high-profile garden settings that would hold up to the harsh rooftop environment without the use of permanent irrigation.

The green roofs consist of a multi-layered waterproofing membrane integrated with an engineered soil support system that includes insulation and drainage/moisture retention elements, all part of a total assembly supplied by American Hydrotech, Inc. (Chicago). Snyder Roofing served as the roofing contractor for both the Justice Center and City Hall green roof projects.

The watertight integrity of the roofs' waterproof membrane is essential. Like any roof system, long-term moisture protection for the structure below is crucial. The seamless waterproofing membrane used for both green roof projects, Monolithic Membrane 6125, is a hot fluid-applied, rubberized asphalt that forms a long-lasting, tenacious bond to the substrate. Because it is a fluid-applied membrane, there are no seams, so the membrane can withstand submersed water conditions — an important benefit in a green roof, which needs to hold water to nourish the plants. While still hot, Hydroflex 30, a fiberglass reinforced, rubberized asphalt protection sheet was embedded into the membrane to complete the 215 mil-thick waterproofing assembly.

A polyethylene sheet, Root Stop WSF40, was then rolled out over the assembly as a root barrier. Over the root barrier, STYROFOAM closed cell, extruded polystyrene was applied to provide the required thermal value.

WATER RETENTION/DRAINAGE A KEY

An essential component of both garden roof assemblies is the water retention/drainage element, which aids in the growth of the plantings and drains excess water to minimize structural loading.

With the Justice Center and City Hall Garden Roof assemblies, water retention and drainage are provided by Floradrain 40, lightweight panels made of 100 percent recycled polyethylene molded into specially designed retention cups and drainage channels. Floradrain allows for the free drainage of excess water, achieving flow rates significantly higher (up to 39 gallons per minute per width foot) than that of conventional drainage methods, while simultaneously promoting irrigation through capillary action and evaporation into the soil/vegetation level. This allows for critical moisture retention within the green roofs' shallow soil profiles at a fraction of the weight of other growing mediums.

"For City Hall, a detail change we made over the previous EPDM roof design concept was with the south side City Hall roof drains," says Hepp. "We didn't change the location of the drains between the two roof schemes, but we raised the inlet surface of the drains to get the benefit of storing water at the Floradrain level. With the surface of the drain above the surface of the membrane, water is retained for the plants to help extend the growing season."

Lastly, a geotextile filter sheet, Systemfilter SF, was unrolled over the entire drainage/water storage/aeration layer. The filter sheet, made of non-woven polypropylene fibers, helps prevent the loss of soil, mulch and plant debris while allowing for the flow of moisture.

THE PLANTING MEDIUM

Following the installation of all components of the soil support assemblies, the planting medium was installed. A critical part of any green roof system, the planting medium must provide a stable structure for the anchorage of the plants' root system, while remaining as lightweight as possible to prevent excess loading of the roof structures. For each project, the planting medium was specifically engineered for that application, taking into account the plant palette, sun exposure and other factors. Each of the engineered soil mixtures used is designed to provide optimum infiltration, moisture retention, temperature and insulation, and chemistry.

The Justice Center used a custom mixture of nitrolized pine bark, sand, pumice, nutrients and peat. The engineered soil mix used for the City Hall Garden roof included pumice, sand, compost and nutrients.

LANDSCAPE DESIGN

"In the initial planning stages, a simple, monoculture green roof was considered for the Justice Center," says Matthew Suhadolnik, ASLA, of SvR Design Company. "However, because the green roof would be located in a high profile, publicly accessible space, it was ultimately determined that high aesthetic value was essential."

The landscape concept for the Justice Center green roof sustains and builds upon one of the central design concepts for the three-block downtown civic campus plaza. The pedestrian-friendly, street-level plaza seeks to reference and celebrate the flow of water from Washington's Central Cascades Mountains to Puget Sound, with the Justice Center representing the headwaters. A symbolic water feature originating from the Justice Center Plaza will span the entire

civic campus project, meandering through landscaping, streets and structures.

"Building upon this water theme, the landscape design for the Justice Center garden roof was guided by an image of sunlight reflected in a shallow streambed," says Suhadolnik. "Flowing, naturalistic patterns have been created using groundcover plants of varying textures and in subtle shades of blue, gray and green. Sheep fescue placed throughout the plantings provides a unifying silvery-gray element representing ripples in a shallow, slow-moving stream."

Many of the plants used for the Justice Center roof are native to the area, such as Point Reyes Creeper and Barren Strawberry. "Most of the plants were incorporated because of their drought tolerance, their acceptance to shallow soil depths and overall form and texture," says Suhadolnik. "With the emphasis on the visibility of this green roof, and the way it was designed, we chose plants with their various grays and subtle blues to show waves of different kinds of vegetation moving through the site."

Because the 13,000-square-foot Seattle City Hall garden roof is not physically accessible to the public and would be primarily viewed from above, the design concept was to turn the roof into a "carpeted patchwork" of vegetation.

"We elected to mingle different textures and colors, so that the roof becomes one integrated carpet of plantings when you look down on it — with squares and patches of different plantings that blend together at the edges," says Marcia West, Gustafson Guthrie Nichol Ltd. "The important thing for us was achieving this mingled pattern and choosing plants that we knew were going to survive the environment."

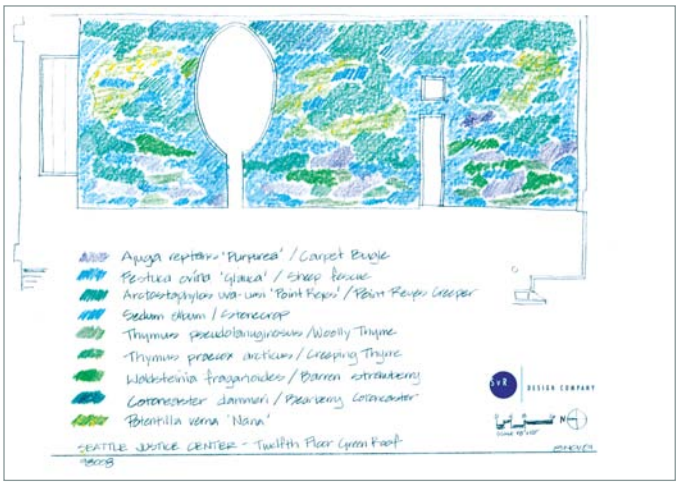
Well before selecting the roof's plant materials, Gustafson ran test plots atop Seattle's old (and formerly adjoining) City Hall Building. "On these plots we tested a number of sedums and grasses and ultimately chose our green roof plantings based on what survived the best," says West. They also performed additional growing tests in cooperation with Rana Creek, a nursery in Northern California that specializes in growing drought tolerant plants.

The roof contains approximately 60 percent grasses and 40 percent sedums, all direct planted from plugs grown in four-inch pots. Plantings included 5,600 pots of sedums, including varieties such as Frosty Morn, John Creech, and Sedum reflexum, and almost 8,400 pots of fescue and 8,400 pots of June Grass.

"It's important with a project like this to thoroughly plan out how the planting is to be staged," says West. The young plants must get in the ground before they become susceptible to drying out. "Staging was very important for the City Hall project because of the large size of the green roof coupled with limited roof access. All the soil and plants had to come up on a lift because there is only a small access hatch to the roof."

SUSTAINABILITY WITH A VIEW, AND OTHER BENEFITS

"We were always interested in a garden roof for the Justice Center project, regardless of the LEED points it may provide," says Hansen of NBBJ Design. "LEED didn't become a requirement until part way through the project. But before that, we already realized that because of a garden roof's insulation value, its ability to retain water and our ability to use the top of a roof to make a public amenity, it made a lot of sense."



Because the Seattle Justice Center green roof would be located in a high profile, publicly accessible space, it was ultimately determined that high aesthetic value was essential. The landscape concept for the Justice Center green roof sustains and builds upon one of the central design concepts for the three-block downtown Seattle Civic Campus Plaza. ***Courtesy of SvR Design.***

The Seattle Justice Center did earn a LEED Silver rating. The project incorporates a curtainwall system by Benson Industries (Portland, Ore.) to act as a naturally-vented double-skin façade (the inner layer is a storefront system by Kawneer of Norcross, Ga.). A high efficiency HVAC system includes variable-flow chillers from Trane (Tyler, Texas), carbon dioxide monitors from Siemens (Alpharetta, Ga.), and air-handling unit filters from Farr of Jonesboro, Ark. (for medium efficiency conditions) and Farr's Riga-Flo (for high-efficiency conditions).

City Hall features a plaza that is still under construction, but the team is anticipating LEED Silver also. In addition to the green roof, notable green design strategies include rainwater harvesting and an under-floor HVAC system.

"There has been a tremendous amount of positive feedback from the City Hall garden roof," says Hepp of Bassetti Architects. "It provides a highly engaging landscape for city staff and the public to enjoy as well as serves as an example of sound municipal environmental policy."

In addition to providing pleasing open spaces, the combined benefits of garden roofs offer particular advantages to municipal governments, such as sustainability, extended durability of a roof's waterproofing membrane, moderating temperatures (thus reducing energy demand), and improved acoustic insulation. But their greatest benefit, particularly for the City of Seattle, is in the dramatic reduction in storm water runoff. As Seattle and other cities struggle to cope with storm water runoff and the requirements of the new, more stringent EPA storm-water regulations, green roofs will become an increasingly important option for municipalities around the country.

Charles Cronenweth is the western regional manager of American Hydrotech, Inc., Seattle. For more information on LEED certification, visit www.usgbc.com. Additional information on the Garden Roof Assembly is available at www.hydrotechusa.com.

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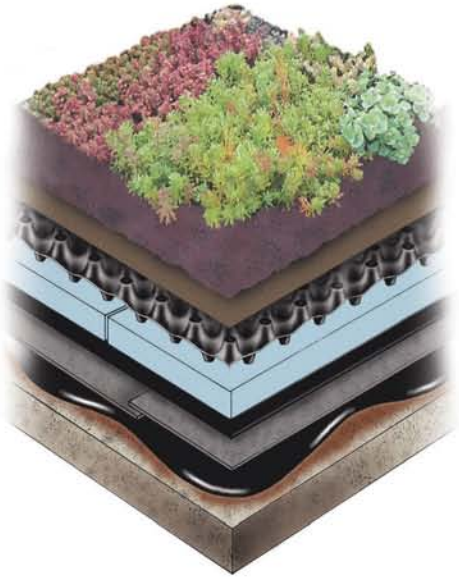

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