

VERTICAL STORMWATER MANAGEMENT

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VOLUME 19 / ISSUE 2 / SUMMER 2017

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- Plant Profiles: Coreopsis Lanceolata
- Green Roofs and Water Quality Research
- The Philadelphian on the Parkway
- One the Roof with...  
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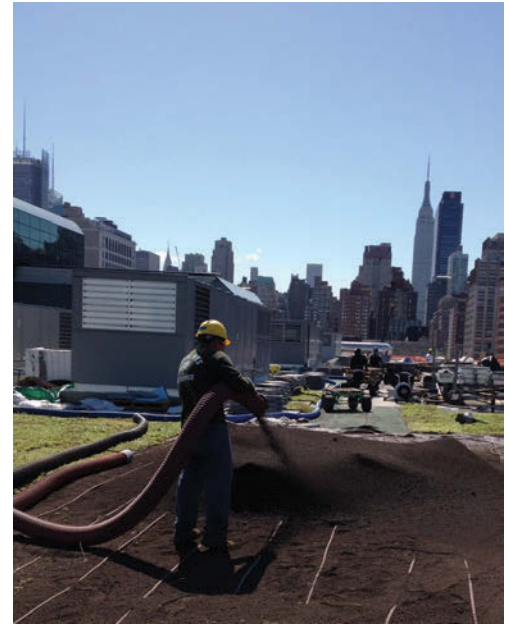
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*On the Cover: An example of Vertical Stormwater Management. The Expo Center Stormwater Green Wall in Portland, Oregon, is the first of its kind in the United States. Stormwater runoff from the adjacent structure flows through a series of channels into vegetated planters mounted to a vertical structure. The planters are filled with native Oregon vegetation to mimic the deep, verdant canyons of the Columbia River Gorge. Find out more at Seattle CitiesAlive 2017. [www.citiesalive.org](http://www.citiesalive.org) Courtesy Environmental Services, City of Portland.*



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# ALT-FACTS, BEER, STORMWATER & GREEN INFRASTRUCTURE

**C**holera swept through London, England killing tens of thousands of people from the 1820's to the 1850's. The prevailing belief at that time was that Cholera was caused by miasma, or noxious airborne particles. The truth of the matter was discovered by physician John Snow, who used a dot map in the Soho district to tract Cholera fatalities in an 1854 outbreak. He determined that the majority of deaths centered around a particular water pump. His research into Cholera deaths found that employees of the nearby Broad Street Brewery, all of whom were given a daily allowance of beer and didn't drink from the well did not contract the disease. With this revelation, he discovered that the well was responsible for spreading the disease through the water, rather than the air. With this discovery he ushered in a new industry - the waste water industry. City engineers, now understanding that disease is carried by water, and the damage caused by flooding, have worked tirelessly ever since to develop infrastructure to manage waste water and carry stormwater away from buildings and roads.

Their work makes life in cities possible. The logic of removing water is embedded deeply into codes of practice for buildings and communities used by civil engineers and planners, even today. Tens of billions of dollars have been, and continue to be, invested in schemes that separate us from stormwater. Despite these efforts, intense storms, never before experienced, are increasingly overwhelming the carrying capacity of these systems and new solutions are needed.

The solution: we need to capture as much stormwater on site as possible and use it to grow plants in, on and around buildings! If we establish policies that promote this practice, we will help to address our current stormwater infrastructure crises, and solve a number of additional problems.

In this issue of the LAM on Stormwater, we interview award winning green roof designers Charlie Miller and Monica Kuhn about their perspectives on stormwater management and project work. William Foley also provides us with a case study of how stormwater incentives tipped the scales in favor of an innovative multiunit green roof retrofit solution in Philadelphia.

We also learn about stormwater quality and green roofs through the research of Mike Hardin, and find out how green infrastructure has significantly cut the costs of stormwater management in Portland, Oregon by Tom Liptan.

John Snow's discovery of water borne illness changed the landscape on public health and water management in the 19th century. Here in the 21st, we are working yet again to change the landscape on how we deal with stormwater. I hope you join us in Seattle for *CitiesAlive: 15th Annual Green Roof and Wall Conference*, where we will continue to work at turning what once contributed largely to death, into a wellspring of life, health and resilience through green infrastructure. We may also celebrate with a little beer!

Sincerely yours,



Steven W. Peck,  
Founder and President



STRATA



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CitiesAlive® 2017 highlights the necessity of green roofs and walls alongside the region's unique characteristics as they contribute to community, place making and the resilience of the people in a variety of sessions and workshops. Go to page 15 to learn more.

Visit [CitiesAlive.org](http://CitiesAlive.org) to register.



## BOOK REVIEW: SUSTAINABLE STORMWATER MANAGEMENT, THOMAS LIPTAN

Tom Liptan is a pioneer of eco-roofs in Portland, OR. His new book *Sustainable Stormwater Management* (available in July 2017) provides landscape professionals and students with a comprehensive guide to landscape design, installation and maintenance for sustainable stormwater management.

Tom Liptan plans to be on-hand at CitiesAlive for an exclusive book signing. Keep an eye out for details!

## 2017 UPDATES STRENGTHEN CITY OF TORONTO GREEN ROOF INCENTIVE

The City of Toronto recently strengthened the Eco-Roof Incentive Program, further improving the business case for green roofs in Toronto. The incentive was increased from \$75/m<sup>2</sup> to 100/m<sup>2</sup> for green roofs on existing buildings, new buildings with a gross floor area under 2,000 m<sup>2</sup>, and all new construction projects by Toronto School Boards. The amendments to the program also include a structural assessment grant of up to \$1,000, and eligibility for new construction projects of any size by not-for-profit organizations. For more, visit [toronto.ca/livegreen/ecoroofs](http://toronto.ca/livegreen/ecoroofs)



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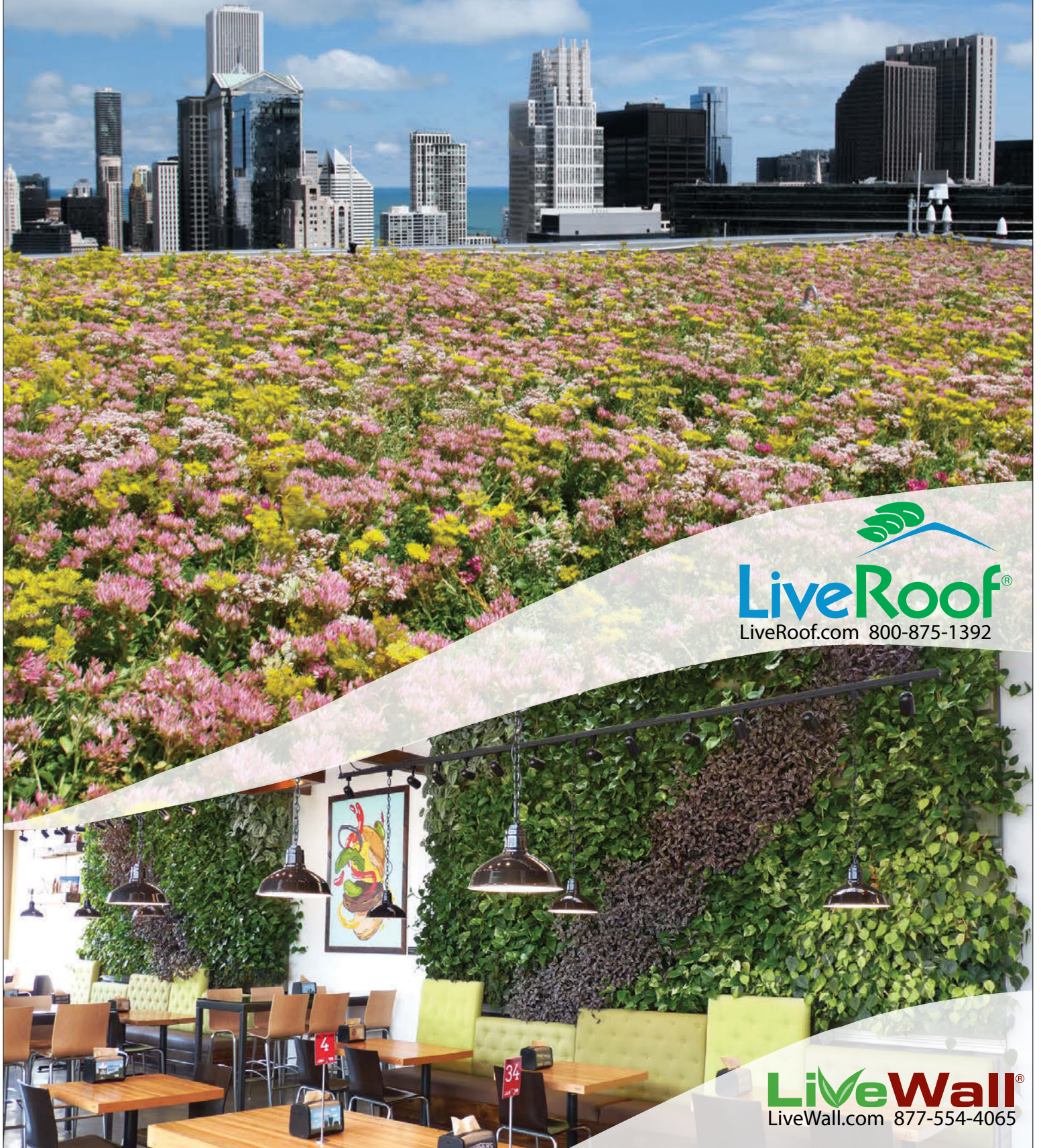
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# COREOPSIS LANCEOLATA

BY BRADLEY ROWE, MICHIGAN STATE UNIVERSITY,  
EAST LANSING

“NATURAL STANDS OF THE SPECIES ARE OFTEN FOUND ON DRY, INFERTILE SITES — NOT UNLIKE THE CONDITIONS PRESENT ON A ROOF.”

- BRAD ROWE

It is generally accepted that plants with greater above- and below-ground biomass and that possess higher transpiration rates are better equipped to intercept, hold, and transpire rainwater. When compared to *Sedum* spp., one such plant is *Coreopsis lanceolata* (lance-leaf coreopsis, sand coreopsis, lance-leaf tickseed). The species is an herbaceous perennial that is native to the eastern and central areas of North America. It is a fast grower, a proficient self-seeder, and is suitable for naturalized areas. In addition to its seasonal interest, the plant attracts wildlife and serves as a pollinator species.

Under ideal growing conditions it may reach a height of 60 cm (24 in) and a spread of 45 cm (36 in). The plant forms clumps with the majority of the leaves occurring at the base of the plant. The lance shaped leaves are variable and may be pinnately lobed or entire (not lobed). The showy, daisy-like yellow flowers sit on upright stems and range in size from 2.5 to 5.0 cm (1 to 2



in) in diameter and are present during late spring to early summer. Although yellow is not my favorite color, the bright yellow flowers stand out and are highly visible, a characteristic that is favorable for a green roof since most roofs are viewed from a distance.

*Coreopsis lanceolata* prefers full sun (4 to 6 hours of direct sunlight per day), but can tolerate partial shade. If there is less direct sunlight than the stems will stretch (grow taller) and the plants will not produce as many flowers. Regarding growing substrate, it thrives in poor, dry, sandy or rocky soils that are well drained. Natural stands of the species are often found on dry, infertile sites – not unlike the conditions present on a roof. It is very drought tolerant and is one of few herbaceous perennials



Brad Rowe has been conducting green roof research at Michigan State University (MSU) since 2000. Research topics include plant selection, growing substrates, carbon sequestration, stormwater runoff, energy conservation, and roof vegetable production. He was the founding chair of the GRHC Research Committee and received the GRHC Research Award of Excellence in 2008. Brad also teaches a course on green roofs and walls at MSU and will be presenting at this year's *CitiesAlive* Conference in Seattle, Washington. To hear him speak, register at [CitiesAlive.org](http://CitiesAlive.org).

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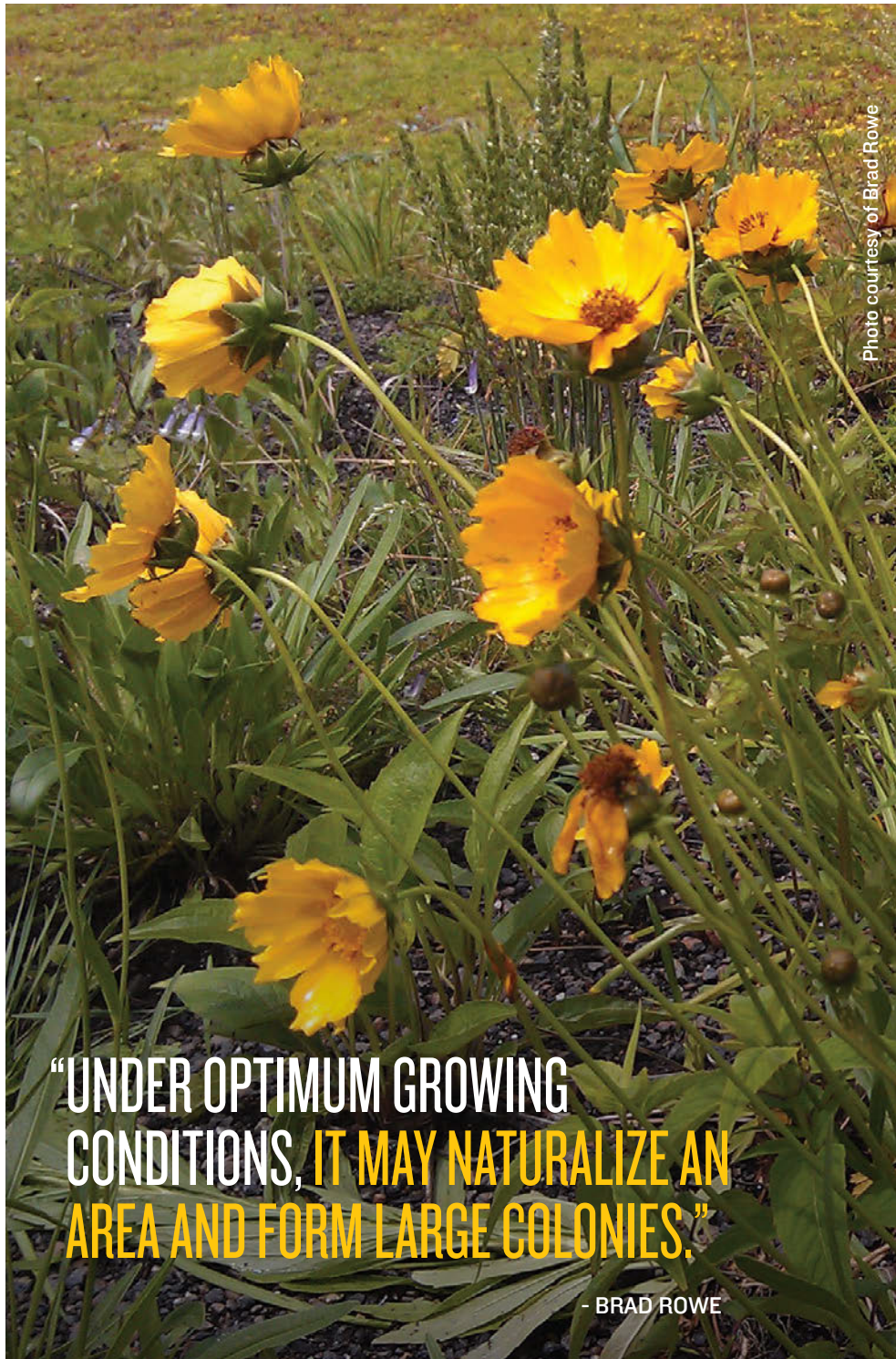


Photo courtesy of Brad Rowe

**“UNDER OPTIMUM GROWING  
CONDITIONS, IT MAY NATURALIZE AN  
AREA AND FORM LARGE COLONIES.”**

- BRAD ROWE

that has survived in our 10 cm (4 in) deep test plots without supplemental irrigation. Besides drought, the species is also tolerant of heat and humidity and is classified within USDA hardiness zones 4 to 9.

The species has no serious insect or disease problems, but may sprawl if the soil is too moist and fertile. Also, poorly drained soils may result in crown rot. Also, as previously mentioned, the species has a propensity to self-seed. This can be a positive or negative characteristic depending on your point of view. Under optimum growing conditions, it may naturalize an area and form large colonies. Even though it is native, it can be invasive and outside of its native range, this could be a problem. For example, the species was introduced to Japan and China where it is now displacing native plant life and has been labeled an invasive species by the Invasive Alien Species Act.

Although the use of herbaceous perennials such as *Coreopsis* may improve water retention relative to succulents, a large part of their superior performance is likely due to the greater substrate depths necessary to grow these plants relative to *Sedum*. Also, if the roof is irrigated, a balance must be found between providing enough water to maintain plant health while also allowing the substrate to dry out enough to provide stormwater storage capacity for the next rain event.



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Photos courtesy of Etera

# A GIANT OF THE SEDUM WORLD



BY DARCY DRYSDALE, GRP, GREEN ROOF ACCOUNT MANAGER, ETERA

With their colorful blooms and foliage, low maintenance requirements and drought tolerance, Sedums continue to be the plant family of choice for most extensive green roofs. One of the industry giants is West Coast based Etera®.

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Etera has sold over 3.5 million square feet of their pre-vegetated SEDUM TILE® mat since 2010 and last year produced over 900,000 lbs of Sedum cuttings both for their own production and to sell to other green roof product producers and installers. Sedums are shipped across North America on refrigerated trucks or by air to ensure they arrive on site in excellent condition.

Customers can order custom mixes of bulk Sedum, have custom mixes grown as SEDUM TILE mats, or order Sedum or perennials plugs suitable for green roofs such

as *Allium*, *Fragaria* or *Achillea*. Custom mixed SEDUM TILE mats with perennials grown into them are a favorite with designers. A large on-hand inventory of SEDUM TILE mats designed for maximum color are available year-round from Etera. Unlike the Midwest and East Coast, green roof projects install year-round on the West Coast.

Etera’s three separate production facilities located in Western and Eastern Washington State and Northern California offer different climates and allow for a wider range of green roof plant options. It also allows them to trial new varieties for specific

climates and regions and offers production capabilities on a huge scale. “Our goal is to constantly improve and refine our production techniques and increase green roof plant options in challenging regions,” Wisshack added.

An exclusive tour of the Mount Vernon production facility in the beautiful Skagit Valley will be held on September 21st as part of *CitiesAlive Green Roof and Wall Conference* in Seattle!

*Darcy Drysdale, GRP, Green Roof Account Manager, Etera based in Seattle, Washington. To learn more, visit [etera.com](http://etera.com).*



## RESEARCH:

# THE CONTROL OF NUTRIENTS IN GREEN ROOF RUNOFF

BY MIKE HARDIN, PHD, PE, CFM

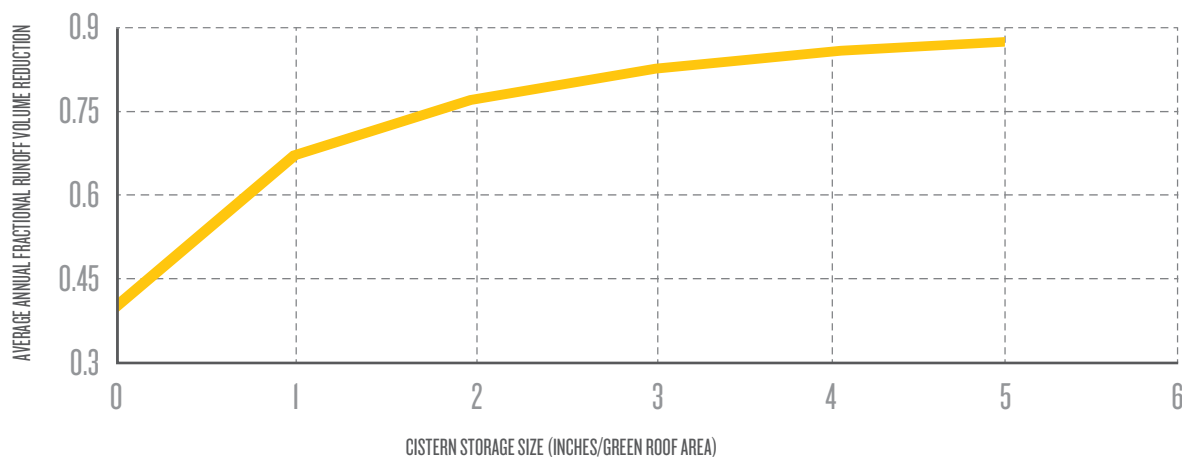
One of the most significant benefits of green roofs is the stormwater volume reduction they can provide in urban environments. This inherently provides a water quality benefit, in the sense that a runoff volume reduction typically results in a mass reduction.

However, green roofs have a significant mass of organic materials associated with them. This comes in the form of organics such as compost or peat that are a part of the growing media, the plants, and any fertilization during plant establishment. Conventional roofs can also be a source of nutrients with the primary source being atmospheric deposition, for example combustion processes release NO<sub>x</sub> into the atmosphere which can accumulate on roof tops during interevent dry periods and be washed off during rainfall events.

Several studies performed by the University of Central Florida's (UCF) Stormwater Management Academy examined the water quantity and quality benefits of a specifically designed green roof. That design consisted of a green roof that utilized a

cistern to capture runoff and reuse it for irrigation of the green roof. This resulted in a significant increase in stormwater volume reduction. This reduction is, of course, dependent on the amount of storage provided and local rainfall patterns. A model which allows for prediction of the hydrologic efficiency based on green roof design, cistern size, and local rainfall data was developed as part of this work. It is a long-term continuous simulation model that uses a mass balance approach to calculate the hydrologic efficiency. **Figure 1** shows an example efficiency curve for Orlando, Florida. It can be seen that a green roof in Orlando, Florida can reduce the volume of stormwater by between about 40% to 95% on an average annual basis, depending on if a cistern is used and the size.

**FIGURE 1: GREEN ROOF HYDROLOGIC EFFICIENCY RELATIVE TO CISTERN SIZE FOR ORLANDO, FLORIDA**





Additionally, the UCF studies examined the addition of a pollution control media (PCM) layer, or soil amendment layer, to improve water quality. Two different approaches were examined, namely one where the PCM was used as a growth media and one where the PCM was used as a layer under the growth media. The PCM examined consisted mostly of tire crumb and expanded clay. This material can absorb phosphorus, removing it from green roof filtrate as it flows through the media (Wanielista, et al., 2007; Wanielista, et al., 2008; Wanielista & Chang, 2008).

The UCF studies showed that green roof test chambers that incorporated this media into their design, in general, had lower total phosphorus (TP) concentrations in the green roof filtrate than green roofs that used just a growth media with more than half of the test chambers being significantly lower ( $\alpha=0.05$ ). The addition of a PCM layer did not appear to affect total nitrogen (TN) concentrations. It is noted that the vegetation did not grow as well in the test chambers that utilized just the PCM as growth media. It was speculated that this was due to the dark color of the PCM, which resulted in burning the plants. The test chambers that utilized the PCM as a layer, under the growth media, exhibited healthy plant growth. All green roof test chambers in the study that examined using the PCM as a growth media were shown to have significantly higher concentrations of TP compared to the control chambers ( $\alpha=0.05$ ). The study that examined the use of PCM as a layer under the growth media showed that about half of the test chambers had significantly lower concentrations than the control test chambers with the others not being significantly different ( $\alpha=0.05$ ). TN concentrations, in general, were shown not to be significantly different ( $\alpha=0.05$ ) from the control chambers.

The UCF studies also showed that vegetation plays an important role in reduction of TN and TP from green roof filtrate. The UCF study showed that test chambers with vegetation had, in general, significantly reduced TN and TP concentrations compared to test chambers with only media ( $\alpha=0.05$ ). This is expected since nitrogen and phosphorus are macro nutrients required for plant growth. Comparing the vegetated test chambers to the control test chambers, TN concentrations were found to not be significantly different ( $\alpha=0.05$ ) while TP concentrations were found to be significantly higher ( $\alpha=0.05$ ) for the test chambers without the PCM.

Finally, the UCF studies showed that the use of a cistern can also help in reducing TP concentrations in runoff discharged from a green roof. This is likely due to settling that occurs in the cistern. It was shown that most of the test chamber cisterns had lower TP concentrations than the filtrate ( $\alpha=0.1$ ). TN concentrations, in general, were shown to not be significantly different between the green roof filtrate and cisterns.

As noted previously, the volume reduction achieved by green roofs can result in a decrease in mass of TN and TP relative to conventional roofs. **Figure 2** shows the mass of TN and TP

**“BASED ON THE RESULTS FROM THESE STUDIES, GREEN ROOFS CAN BE USED TO REDUCE THE NUTRIENT LOADING DUE TO STORMWATER RUNOFF FROM ROOF TOPS.”**

**- MIKE HARDIN**

discharged from the green roof and control roof test chambers. It can be seen that in green roofs that utilize a pollution control media, vegetation, and a cistern (sized to 5 inches over the green roof area) to capture and reuse green roof filtrate, a significant mass reduction can be achieved.

Based on the results from these studies, green roofs can be used to reduce the nutrient loading due to stormwater runoff from roof tops. Further, the use of a PCM layer was shown to help reduce the TP loading from green roofs. The addition of a cistern to capture and reuse the green roof filtrate further helps to reduce the TP and TN. Finally, the establishment of healthy vegetation contributes to the reduction of nutrients from a green roof. Incorporating all these elements in a green roof design can result in a green roof that discharges less nutrient mass than a conventional roof.

## FIND OUT MORE

*Mike Hardin is a Water Resources Engineer with Geosyntec Consultants, Inc., Orlando, Florida. For more information <http://geosyntec.com/geosyntec/pdf/The-Control-of-Nutrients-in-Green-Roof-Runoff.pdf>.*

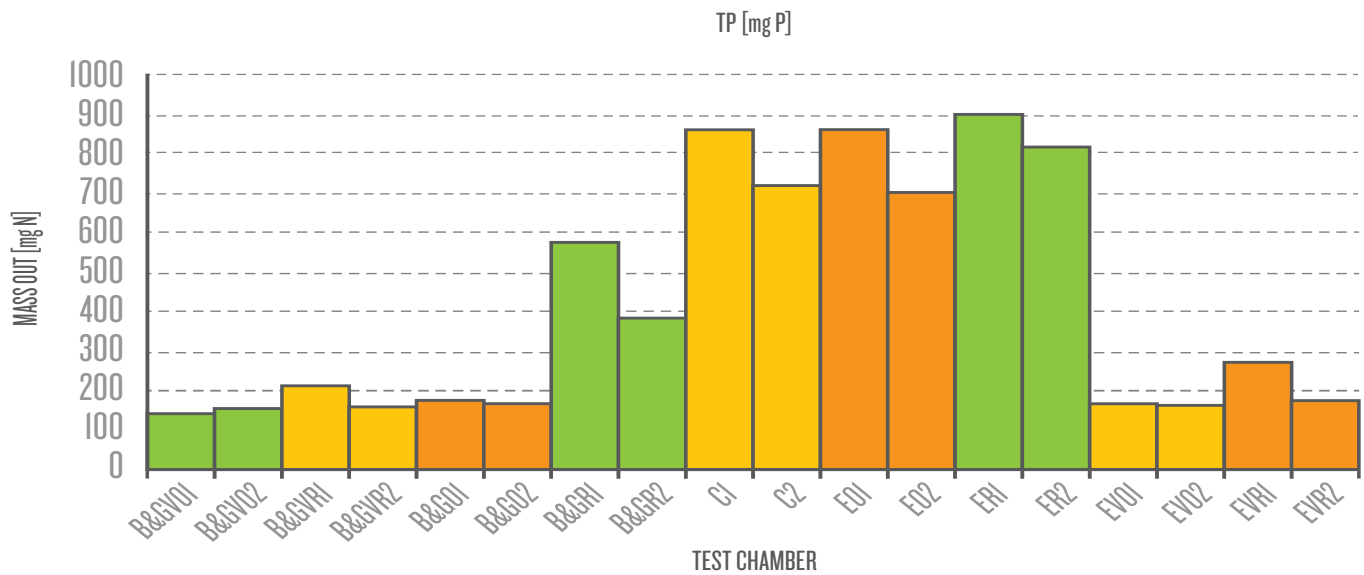
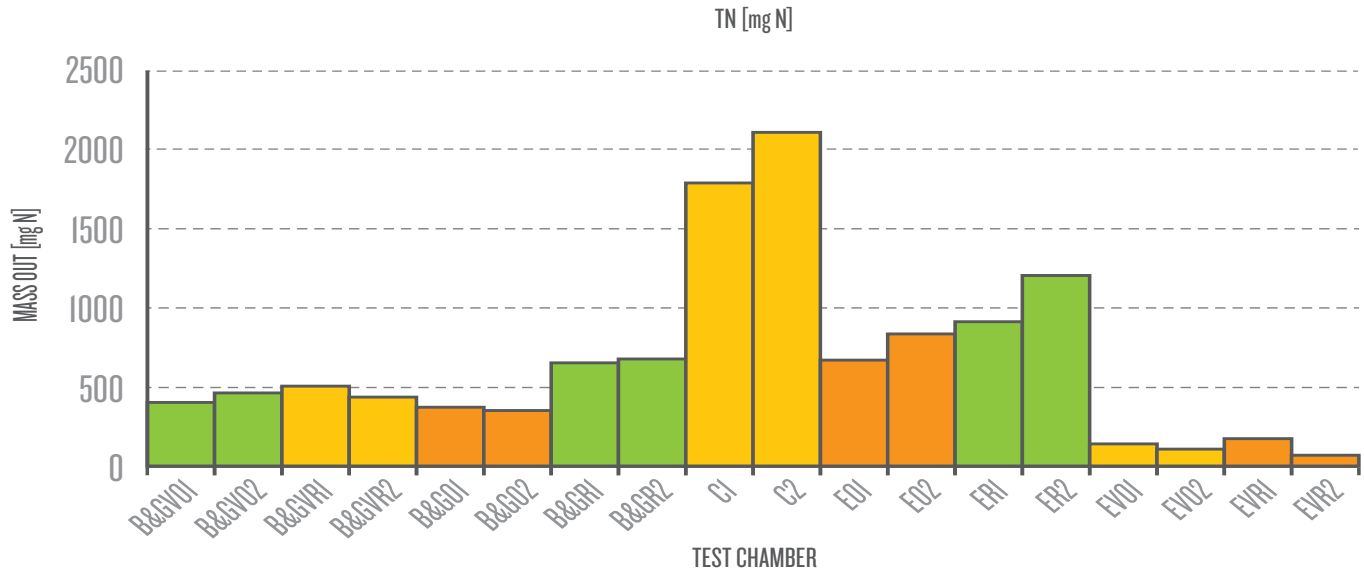
**References:** *Wanielista, M., Kelly, M., & Hardin, M., “A Comparative Analysis of Greenroof Designs Including Depth of Media, Drainage Layer Materials, and Pollution Control Media”, FDEP Final Report WM 864, September 2008.*

*Wanielista, M., Hardin, M., & Kelly, M., “The Effectiveness of Green Roof Stormwater Treatment Systems Irrigated with Recycled Green Roof Filtrate to Achieve Pollutant Removal with Peak and Volume Reduction in Florida”, FDEP Final Report WM 864, May 2007.*

*Wanielista, M., & Chang, N., “Alternative Stormwater Sorption Media for the Control of Nutrients”, Southwest Florida Water Management District Final Report B236, September 2008.*



**FIGURE 2: TN AND TP MASS COMPARISON FOR DIFFERENT GREEN ROOF DESIGNS AND A CONTROL ROOF**



Note: B&G is Bold & Gold™ PCM, E is expanded clay growth media, V is vegetation, O is over irrigation (2 inches per week), R is regular irrigation (1 inch per week), and C denotes control roof. Each test chamber was duplicated once.

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BY WILLIAM F. FOLEY, GRP

## GREEN ROOF PRELIMINARY ASSESSMENT

In 2014, The Philadelphian on the Parkway was in the process of planning the long overdue replacement of the Social Room Roof. The facilities management department had contracted with Systems Design and Analysis, Inc. (SDA), a trusted roof consultant for past projects at the Philadelphian. After careful consideration, SDA concluded that a “vegetated assembly should not be installed on this roof. A low flashing height below the windows is a risk not worth taking. The roof deck is flat and the windows are less 10” above the deck”. SDA recommended an 80 mil PVC roof membrane applied directly to the concrete deck with R-20 insulation and covered with two foot square decorative pavers.

The Owners Association wanted a green roof and I got involved to see if a vegetated system could work. We agreed that a positive slope to drain is preferable for a green roof assembly, however, we were able to recommend an extensive green roof system designed specifically for 0 / 12” slope using 1.575” deep Floradrain FD-40 E. This depth compensates for ponded water at low spots in a flat roof system. The concern raised by SDA regarding green roof flashing heights was eliminated because flashing details against, walls, windows and perimeter edging would remain exactly as designed by SDA.

Photo courtesy of William F. Foley



McArthur/McCollum Roof Winner of Sika's  
2016 Contractor Project of the Year

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Photo courtesy of William F. Foley



## THE PHILADELPHIAN SITE MAP

**“THE PHILADELPHIAN JUST RECEIVED THE ONLY ENERGY STAR RECOGNITION FOR MULTI-FAMILY HOUSING 2017”**

- WILLIAM F. FOLEY

### GREEN ROOF SHADING PROBLEM

A concern raised was could a sedum prosper on a shaded roof? The roof is almost entirely shaded from October through March and receives only a few hours of direct sunlight daily in summer. Oscar Warmerdam, of Sempergreen, was called to assess the sunlight conditions and make plant recommendations. At the next Board Meeting he reassured the Owners and SDA that with the proper mix sedum plants would thrive. A plant list was specifically developed with selected varieties of sedum supplied as mats, sedum plugs, cuttings and larger ornamental sedum. Sempergreen managed the establishment of the sedum for two years and as of April 2017 the plants are performing well.

### PHILADELPHIA WATER INCENTIVES AND TAX PROGRAMS

The last remaining hurdle was the overall cost of the system. We understood green infrastructure incentives from seminars given by Erin Williams of Philadelphia Water. The Philadelphian would be eligible for a reduction in their stormwater rates by adding green infrastructure. The impervious area reduction resulted in a savings of over \$900 per year or \$29,000 over the warranted roof life. The Philadelphian would also be eligible for a SMIP Grant (Stormwater Management Incentive Program). The SMIP Grant application required the Owner to commission a “Stormwater Plan” for the entire property. General Manager Frank Bonom, hired a civil engineer to commission the stormwater plan and to complete the SMIP grant application earning a Grant award of \$25,000.00. The combined stormwater savings, along with decrease in energy costs, increased membrane life expectancy, and substantial increases in property value for green roof facing condominiums, provided the needed leverage for the Green Committee to convince the Owners Association Board to move ahead with the project.

### ENGINEERING, PROCUREMENT AND ESTABLISHMENT

The Board approved the green roof concept in August 2014. The final plans included changes to the preliminary plan to accommodate window washing scaffolds and balconies on the project. This resulting design extended the green roof to the perimeter edge to comply with the SMIP Grant requirement of 70% coverage.

The installed Flex PVC roof system included an International Leak Detection (ILD), Electric Field Vector Mapping (EFVM) vector mapping grid beneath the PVC membrane and the system was tested for defects prior to covering with a green roof. The green roof installation was done in March and April of 2015. Before the installation of the green roof the perimeter paver system was installed above the Floradrain™ drainage panels on a pea gravel base. The green roof system can store up to 1.8 gallons of stormwater per square foot. The substantial completion of The Philadelphian green roof project occurred on Earth Day 2015 and was featured on the front page of the Philadelphia Inquirer Newspaper.

### CONCLUSIONS

The Philadelphian green roof has grown beautifully in its first two years. The best evidence of the success of this project is the pride and affection shown by the Owners. The Philadelphian, originally built in 1964, just received the only Energy Star “Labeled Building and Plants” recognition for multi-family housing 2017 in Pennsylvania. Only six multi-residential properties in Pennsylvania have ever received this prestigious recognition. The green roof replacement was factored into the building assessment and played a significant role. Philadelphian Owners Association and their Green Committee should be praised for having the foresight and compassion to consider how their building impacts energy consumption and water management for the City of Philadelphia.

*William F. Foley is a green roof veteran who has taught the Green Roof Design and Installation course for over 14 years.*



# HOW GREEN ROOF LAYERS MANAGE STORMWATER

By Rohan Lilauwala, GRP

The many layers of green roofs work together to effectively manage stormwater in three important ways: by retaining water, by delaying runoff from the roof, and by slowing the flow of runoff. For more information on the work being done by the Green Infrastructure Foundation to establish standards for stormwater performance, and to read a white paper on the subject, visit [greeninfrastructurefoundation.org/lapt](http://greeninfrastructurefoundation.org/lapt)

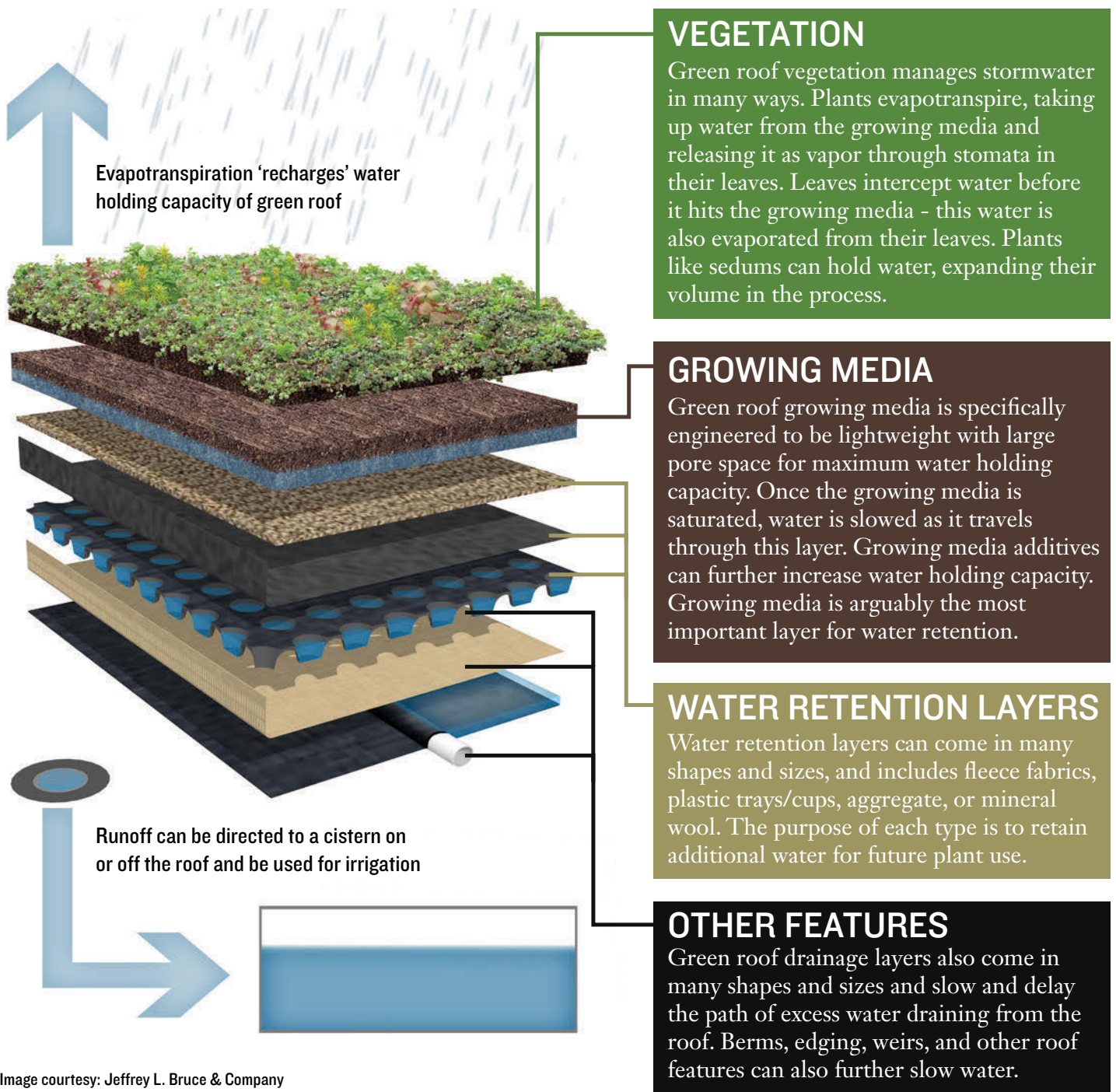


Image courtesy: Jeffrey L. Bruce & Company



BUILDING RESILIENCE AND EQUITY ACROSS CASCADIA: PEOPLE, COMMUNITY, AND PLACES

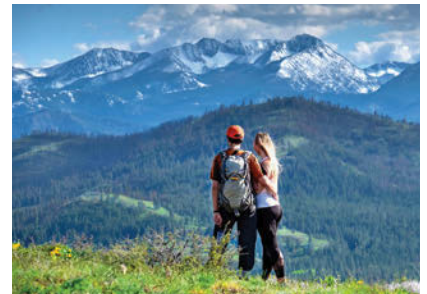


# CITIESALIVE

15<sup>TH</sup> ANNUAL GREEN ROOF & WALL CONFERENCE  
SEATTLE | SEPTEMBER 18-21, 2017

P R O G R A M

Within the western region of North America lies Cascadia. Although the boundaries of the region differ depending on ecological, political, economic or cultural lines - it's undeniable that Cascadia is expansive. The unique climate of Cascadia calls for special building materials, plants, media, and maintenance practices. After years on the east coast, *CitiesAlive*® 2017 is highlighting the necessity of green roofs and walls in this rapidly growing region.



CITIESALIVE.ORG



# AGENDA AT A GLANCE

## MONDAY, SEPTEMBER 18

Training Courses, Opening Plenary, Trade Show & GRP Welcome Reception

## TUESDAY, SEPTEMBER 19

Morning Plenary, Concurrent Sessions, Trade Show & Local Host Committee Reception

## WEDNESDAY, SEPTEMBER 20

Morning Plenary, Concurrent Sessions, Awards of Excellence Luncheon & Tours

## THURSDAY, SEPTEMBER 21

Green Infrastructure Foundation Charrette & Tours



KATHLEEN WOLF

HAMID KARIMI



JEFFREY BRUCE

DEBRA GUENTHER



GAIL VITTORI

PAUL KEPHART



MAMI HARA

CHRIS GUILLARD

## KEYNOTE SPEAKERS

Learn from over 80 expert speakers at the world's largest green roof and wall conference around the theme: Building Resilience and Equity Across Cascadia: People, Community, and Places.

### A TRIBUTE TO STEPHEN KELLERT: THE BUSINESS CASE FOR BIOPHILIC DESIGN AND HUMAN HEALTH!

Stephen Kellert was a pioneer in the development of biophilic design. Celebrate his life and learn how his legacy lives on.

**Kathleen Wolf**, Ph.D., Research Scientist, University of Washington

**Judith Heerwagen**, Office of Federal High-Performance Green Buildings, GSA

**Bill Browning**, Principal, Terrapin Bright Green

**Gail Vittori**, Co-Director, Center for Maximum Potential Buildings Systems; Chair, GBCI

**Bert Gregory**, FAIA, Partner, Mithun

**Amanda Sturgeon**, CEO, International Living Future Institute

### PUSHING THE BOUNDARIES OF LIVING ARCHITECTURE DESIGN IN CASCADIA WITH MASTER DESIGNERS

Learn from master designers about signature projects and the lessons they provide such as the Facebook Roof park and Transbay Terminal.

**Chris Guillard**, PLA, Founding Partner, CMG Landscape Architecture

**Paul Kephart**, GRP, ASLA, President, CEO Ecologist & Designer, Rana Creek Design

### ROUNDTABLE OF GREEN INFRASTRUCTURE POLICY LEADERS - EQUITY & RESILIENCE

Take the pulse of green infrastructure policy from leaders in Cascadia and beyond.

**Dr. Hamid Karimi**, Deputy Director, Natural Resources Administration, DC DOEE

**Jeff Joslin**, Director of Current Planning, San Francisco Planning Department

**Mami Hara**, General Manager / CEO, Seattle Public Utilities

**Bob Sallinger**, Conservation Director, Audubon Society of Portland

**Gil Kelly**, Chief Planner and General Manager, Planning, Urban Design & Sustainability, City of Vancouver



# WHAT'S NEW FOR CITIESALIVE 2017

## REGIONAL THEME

*CitiesAlive*® 2017 will be focusing on green roof and wall designs and policies not just in Seattle, but across the entire Cascadia Region.

## UNIQUE NETWORKING

On Monday, September 18, join us for the GRP Welcome Reception where you'll get acquainted with event attendees and learn about GRP opportunities. On Tuesday, September 19, attend the *CitiesAlive*® Local Host Committee Reception sponsored by Architek, Shamrock Landscaping and Jakob, at the Seattle Aquarium. Enjoy some of the region's best cuisine and local beverages, and meet with green roof and wall professionals from across North America at one of the top visitor attractions in the Puget Sound region.

## NEW TRAINING

Join us for an all new Biophilic Workshop and review the patterns of biophilic design and the supporting science. Two biophilic design leaders, Bill Browning of Terrapin Bright Green and Judith Heerwagen of GSA will present. Participants will then collaborate to produce a set of design principles for green roof and walls.

We've added a half-day Stormwater Workshop that will teach you how to design for maximum stormwater performance, comply with stormwater regulations, and how to make the business case for using a green roof as a stormwater BMP.

## ALL NEW TRACK

*In the Design Studio With* is an all new session track. Learn the tricks of the trade first-hand from award-winning master design professionals, with these intimate sessions. Interact with Jeffrey L. Bruce, FASLA, ASIC, LEED, GRP; Debra Guenther, FASLA, LEED AP BD+C, Partner, Mithun; and David Yocca, FASLA, AICP, LEED AP, Senior Partner, Conservation Design Forum.

## TOURS & NETWORKING



Photo courtesy of Bill and Melinda Gates Foundation



Photo courtesy of Bertschi Center



Photo courtesy of UpGarden P-PatchCommunity



Photo courtesy of Bellevue City Hall



Photo courtesy of Seattle Housing Authority

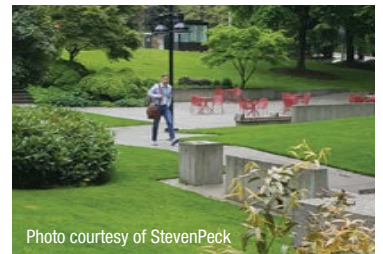


Photo courtesy of StevenPeck

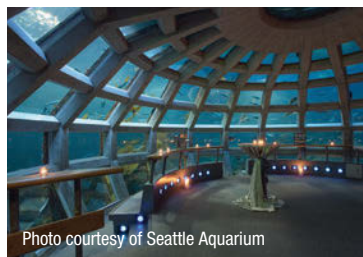


Photo courtesy of Seattle Aquarium



Photo courtesy of Sheraton Hotel



## GREEN ROOFS AND WALLS IN THE HEART OF DOWNTOWN SEATTLE

*CitiesAlive*® opening and closing plenary, all programming, and the trade show are all conveniently taking place at the Sheraton Seattle Hotel, located in the heart of Downtown Seattle. *CitiesAlive*® attendees receive a significantly reduced room rate of only \$225 per night for a single room if booked before September 1, 2017. Benefits of staying at the Sheraton Seattle Hotel:

- Convenient, on-site access to all *CitiesAlive*® programming and trade show
- Access to their state-of-the-art Fitness Center and pool
- Selection of restaurants, cafes, and lounges close to the hotel

Book your room at [CitiesAlive.org](http://CitiesAlive.org) or call 1-888-627-7056. If reserving your room by phone, please indicate you are attending *CitiesAlive*® to receive the special conference rate.



## EXCLUSIVE TOURS

### HIGH POINT COMMUNITY

High Point community serves as a model for inclusive sustainability. Commissioned by the Seattle Housing Authority, this 1,600 home residential project incorporates affordable housing, parks, gardens, public amenities, as well as ecologically sound design.

### BILL & MELINDA GATES FOUNDATION GREEN ROOF

The Bill & Melinda Gates Foundation boasts an expansive LEED Platinum Certified building and multiple green roofs. This tour will explore the design, installation, and maintenance characteristics of this 130,000 square foot sustainable infrastructure project.

### FREEWAY PARK

Learn about the evolution of this historical project designed by landscape architect guru Lawrence Helprin, while exploring the truly unique architectural cohesion of lush vegetation, flowing water, and concrete.

### BELLEVUE CITY HALL GREEN ROOF

With three separate green-roof installations at Seattle City Hall, tour guests are invited to learn about the site's new and retrofitted green roof installations.

### UPGARDEN P-PATCH COMMUNITY GARDEN

UpGarden P-Patch Community Garden is a rooftop urban agriculture initiative. Overlooking the Seattle skyline, the multi-purpose garden serves a green community space as well as source of fresh, organic produce for the community.

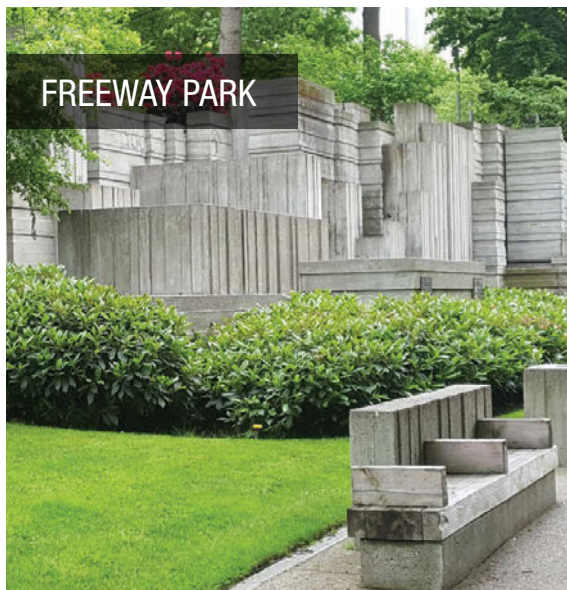
### BERTSCHI SCHOOL

The Bertschi School is one of the first fully certified Living Building Projects. It features multiple green roofs and an interior living wall that is irrigated with grey water from the science classroom and rainwater in a fully closed system.

### HIGH POINT COMMUNITY



### FREEWAY PARK



### UPGARDEN P-PATCH COMMUNITY GARDENS



## NETWORKING

### GRP WELCOME RECEPTION

Once the Opening Plenary and Trade Show wrap up on Monday, September 18, join colleagues at the Welcome Reception, from 8:00pm - 10:00pm. For your convenience, the party will take place the conference hotel, with light appetizers and cash bar.

Everyone is welcome, and we'll be honoring our Green Roof Professionals.

### LOCAL HOST COMMITTEE RECEPTION

The dedicated *CitiesAlive* Local Host Committee plans and hosts the Local Host Committee Reception on Tuesday, September 19 at the Seattle Aquarium. Enjoy a unique networking opportunity at the waterfront aquarium with local food and drink.

(Ticket Event)

### AWARDS OF EXCELLENCE LUNCHEON

On Wednesday, September 20, *CitiesAlive* will host the Awards of Excellence Luncheon. Come and celebrate integrated design and installation excellence with the Green Roof & Wall Awards of Excellence and recognize outstanding contributions to the industry in research, policy, and corporate contribution. (Ticket Event)

Seats are limited, so register early.



# REGISTRATION PACKAGES

## EARLY BIRD DEADLINE #1

Register by June 30 and save \$100 on the GRP & Emerging Professional Pass, Advanced Delegate Pass, and Basic Delegate Pass

### GRP & EMERGING PROFESSIONAL PASS - \$849\* \$749 - GRHC Member. Save over \$440 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Breakfast & Lunch
- Local Host Reception
- Awards of Excellence Luncheon
- GRP Welcome Reception
- One Training Course
- Conference Recordings

## EARLY BIRD DEADLINE #2

Register by August 14 and save \$50 on the GRP & Emerging Professional Pass, Advanced Delegate Pass, and Basic Delegate Pass

### ADVANCED DELEGATE PASS - \$749\* \$699 - GRHC Member. Save over \$335 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Breakfast & Lunch
- Local Host Reception
- Awards of Excellence Luncheon
- GRP Welcome Reception
- Conference Recordings
- One half-day walking tour

### BASIC DELEGATE PASS - \$649\*

\$549 - GRHC Member. Save over \$236 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Breakfast & Lunch
- Awards of Excellence Luncheon
- GRP Welcome Reception
- Local Host Reception

### ONE-DAY PASS - \$399

\$349 - GRHC Members

- Technical Session on Tuesday
- Trade Show Access
- Breakfast & Lunch

## À LA CARTE REGISTRATION

Unless otherwise indicated, separate registration is required for training, the Local Host Committee Reception, Awards of Excellence Luncheon, and tours. Registration items listed below are available for purchase independently. Note, many items are included in registration packages/passes above.

### CONFERENCE PASSES

#### OPENING PLENARY (MONDAY, SEPT 18 ONLY) - \$79

Includes Opening Plenary and reception on the trade show floor

#### HALF-DAY PASS - \$299 / \$199 MEMBERS

Includes Tuesday or Wednesday Technical Sessions, trade show access and, breakfast and lunch

### TRAINING, WORKSHOPS & TOURS

#### TRAINING COURSES - \$225-\$399

Professional development opportunities covering a variety of green infrastructure topics

#### BIOPHILIC WORKSHOP - \$50

We will review the patterns of biophilic design and the supporting science, then break into small groups. Monday, September 18, 1:00 pm - 4:30 pm

#### TOURS - \$39-\$69

Exclusive tours of local green infrastructure projects in and around Seattle

#### GRP ACCREDITATION EXAM - \$495

Earn North America's only green roof specific designation for professionals

### CONFERENCE RECORDINGS

#### CONFERENCE RECORDINGS - \$179

This includes 35+ hours of audio recordings - every session synced with presentation slides

### EVENT TICKETS

#### AWARDS OF EXCELLENCE LUNCHEON - \$89

Includes *CitiesAlive* Awards of Excellence Ceremony and three-course lunch

#### LOCAL HOST COMMITTEE RECEPTION - \$89 / \$69 Members

Ticket to the *CitiesAlive* Local Host Committee Reception at the Seattle Aquarium, includes one drink and local food

### TRADE SHOW ONLY PASSES

#### TRADE SHOW ONLY - \$49

Includes access to the trade show floor on Tuesday, September 19

#### LUNCH ON THE TRADE SHOW FLOOR - \$39

For students, half-day or trade show only pass holders who would like to have lunch with the delegates on Tuesday, September 19 from 12:00pm to 2:00pm only

\* Early bird prices listed. Rates increase by \$50 on July 1, and an additional \$50 on August 15. All prices in USD.



# DETAILED AGENDA | SHERATON SEATTLE HOTEL

MONDAY, SEPTEMBER 18, 2017					
PROFESSIONAL TRAINING (TICKETED EVENT) + OPENING PLENARY & TRADE SHOW					
4:45 pm - 6:30 pm	Opening Plenary	<b>Opening Remarks: Governor Jay Inslee</b> , Governor of Washington <b>A Tribute to Stephen Kellert: The Business Case for Biophilic Design and Human Health</b> <b>Kathleen Wolf</b> , Ph. D., Research Social Scientist, University of Washington <b>Judith Heerwagen</b> , Program Expert, Office of Federal High Performance Green Buildings, GSA <b>Bill Browning</b> , Principal, Terrapin Bright Green <b>Gail Vittori</b> , Co-Director, Center for Maximum Potential Building Systems; Chair, GBCI <b>Bert Gregory</b> , FAIA, Partner, Mithun <b>Amanda Sturgeon</b> , CEO, International Living Future Institute <b>Master of Ceremonies: Steven Peck</b> , GRP, Founder and President, Green Roofs for Healthy Cities		Ravena A, B & C (overspill room Issaquah)	
6:30 pm - 8:00 pm	Trade Show & Opening Reception	Enjoy hospitality on the trade show floor		Metropolitan Ballroom A & B & Prefunction	
8:00 pm - 10:00 pm	GRP Welcome Reception	Start your conference experience off with an additional opportunity to meet green roof and wall professionals and learn more about the Green Roof Professional Accreditation		Greenwood	
TUESDAY, SEPTEMBER 19, 2017					
7:00 am - 9:00 pm	Registration Open			Metropolitan Prefunction	
8:00 am - 8:30 am	Coffee & Continental Breakfast				
8:30 am - 9:45 am	Morning Plenary & Keynotes	<b>Round Table of Green Infrastructure Policy Leaders - Equity &amp; Resilience</b> <b>Jeff Joslin</b> , Director of Current Planning, San Francisco Planning Department <b>Gil Kelly</b> , Chief Planner and General Manager, Planning, Urban Design & Sustainability, City of Vancouver (Invited) <b>Mami Hara</b> , Commissioner Seattle Public Utilities <b>Bob Sallinger</b> , Conservation Director, Audubon Society of Portland <b>Master of Ceremonies: Dr. Hamid Karimi</b> , Deputy Director, Natural Resources Administration, DC Department of Energy & Environment		Ravena A, B & C (overspill room Issaquah)	
9:00 am	Trade Show Opens				
10:00 am - 11:00 am	<b>PROGRAMMING SESSION 1</b>				
Five concurrent sessions feature expert speakers on Policy (P), Design (D), and Research (R) topics; "On the Roof With" panel discussions (O) address emerging issues and opportunities, and with the new "In the Design Studio With" (S) you will learn firsthand from experts and their approach to complex design projects.					
	RAVENA A, B & C	CAPITOL HILL	ISSAQUAH A & B	BALLARD	GREENWOOD
	DESIGN TRACK (D)	RESEARCH TRACK (R)	POLICY TRACK (P)	ON THE ROOF WITH (O)	INNOVATIVE PRODUCT PROFILES
	<b>Living Architecture Performance - More Than the Sum of Parts</b>  <b>David Yocca</b> , FASLA, AICP, LEED AP, Senior Partner, Conservation Design Forum <b>Pete Munoz</b> , PE, Senior Engineer, Biohabitats	<b>Habitats and Biodiversity - Green Roof Services</b>  <b>Habitats and Biodiversity - Green Roof Services</b> <b>Desirae Wood</b> , LAIT, Principal, Dobro Design  <b>Ecosystem Services Provided by Green Roof Habitat Analogs</b> <b>Kelly Ksiazek-Mikenas</b> , PhD Candidate, Northwestern University	<b>Green Roof Policy, Performance, Costs, and Benefits</b>  <b>Portland's Ecoroof Policy: Achieving the Climate Action Plan</b> <b>Mindy Brooks</b> , City Planner, City of Portland, Bureau of Planning and Sustainability  <b>Presenting: The Green Infrastructure Charrette &amp; Cost Benefit Matrix</b> <b>Rohan Lilauwala</b> , GRP, Project Manager, Green Infrastructure Foundation	<b>Best Practices in Green Wall Design and Maintenance for the Cascadia Region</b>  <b>Session Chair:</b> <b>Melissa Daniels</b> , Vice President & Horticultural Specialist, Plant Connection, Inc.  <b>Session Panelists:</b> <b>Daniel Sharp</b> , Landscape Architect, Consultant in Landscape Architecture and Green Infrastructure <b>Chris Wright</b> , Director of Sales, Baseline Irrigation Systems <b>Angela Jones</b> , Horticulturalist & Landscape Division Manager, SolTerra Systems, Inc. <b>Christopher Lyon</b> , President, Tournesol Siteworks	Outstanding innovative products will be profiled during this session
11:00 am - 11:15 am	Break				Metropolitan Prefunction
11:15 am - 12:15 pm	<b>PROGRAMMING SESSION 2</b>				
	RAVENA A, B & C	CAPITOL HILL	ISSAQUAH A & B	BALLARD	GREENWOOD
	DESIGN TRACK (D)	RESEARCH TRACK (R)	POLICY TRACK (P)	ON THE ROOF WITH (O)	IN THE DESIGN STUDIO WITH (S)
	<b>Turning the Tide on Polluted Runoff</b>  <b>Transforming Communities to Turn the Tide on Polluted Runoff</b> <b>Christin Hilton</b> , Urban Partnership Director, The Nature Conservancy <b>Dr. Kathleen Wolf</b> , Research Social Scientist, College of the Environment, University of Washington <b>Michelle Benetua</b> , Duwamish Valley Program Manager, Seattle Parks Foundation	<b>Latest Green Roof Research: Urban Agriculture and Thermal Performance</b>  <b>Carrying the Ball: Profiles of Courage in Urban Rooftop Agriculture</b> A Presentation of Green Infrastructure Sociological Benefits <b>Michael Sanchez</b> , Assistant Professor, Washington State University  <b>Beyond Aesthetic Motivation: Designing Living Walls for Small Scale Urban Agriculture</b> <b>Dr. Yael Stav</b> , Invivo Design	<b>Living Architecture Policy-Making in Massachusetts</b> <b>Peter Lowitt</b> , FAICP, Land Use Administrator, Director & Records Access Officer, Devens Enterprise Commission  <b>Stormwater Retention Training Program</b> <b>Dr. Hamid Karimi</b> , Deputy Director, Natural Resources Administration, DC Department of Energy & Environment (Invited)	<b>Promoting Greater Equity Through Living Architecture - Are Green Roofs Only for the Rich?</b>  <b>Session Chair:</b> <b>Jessica Finn Coven</b> , Director, City of Seattle's Office of Sustainability (Invited)	Learn the tricks of the trade first-hand from award-winning master design professionals, with these intimate sessions  <b>Debra Guenther</b> , FASLA, LEED AP BD+C, Partner, Mithun  Debra is a regular contributor to conversations on equity, resilience and climate change at venues such as Greenbuild, Living Futures, and the Urban Land Institute. Nationally recognized for her leadership on green infrastructure and ecosystem service issues, she was awarded the American Society of Landscape Architects President's Medal in 2010



12:00 pm - 2:00 pm	Lunch on Trade Show Floor				Metropolitan Ballroom A & B
12:15 pm - 1:15 pm	Poster Session				
2:15 pm - 3:45 pm	<b>PROGRAMMING SESSION 3</b>				
	<b>RAVENA A, B &amp; C</b>	<b>CAPITOL HILL</b>	<b>ISSAQUAH A &amp; B</b>	<b>BALLARD</b>	<b>GREENWOOD</b>
	<b>DESIGN TRACK (D)</b>	<b>RESEARCH TRACK (R)</b>	<b>POLICY TRACK (P)</b>	<b>ON THE ROOF WITH (O)</b>	<b>IN THE DESIGN STUDIO WITH (S)</b>
	Green wall design for aesthetics, storm-water, and food production	Green roof and wall research: urban agriculture, sensors, and growing media	Green infrastructure for environmental justice	Waterproofing; Essential Best Practices for the Cascadia Region	Learn the tricks of the trade first-hand from award-winning master design professionals, with these intimate sessions
	<b>Designing and Measuring Benefits of Moveable Living Walls</b> Nancy Rottle, Professor, Director, UW Green Futures Lab, University of Washington, Department of Landscape Architecture Leann Andrews, Lecturer, UW Green Futures Lab, University of Washington, College of Built Environments	<b>Green Roof Thermal Properties as Influenced by Plant Species: Sedum Versus Herbaceous Perennials</b> Dr. Bradley Rowe, Professor, Michigan State University Mert Eksi, Assistant Professor, Istanbul University Indrek Wichman, Professor, Michigan State University	<b>Community Participation Building a Green Wall to Decrease Inequities</b> Linn Gould, Executive Director, Just Health Action Andrew Schiffer, Assistant Project Manager, Just Health Action Paulina Lopez, Community Engagement Manager, Just Health Action	<b>Session Chair:</b> Matt Barmore, GRP, Vice President, Greenrise Technologies  <b>Session Panelists:</b> Timothy M. Barrett, GRP, RRC, CDT, President, Barrett Company Elizabeth Hart, CDT, GRP, Manager, Sustainability Program Development, Tremco Roofing and Building Maintenance John Robinson, Sika Sarnafil (Invited) Peter D'Antonio, Sika Sarnafil (Invited)	David Yocca, FASLA, AICP, LEED AP, Senior Partner, Conservation Design Forum  David leads many of CDN's pioneering demonstration projects. He strives to find holistic, ecologically restorative solutions to complex social, economic, and practical problems that hinder healthy places. Focus on performance-based landscapes has guided him to serve on boards/committees of similarly aligned organizations, including SITES and the Green Infrastructure Foundation (GIF)
	<b>Stormwater Wall: Integrating Sustainability, Art and Science to Manage Stormwater Runoff</b> Amy Chomowicz, Program Manager, City of Portland Environmental Services Dave Elkin, Landscape Architect, Juncus Studio Mike Faha, PLA, FASLA, LEED AP, Principal, GreenWorks	<b>Characterizing Green Roof Vegetation Using Color-Infrared and Thermal Sensors</b> Lee R. Skabelund, PLA, ASLA, Associate Professor, Department of Landscape Architecture, Regional & Community Planning College of Architecture, Planning and Design, Kansas State University Priyasha Shrestha, Graduate Student, Kansas State University	<b>Green Infrastructure for Environmental Justice Communities: Seattle and Los Angeles</b> Cathy Roberts, Project Manager, greenscreen Linn Gould, Executive Director, Just Health Action Reuben Freed, Project Manager, greenscreen		
	<b>Designing the Fifth Facade to Nourish a City</b> Susie Teal, Senior Associate, COOKFOX Architects	<b>Recycled Substrates: Plant Biomass and Plant Cover Correlations</b> Dr. Richard Sutton, PhD, GRP, FASLA, PLA, Professor, Agronomy & Horticulture, UN-Lincoln	<b>Policy Guest Speaker</b> Dave LaClergue, Community Planning Manager, City of Seattle, Office of Planning & Community Development		
3:45 pm - 4:00 pm	Break				Metropolitan Prefunction
4:00 pm - 5:30 pm	<b>PROGRAMMING SESSION 4</b>				
	<b>RAVENA A, B &amp; C</b>	<b>CAPITOL HILL</b>	<b>ISSAQUAH A &amp; B</b>	<b>BALLARD</b>	<b>GREENWOOD</b>
	<b>DESIGN TRACK (D)</b>	<b>RESEARCH TRACK (R)</b>	<b>POLICY TRACK (P)</b>	<b>ON THE ROOF WITH (O)</b>	<b>IN THE DESIGN STUDIO WITH (S)</b>
	Sustainable and restorative living architecture	Green roofs research in the Cascadia and dry climates	Green Roofs Support the Salmon Ecosystem in the Northwest	Integrative Living Architecture Design Installation and Maintenance Best Practices	Learn the tricks of the trade first-hand from award-winning master design professionals, with these intimate sessions
	<b>System-Scale Biomimicry: Mimicking Local Forests to Design Restorative Buildings</b> Jennifer Barnes, AIA, LEED AP, Owner, 55-5 Consulting Alexandra Ramsden, Principal, Director of Sustainability, Rushing	<b>Shopping Center Ecoroof as a Living Laboratory in Portland: Monitoring Environmental Parameters</b> Olyssa Starry, Ph. D., Assistant Professor, Portland State Adrienne Aiona, Manager, Stormwater Management Manual, City of Portland, Bureau of Environmental Services Pradeep Ramasubramanian, Graduate Student, Portland State University	<b>Green Roofs Support the Salmon Ecosystem in the Northwest</b> Andrea Saven, LEED AP, RLA, Technical Director, Columbia Green Technologies Jason King, ASLA, CLARB, LEED AP, SITES AP, Landscape Architect, Senior Associate, Mithun. Ellen Southard, Hon. AIA Seattle, Salmon-Safe Inc.	<b>Session Chair:</b> Kirsten Weeks, GRP, LEED AP, CEM, WELL AP, Associate, Building Ecology Specialist, Arup Engineering  <b>Session Panelists:</b> Peg Staeheli, LEED AP, Principal, MIG/SvR Jörg Bruening, Owner/Founder, Green Roof Service LLC / Green Roof Technology Pliny Fisk, Co-Director, Centre for Maximum Potential Building Systems	Watch out for an exciting announcement!
	<b>Zero Waste Green Roofing - Extended Lifecycles and Common Concerns</b> Elizabeth Hart, GRP, CDT, Manager, Sustainability Program Development, Tremco Roofing and Building Maintenance  <b>Biomimicry at Work: Facade Design and Dynamic Landscapes</b> Sandy Mendler, AIA, LEED AP BD+C, Mithun Reuben Freed, Project Manager, greenscreen Debra Guenther, FASLA, LEED AP BD+C, Partner, Mithun	<b>How Can Green Roofs Thrive in Extremely Dry Climates? A Presentation of Case Studies</b> Darja Majkovic, Head of Products and Applications, Green Solutions Knauf Insulation			
9:00 am - 7:00 pm	Trade Show Floor Open				Metropolitan Ballroom A & B & Prefunction
7:30 pm - 10:30 pm	Local Host Committee Reception - Seattle Aquarium				Seattle Aquarium

\*Agenda subject to change. Please visit [citesalive.org](http://citesalive.org) for the most updated schedule.



**WEDNESDAY, SEPTEMBER 20, 2017**

<b>9:00 am - 10:30 am</b>	<b>Morning Plenary &amp; Keynotes</b>	<b>Pushing Social and Ecological Limits: Massive West Coast Living Architecture Projects</b> <b>Chris Guillard</b> , PLA, Founding Partner of CMG Landscape Architects, on the Facebook Rooftop and more. <b>Paul Kephart</b> , GRP, ASLA, CPSE, CEO, Principal Ecologist & Designer, Rana Creek Design, on the Transbay Terminal and more.				Ravena A, B & C
<b>10:30 am - 10:45 am</b>	<b>Break</b>					Metropolitan Prefunction
<b>10:45 am - 12:45 pm</b>	<b>PROGRAMMING SESSION 5</b>					
	<b>RAVENA A, B &amp; C</b>	<b>CAPITOL HILL</b>	<b>ISSAQUAH A &amp; B</b>	<b>BALLARD</b>	<b>GREENWOOD</b>	
	<b>DESIGN TRACK (D)</b>	<b>RESEARCH TRACK (R)</b>	<b>POLICY TRACK (P)</b>	<b>ON THE ROOF WITH (O)</b>	<b>IN THE DESIGN STUDIO WITH (S)</b>	
	<b>Diverse green roof applications: food, healing, unusual climates, and more</b>	<b>Cutting edge green roof research</b>	<b>Research and case studies for healthy plants and high performance stormwater management</b>	<b>Best Practices in the Maintenance of Green Roofs in the Cascadia Region</b>	<b>Learn the tricks of the trade first-hand from award-winning master design professionals, with these intimate sessions</b>	
	<b>KPU SkyFarm: Food Production on a Shallow Soil Roof</b> <b>Dr. Katherine Dunster</b> , MBCSLA, RPBio, Kwantlen Polytechnic University School of Horticulture	<b>Developing a Regional Green Roof System for Hot Climates</b> <b>John Hart Asher</b> , MLA, Environmental Designer, Project Manager, Department of Ecological Research & Design, Lady Bird Johnson Wildflower Center <b>Michelle Bertelsen</b> , Ecologist, Lady Bird Johnson Wildflower Center	<b>Choosing Sedum Species for Survivability on Extensive Greenroofs</b> <b>Robert Long</b> , President/Owner, Carolina Stonecrops Inc.	<b>Session Chair:</b> <b>Michael Wisshack</b> , Etera National Sales Manager  <b>Panelists:</b> <b>Lynda Wightman</b> , Industry Relations Manager, Hunter Industries <b>Andy Creath</b> , President, Green Roofs of Colorado, LLC <b>Ron Schwenger</b> , GRP, President at Architek Sustainable & Rope + Cable Canada <b>Jon Crumrine</b> , RRO, GRP, A-Tech/Northwest, Inc.	<b>Jeffrey L. Bruce</b> , GRP, FASLA, LEED, ASIC, Jeffrey L. Bruce & Company; Chair, Green Roofs for Healthy Cities  Jeffery is the owner of Jeffrey L. Bruce & Company (JBC) founded in 1986. Jeff has received over 120 separate design and leadership awards, and has worked on over 100 green roofs encompassing over 6 million square feet.	
	<b>2017 Top 10 List of Hot Trends in Greenroof &amp; Greenwall Design</b> <b>Linda Velazquez</b> , GRP, ASLA, LEED AP, Founder & Publisher, Greenroofs.com	<b>Monitoring Two Large-Scale Prairie-Like Green Roofs in Manhattan, Kansas</b> <b>Jeffrey L. Bruce</b> , GRP, FASLA, LEED, ASIC, Jeffrey L. Bruce & Company, Chair, Green Roofs for Healthy Cities <b>Lee R. Skabelund</b> , PLA, ASLA, Associate Professor, Department of Landscape Architecture and Regional & Community Planning College of Architecture, Planning and Design Kansas State University	<b>Biological Research on Extensive Green Roof on Calgary's Municipal Hall</b> <b>Kerry Ross</b> , Principal, Green T Design Inc. <b>Sasha Liston</b> , Green Wall Sales, Estimator, Research and Development, Ginkgo Sustainability Inc.			
	<b>Bay State Medical Center: A Healing Rooftop Garden with Complex Design Features</b> <b>Nicholas Smith</b> , National Sales Manager, ZinCo USA, Inc.	<b>Effect of Microniches on Plant Growth Found On the Millennium Science Complex Green Roofs at University Park, PA</b> <b>Julie Razryadov</b> , Graduate Student, Pennsylvania State University	<b>Green Stormwater Infrastructure: How Well Do These Techniques Stand the Test of Time</b> <b>Tom Liptan</b> , Green Infrastructure Specialist and Researcher, LIVE Center			
	<b>A New Model of Urban Re-Generation: Making Resilient, Sustainable and Socially Just Neighborhoods</b> <b>Eric Corey Freed</b> , LEED, Chief Community Officer, EcoDistricts, Founding Principal, organicARCHITECT	<b>Evaluation of Green Roofs from the Water-Energy-Food Nexus Perspective</b> <b>Mooyoung Han</b> , Professor, Seoul National University	<b>Architectural Systems for ZERO Potable Water and Stormwater Runoff</b> <b>Paul Kephart</b> , GRP, ASLA, CPSE, CEO, Principal Ecologist & Designer, Rana Creek Design			
<b>1:00 pm - 2:45 pm</b>	<b>Awards of Excellence Luncheon</b>	Ticketed; included in the GRP & Emerging Professional Pass, Advanced Delegate Pass, and Basic Delegate Pass.				Metropolitan Ballroom A & B
<b>3:00 pm - 6:00 pm</b>	<b>Living Architecture Performance Tool/Standard - Workshop</b> (Green Infrastructure Foundation)					Greenwood
<b>3:00 pm - 6:00 pm</b>	<b>Tours</b> (Ticketed)					Various Locations
<b>THURSDAY, SEPTEMBER 21, 2017</b>						
<b>9:00 am - 4:30 pm</b>	<b>Tours</b> (Ticketed)					Various Locations
<b>8:30 am - 4:30 pm</b>	<b>Green Infrastructure Charrette</b> (Green Infrastructure Foundation) (By Invitation)					Ballard

**TRAINING COURSES**

<b>Design and Installation</b> Monday, September 18 from 8:30 am - 4:30 pm Price: \$399 (GRHC Member) // \$449 (Non-Member)  Full-day course. Provides detailed information on green roof benefits and technical standards, as well best practices for design, installation and maintenance.  <i>Tuition includes the course, a 300-page Resource Manual. Led by Rohan Lilauwala, GRP, Project Manager, Green Infrastructure Foundation.</i>	<b>Introduction to Rooftop Urban Agriculture</b> Monday, September 18 from 8:30 am - 12:00 pm Price: \$225 (GRHC Member) // \$299 (Non-Member)  Learn about multiple approaches to growing food on rooftops through design and maintenance principles, and case studies drawn from across North America.  <i>Tuition includes the course, an 85-page Resource Manual.</i>	<b>Stormwater Training - NEW!!</b> Monday, September 18 from 8:30 am - 12:00 pm Price: \$225 (GRHC Member) // \$299 (Non-Member)  Half-day training course. Teaches you how to design for maximum stormwater performance, comply with stormwater regulations, and how to make the business case for using a green roof as a stormwater BMP.	<b>Green Walls (New Edition)</b> Monday, September 18 from 1:00 pm - 4:30 pm Price: \$225 (GRHC Member) // \$299 (Non-Member)  This course discusses design and construction best practices for green facades and living walls, as well as the latest research findings on the environmental benefits of these technologies.  <i>Led by Melissa Daniels, Vice President &amp; Horticultural Specialist Plant Connection, Inc.</i>
<b>GRP Business Skills Development Session</b> Monday, September 18 from 1:00 pm - 4:30 pm Free for GRPs!  Available to all GRPs, the first half of the workshop demonstrates how to deliver the green roof lunch n' learn presentation; the second half is an introduction to the green save calculator and explanation of how to use it.	<b>Biophilic Design Workshop</b> Monday, September 18 from 1:00 pm to 4:30 pm Price: \$50  Review the patterns of biophilic design and the supporting science. Participants will then be charged with collaborating to design the most biophilic green roof and wall projects, with a goal of producing a set of design principles for each.  <i>Led biophilic design leaders, Bill Browning of Terrapin Bright Green and Judith Heenwagen of GSA.</i>	<b>Advanced Green Roof Maintenance</b> Monday, September 18 from 1:00 pm - 4:30 pm Price: \$225 (GRHC Member) // \$299 (Non-Member)  Half-day course. Explores green roof maintenance considerations. Learn how to: design and budget to facilitate maintenance; develop maintenance plans and inspection reports that work in concert with warranty requirements; perform common maintenance procedures; and rehabilitate green roofs.  <i>Led by Christian Mahlstedt, GRP, LEED AP, President, Ginkgo Sustainability.</i>	<b>Green Roof Professional (GRP) Accreditation Exam</b> Monday, September 18 from 10:00 am - 12:00 pm Price: \$495  Earn North America's only green roof specific designation for professionals.  <i>All exam registrations must be completed by October 18th, 2016 at noon. Registrations will not be accepted after that date. On-site registration will not be available.</i>

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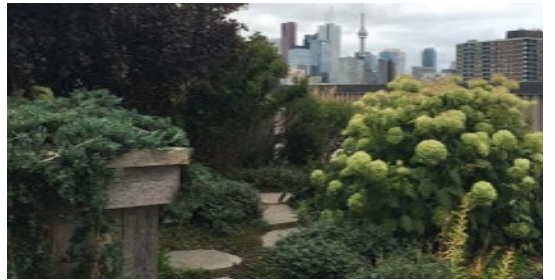
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Photos courtesy of Monica Kuhn



## ON THE ROOF WITH... AWARD WINNING ARCHITECT, MONICA KUHN

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BY STEVEN W. PECK, GRP, HON. ASLA, FOUNDER & PRESIDENT,  
GREEN ROOFS FOR HEALTHY CITIES

Monica Kuhn has been working as an architect on green roofs, mostly in the residential sector, for more than twenty years. She has co-authored numerous papers on green roof design and won many awards of excellence, like the Hugh Garner Housing Co-op, for her innovative design work. I caught up with her in Toronto and asked her about innovative practices for stormwater management on a green roof.

With the winter snowfalls being replaced by spring showers, it is time once again for the Hugh Garner Housing Co-operative staff in Toronto to go up to their 8th floor roof garden and install the roof drain extender. That is because the 8,000sf / 743sm garden was specifically designed to maximize the use of the stormwater that falls on the roof every year. Like all other buildings in Canada and northern United States, the roof structure was designed to accommodate a live load for snow throughout the winter months – however, once the ice and snow melt every year, that load capacity is available for another, three season use!

When the roof membrane was replaced in 2006, prior to the installation of the roof garden on the South roof in 2010, the design team installed a “cistern layer” over 75 per cent of the roof, using a 2” (5cm) thick drainage board between the root protection membrane and the filter cloth, to retain stormwater on the roof. The height of the roof drain was extended, with a removeable piece of pipe, to hold the 2” of water on the roof – while allowing any additional precipitation to “overflow”, preventing potential overloading. The retained stormwater is used to drip-irrigate the green roof



throughout the summer months, allowing the Co-op to save money and to divert water from the City's already overburdened stormwater system. The irrigation pump is set up with a level that measures the depth of the retained stormwater, so that during a dry spell, the cistern is automatically refilled with City water as required. This additional layer of water also adds to the thermal and sound performance of the roof assembly, which has led to increased savings in heating and cooling on the top floor, as well as increased tenant comfort.

The 14,000 sf (1,300 sm) North roof, which is still waiting for the installation of its extensive green roof, already has a 4" (10cm) deep cistern. This half of the green roof was designed to allow for night-time spray irriga-

tion, which, when tied to the building's mechanical system, will allow for heat rejection as the water is sprayed into the cooler night air and over the plants and growing media below, before finding its way back to the cistern (similar to

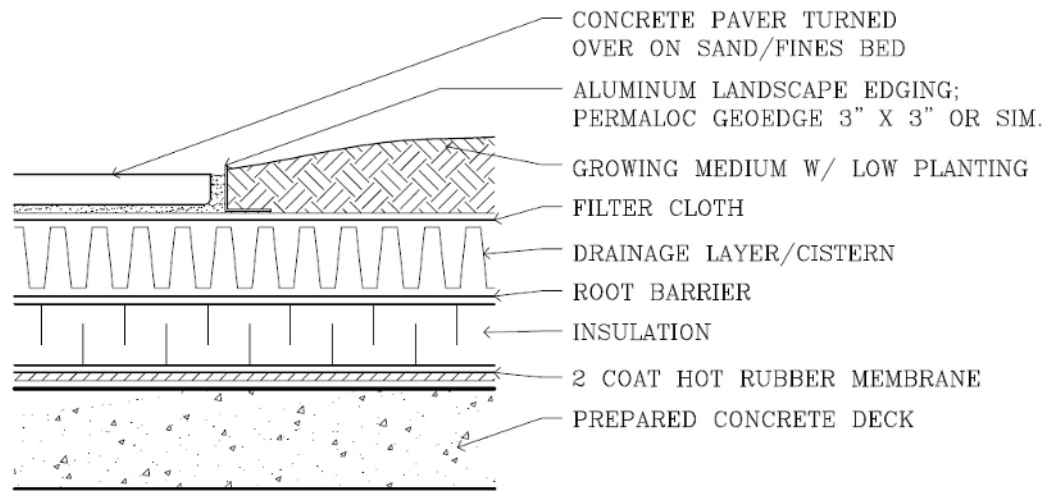
a heat exchanger), thus reducing the cost of heating and cooling of the shared public spaces.

Thus, the simple rethinking of a seasonal loading requirement has led to an elegant design solution with multiple

benefits, and has allowed for a no-cost increase in the loading capacity on an existing building.

*Monica Kubn is the Principal of Monica Kubn Inc., award winning architectural firm based in Toronto, Ontario.*

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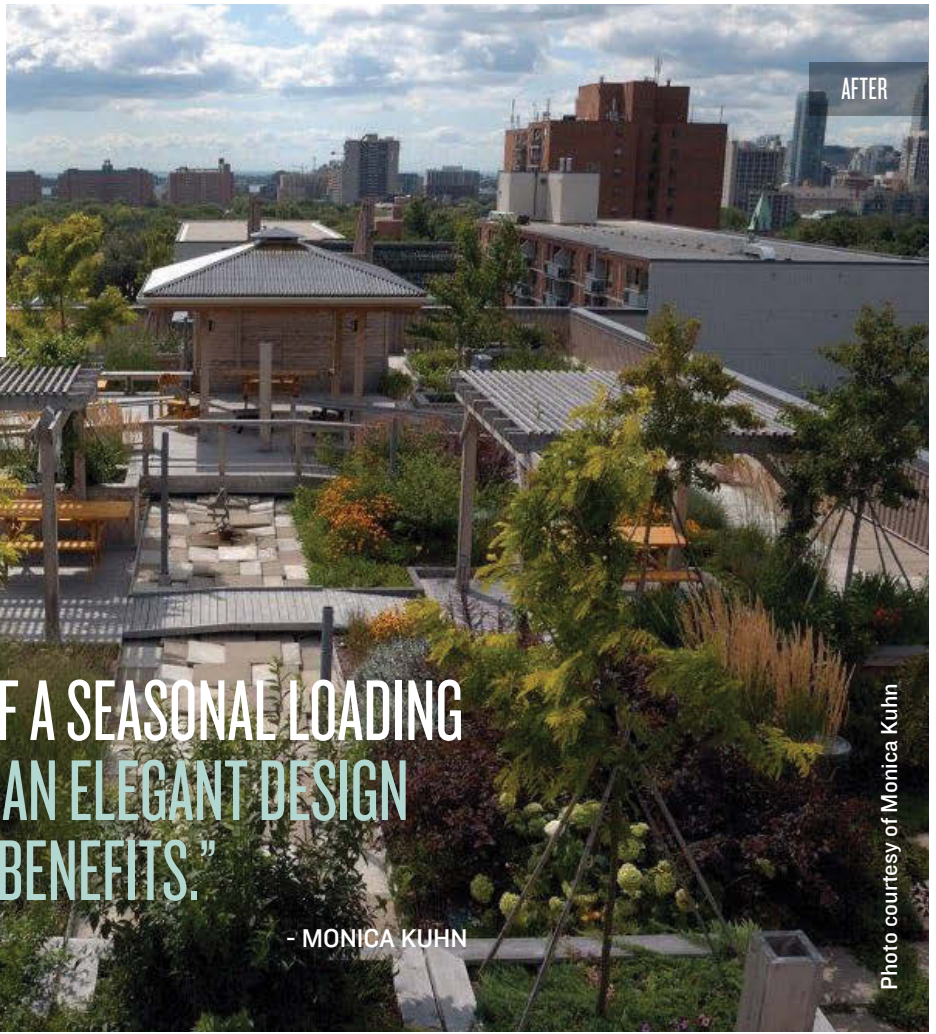
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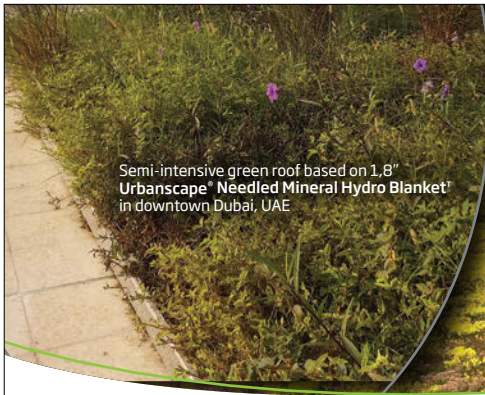




“THE SIMPLE RETHINKING OF A SEASONAL LOADING REQUIREMENT HAS LED TO AN ELEGANT DESIGN SOLUTION WITH MULTIPLE BENEFITS.”

- MONICA KUHN

Photo courtesy of Monica Kuhn



Semi-intensive green roof based on 1,8" Urbanscape® Needled Mineral Hydro Blanket® in downtown Dubai, UAE



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# INTERVIEW WITH CHARLIE MILLER

INTERVIEWED BY STEVEN W. PECK, GRP, HON. ASLA,  
FOUNDER & PRESIDENT GREEN ROOF FOR HEALTHY CITIES



Charlie Miller has won numerous awards for his green roof design work over the past 15 years. He has paid special attention to the ability of green roofs to manage stormwater.

*1. Charlie, we've known each other since about 1998, in the very early days of the green roof industry in North America! You are a pioneer in the field! What attracted you to this industry initially?*

I started out as a skeptic. I suppose the best converts do. I was introduced to green roofs by an old friend, Professor Joachim (Toby) Tourbier, then teaching at the Technical University of Dresden. In 1996, I was preparing the draft for the first Pennsylvania Best Management Practices Manual for Stormwater Management and Toby interested me in including green roofs. He invited me to Germany and introduced me to the burgeoning German green roof industry. I was looking for fresh ideas that had the potential to give the American green engineering movement a kick in the pants. I was amazed to discover a well-developed industry, incentivized by smart public policy. I returned to the United States excited about becoming part of a similar program here.

*2. How would you characterize the changes in the green roof and wall industry over the last ten to fifteen years?*

Despite the size of the American marketplace, green roofs have not lived up to their potential to become commonplace features in the American construction industry. Of course, the great recession affected all construction industries. However, Roofmeadow did not notice a significant slowdown since many of our clients are institutional and have long funding cycles that can bridge economic downturns.

The market has remained too small for consumers to reap the benefits of economy of scale; either in lower costs for basic extensive roofs, or in greater choice in intensive design features. The market is divided between: 1) "compliance roofs," that are a response to regulatory requirements in half a dozen cities, and 2) amenity gardens for commercial and institutional developments. In many cities, green roofs compete with alternative approved measures (e.g., cisterns and photo-cell arrays) that are cheaper or more highly subsidized. However, in recent years, more publicly accessible or visible amenity projects are increasing the public's expectations for engaging elevated garden spaces. Green roof

gardens and walls are increasingly understood to enhance property desirability and value.

*3. You and your collaborators have won many awards for your design and installation work. Is there one project that stands out for you as your favorite and why?*

Of the projects that won Green Roof Awards of Excellence, I will choose two; Life Expression Chiropractic and Le Frak Lakeside Center at Prospect Park. The Life Expression represents simple but elegant design. The roof slopes also offered an exciting engineering challenge. The green roof is an inseparable element of the buildings healing function. It is loving cared for by its owners. Its striking geometry and high visibility makes it a wonderful ambassador for the green roof industry. The Le Frak complex places hydrologic engineering in service of restoring a beloved American Olmstead landscape. The rolling wooded green roof disguises the underlying service buildings and blends imperceptively with the adjacent parkland. The complexity of the design, which features a unique runoff management system, rainwater capture and recycling system, is concealed in the landscape.

*4. Stormwater management has become an important driver for green roofs and other forms of green infrastructure. There are many variables that impact stormwater performance. How do you typically maximize the stormwater management performance of projects you work on where this is a primary objective?*

Over many years, we have focused on understanding how green roofs influence hydrology and how their benefits can be maximized. To this end, we collaborate with a number of universities, including Stevens University, University of Maryland, Villanova and Portland State. Green roofs are unique among stormwater best management practices in that they have massive surface areas compared to their volume. This results in two important outcomes: 1) they fundamentally change the characteristic response of a building to rainfall, however being so thin, 2) their response to any single event will be highly variable and dependent on antecedent conditions. The relationship of green roofs to other



BMPs can be compared to the fable of the 'tortoise and the hare.' Green roofs 'win the race' by harnessing the slow, but constant, loss of water by the process of evapotranspiration. However, unless and until stormwater BMPs are evaluated using long-duration modeling (and observation) the strengths of green roofs will not be fully appreciated. It is our conclusion that all other benefits follow when we maximize: 1) contact time of rainfall with plant roots, and 2) plant vigor.

5. *If you gaze into a crystal ball for a moment, what do you think the most important trends will be in the green roof and wall industry over the next five to ten years?*

After two decades, the novelty of green roofs in North America is diminished. Customers are becoming more discriminating and non-performing green roofs are less likely to be tolerated. Owners of green roofs and walls increasingly (and justly) expect them to be lovely and durable. Fortunately, beauty and performance go hand in hand. We find, increasingly, that purchasers of green roofs understand and appreciate that their installation will require professional maintenance. This change in the level of sophistication on the part of green roof clients will lead to the advent of more skilled green roof maintenance companies. As the bar for performance is raised, elevated urban amenities (e.g., restaurants, cafes, parks, retail areas, and recreational facilities) that include green roofs and walls will become more common.

6. *Although it's early days still, do you have any thoughts about the Trump Administration's possible impact on the market for green roofs and walls?*  
No impact. The die is cast. Contemporary urban citizens are invested in renewable energy, clean air and water, green cityscapes, and walkable communities. The concept of sustainability; promoting better outcomes that are more durable and ultimately less costly, is not going away. Green environmental policies are being developed and refined in our cities, where the practical benefits are understood. To the extent that the Trump policies might spur more investment in infrastructure and real estate (we'll see) green measures will be an essential and indispensable part of the mix.

7. *What advice would you give young people who are thinking about working on green roofs and walls?*

I have always advised young people to develop an engineering or scientific specialty and then apply this to the challenges of urban greening. We live in a world in which technologies are increasingly isolated from one-another (silo'd in the current parlance). The work of green infrastructure is a shining exception to that trend. It was the greatest pleasure for me to step out of the world of conventional civil engineering and wade into the swift currents of botany, design, micro-biology, and construction. Greening is a collaborative exercise. Find a mentor and step into the stream. Take what you learn from field observation, improve your assumptions, and create something better.



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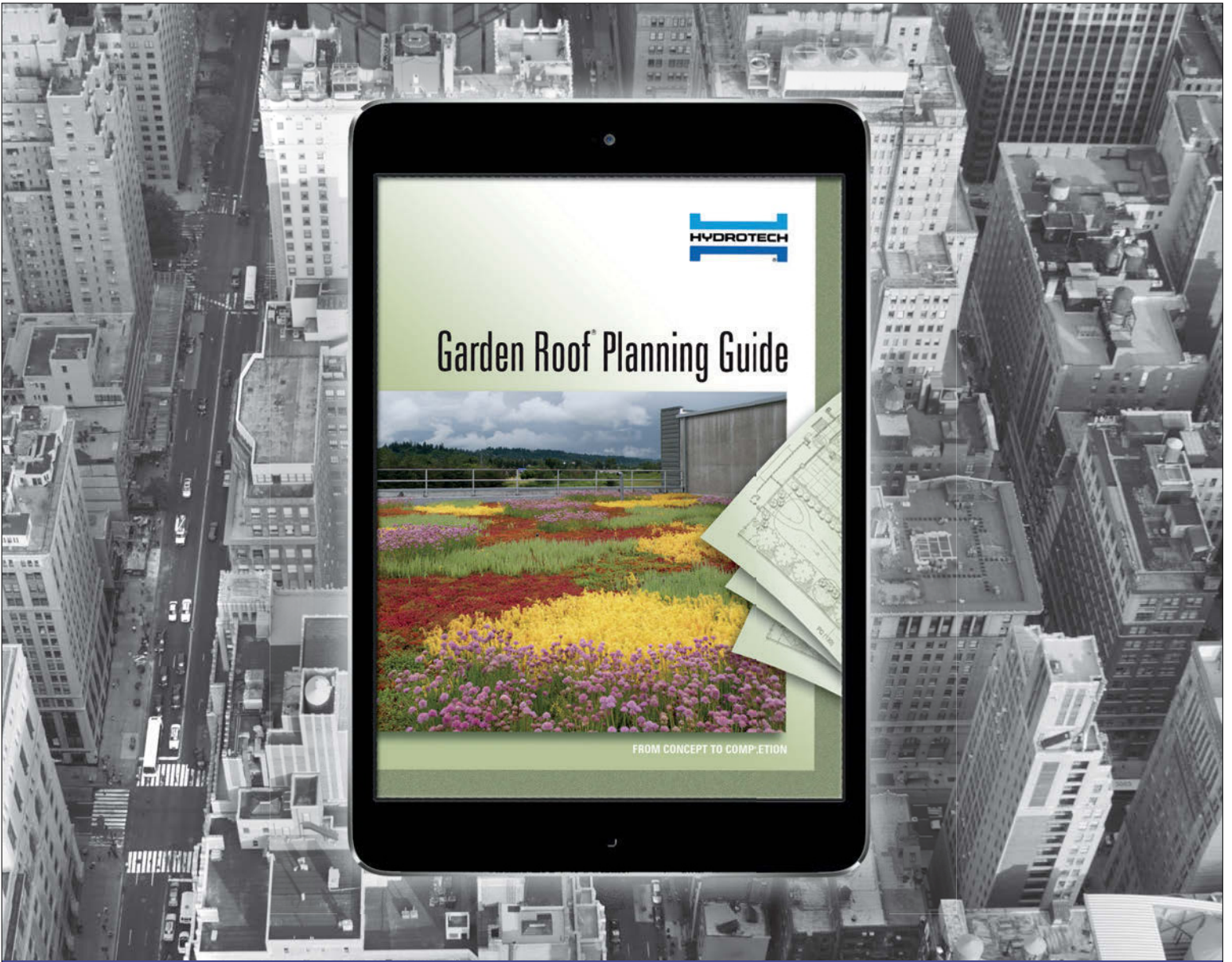
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## EXPLORING TWO OF SEATTLE'S GREEN INFRASTRUCTURE PROGRAMS:

# SEATTLE GREEN FACTOR AND RAINWISE PROGRAM

BY EMMA TAMLIN, GREEN ROOFS FOR HEALTHY CITIES

Seattle, Washington is one of 800 cities in the United States operating on a combined sewer system. But over the past two decades it has been at the forefront of several green infrastructure initiatives and was the first city in North America to adopt a green area ratio program. With an average of 37.49" of precipitation per year, Seattle generates 27,000 gallons of stormwater runoff from a 1,200 square foot roof, and approximately 1 million gallons from 1 acre of pavement annually.

According to Seattle's Green Stormwater Infrastructure 2015-2020 Implementation Strategy (GSI), Seattle managed over 100 million gallons of stormwater annually as of 2015. Their five-year plan calls for a four-fold increase in green stormwater infrastructure by 2020 and is currently on track to meet their goal of managing 400 million gallons of stormwater annually by 2020 and has already set the goal for 2025, aiming to manage 700 million gallons of stormwater.

Seattle encourages the implementation of green infrastructure to manage stormwater and create better quality urban landscapes. The Seattle Green Factor and the RainWise program are two initiatives that complement the 2013 City Council and Mayoral request to have all city departments' work together to meet Seattle's stormwater goals.

## THE SEATTLE GREEN FACTOR

Seattle's Green Area Ratio program, the Seattle Green Factor (SGF), is a landscaping requirement for all new developments that are more than 4,000 square feet, have more than four dwelling units, or more than 20 new parking spaces in the neighborhood business districts. The program was implemented after Ordinance 122311 was passed in December 2006 and then expanded in 2009.

The SGF's objective is to create landscapes in the public right of way that both manage stormwater and offered visual community amenities. According to the American Society of Landscape Architects, "because SGF significantly raises the bar for landscaping in affected zones, landscape design now starts in the initial stages of site planning, allowing more collaboration between design professionals; the resulting landscapes are more attractive and better integrated into site programs and amenity areas" (Wener, 2007).

The program offers a menu of landscaping strategies divided into the following categories: Landscaped Areas, Plantings, Green Roofs, Vegetated Walls, and Water Features. Developers can choose from a variety green stormwater infrastructure tools such as tree canopy, permeable pavement, green roofs, and rain gardens so long as the final score meets the minimum requirement for their geographic area. The score is automatically calculated by inputting data into the Green Factor Score sheet. Some green infrastructure elements are weighted more heavily than others due to their enhance stormwater management and amenity space benefits, such as green roofs and bioretention sites which are given a score of 0.7, compared to ground covers at 0.2. The square footage of each element is then multiplied by the weighting of that element, to provide a total score. The total score from all of the elements in the worksheet is then divided by the size of the parcel to calculate the Green Factor Score. Minimum scores vary based on the different zones across Seattle with different standards set for commercial and residential properties (Figure 1) with residential properties requiring higher green factor scores than commercial zones.

By 2010, the City of Seattle had implemented 52 green roof projects totaling 360,000 square feet as a result of SGF and other green infrastructure strategies and is currently conducting an inventory of green roofs. To ensure maximum uptake and meet the objectives of implementing high quality green infrastructure, the Seattle Department of Construction and Inspections sponsored a number of courses on green walls, rain gardens permeable paving systems, and healthy soils.

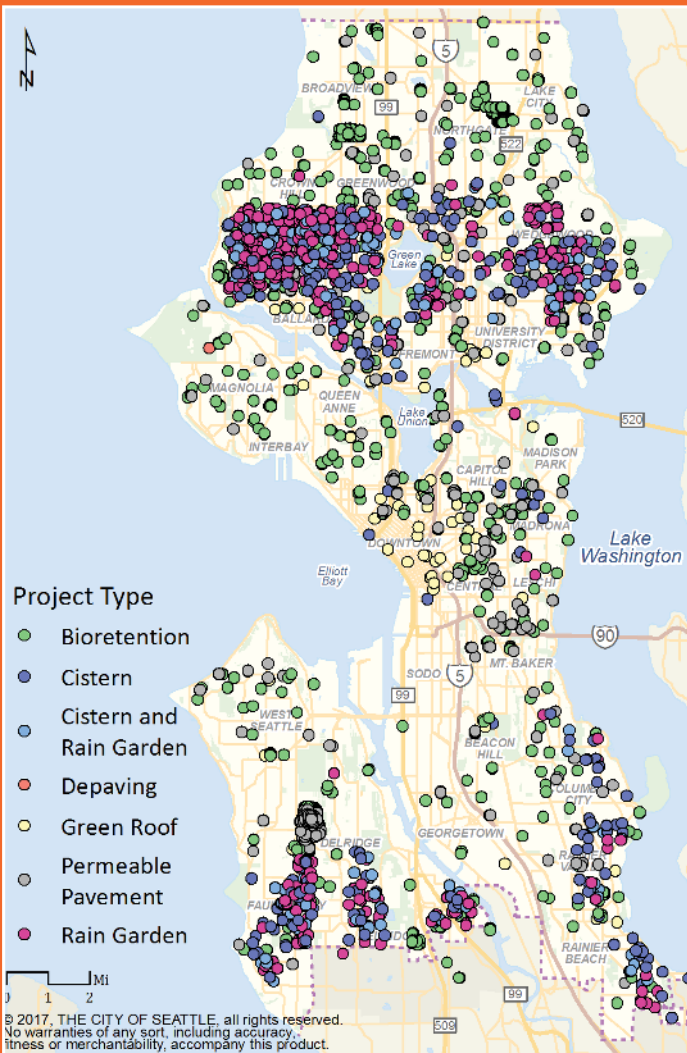
Seattle has been successful in its green infrastructure implementation due, in part, to its flexibility in how developers can meet the requirements. The City believes it is important to reduce rigidity in regulations and allow developers to customize solutions to meet the goals of stormwater management and improve amenity spaces.

**FIGURE 1: MINIMUM GREEN FACTOR SCORES REQUIRED BY ZONE**

ZONE	MINIMUM SCORE
Commercial & Neighborhood Commercial	0.30 (2006)
Industrial Commercial (in Urban Villages)	0.30 (2010)
Midrise and Highrise Residential	0.50 (2009)
Lowrise and Multifamily Residential	0.60 (2010)
South Downtown	0.30 (2011)
South Lake Union	0.30 (2013)

Source: [https://www.seattle.gov/UTIL/cs/groups/public/@spu/@conservation/documents/webcontent/01\\_027984.pdf](https://www.seattle.gov/UTIL/cs/groups/public/@spu/@conservation/documents/webcontent/01_027984.pdf)

**FIGURE 2: SNAPSHOT OF GREEN INFRASTRUCTURE PROJECTS IN SEATTLE**



## RAINWISE PROGRAM

Jointly run by Seattle Public Utilities (SPU) and King County Wastewater Treatment Division (WTD), the RainWise program promotes the use of green infrastructure in residential areas and encourages private property owners to manage their stormwater on-site. The program offers rebates for rain gardens and cisterns for eligible Seattle homeowners. In select areas of Seattle, The City of Seattle and King County will pay up to 100 per cent of the cost of installing rain gardens and cisterns depending on the how much stormwater is managed.

The RainWise program is successful because the program offers rebates and streamlines the application process, making it easy to find a contractor and easy for homeowners to participate. The program was dedicated to raising public awareness about stormwater runoff through partnerships with local organizations, easily accessible resources, and educational workshops. By harnessing the collective action of private property owners, RainWise has contributed to the development of 3,814 rain gardens in Puget Sound along with many other forms of green infrastructure (Figure 2).

The process in which Seattle has implemented their numerous green infrastructure projects is one to be modeled. The lessons learned from Seattle's GSI programs have been crucial resources in developing Washington, DC's Green Factor program. Seattle is proof that a comprehensive stormwater program does not have to exclusively target large developments, as homeowners in urban areas have an important role to play in managing stormwater. The focus on creating cross-sector cooperation in promoting green infrastructure and ensuring feasibility has led to increased application, participation and acceptance of green infrastructure in Seattle.

## FIND OUT MORE

*Emma Tamlin is the Special Projects Coordinator for Green Roofs for Healthy Cities. She is currently collecting best practices for green roof and wall policy across North America. [etamlin@greenroofs.org](mailto:etamlin@greenroofs.org)*

*To learn more about the Seattle Green Factor go to [seattle.gov/dpd/codesrules/changestocode/greenfactor](http://seattle.gov/dpd/codesrules/changestocode/greenfactor) For more information on the RainWise program go to [700milliongallons.org/rainwise/](http://700milliongallons.org/rainwise/)*

**References:** *Green Stormwater Infrastructure in Seattle, 2025 Implementation Strategy (2015). [http://www.seattle.gov/Documents/Departments/OSE/GSI\\_Spreads\\_v2\\_July\\_2015\\_WEB.pdf](http://www.seattle.gov/Documents/Departments/OSE/GSI_Spreads_v2_July_2015_WEB.pdf) King County (2016). *Stormwater runoff pollution and how to reduce it.* <http://www.kingcounty.gov/services/environment/water-and-land/stormwater/introduction/stormwater-runoff.aspx> Richard Wener, "Silver Medal Winner: High Point Redevelopment Project, West Seattle, Washington," in *Building Sustainable Neighborhoods: The 2007 Rudy Bruner Award for Urban Excellence* (Cambridge, MA: Bruner Foundation, 2008), 113–37, [www.rudybruneraward.org/wp-content/uploads/2007/01/07-High-Point-Redevelopment-Project-1.pdf](http://www.rudybruneraward.org/wp-content/uploads/2007/01/07-High-Point-Redevelopment-Project-1.pdf).*



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# SUSTAINABLE STORMWATER MANAGEMENT

## WE SHOULD INVEST IN A LANDSCAPE-DRIVEN APPROACH

BY TOM LIPTAN, FASLA

Over the past two decades, cities around the world have deployed green alternatives to traditional infrastructure approaches through integrated planning and design of vegetative spaces to offset, cover or replace impervious hardscapes. Green roofs, stormwater planters, rain gardens, trees, porous paving, green walls, green streets, stream daylighting and surface conveyance methods are the backbone of green, predominately vegetative approaches. As these approaches have matured and proliferated, we can now validate the promise that going green works.

In side-by-side comparisons to conventional stormwater systems, the landscape stormwater approach costs less to construct, can be integrated on and with impervious surfaces, and manages or eliminates stormwater runoff as well as if not better. Inspired by nature, these predominately vegetative systems also provide ancillary benefits that underground pipes do not. They conserve water and energy, reduce urban heat island effects and thermal gain in waterways, recharge groundwater, create habitat and support biodiversity, buffer noise, improve human health and provide a more adaptive, attractive and resilient infrastructure.

Here in the rainy Pacific Northwest, water and nature inextricably link to forests and salmon, each of which have deep cultural and economic roots dating back for millennia. That may be an underlying reason why cities such as Portland and Seattle have been leaders in recognizing these building blocks of nature as the foundation of healthy urban communities.

Beginning in the 1990s, Portland began piloting successful green approaches. The success of these demonstration projects, led to the city's *Tabor to the River* project, Portland's most significant and intensive implementation of green infrastructure yet. The Tabor area comprises 2,000 acres (809 hectares) of combined sewer catchment traversing late 19th - to early 21st century neighborhoods and commercial areas, with much of the system over 100 years old. During mod-

erate to heavy rains, these sewers would backup into basements causing health risks and property damage. An initial estimate in 2000 tallied \$144 million in necessary repairs and replacements that would also involve tearing up miles of city streets to access pipes. Balking at the price tag, Portland deferred work on the project. During the intervening years, the city cut out asphalt and installed rain gardens, trees, ecoroofs, and porous pavement as demonstration projects. These pilot projects resulted in excellent stormwater management, shedding new light on the capacity for landscape approaches to manage larger areas.

In 2006, a reassessed Tabor project now included \$11 million in green retrofits such as rain gardens and stormwater planters, which in turn eliminated \$68 million in conventional construction costs, mostly by reducing miles of now-unnecessary pipe. The new project cost of \$86 million lopped 40 per cent off the original Tabor estimate, with \$5 saved for every \$1 spent on green infrastructure. Portland continues to use this approach and has over 1,900 green streets to date.

Green infrastructure has been proven as a legitimate, cost effective and efficient way to help address billion-dollar backlogs of crumbling conventional infrastructure. The time is right for designers and policy decision makers to start with green. The time is right to require green and reward green. When once we removed every living thing to provide for our habitat, now we need to bring urban spaces alive with carefully crafted vegetative designs.

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*Tom Liptan is a green infrastructure specialist who lives in Portland, Oregon. He is a GRHC Civic Awards of Excellence winner for his pioneering work on green roof research and policy. He will be available to sign copies of his new book at CitiesAlive 2017 taking place in Seattle, Washington, September 18-21. Visit [CitiesAlive.org](http://CitiesAlive.org) for more information.*

Photo courtesy of Serena Matt





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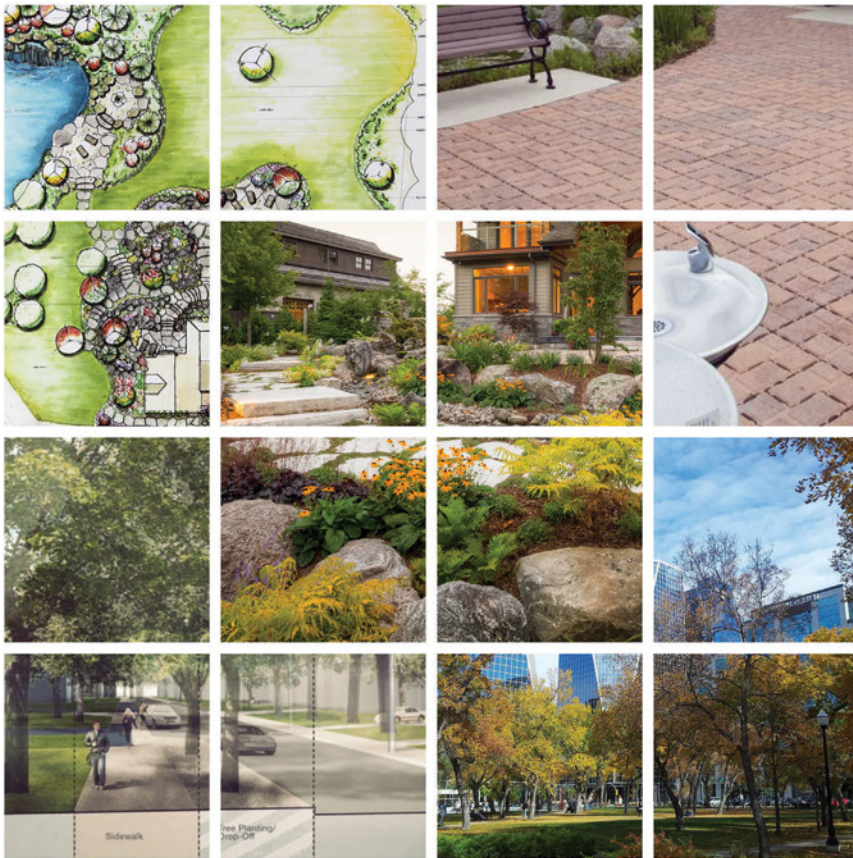
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