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A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION

VOLUME 20 / ISSUE 2 / SUMMER 2018

THE BIOPHILIC DESIGN ISSUE

- Experts Speak: Biophilic Design Stretches Out to Encompass Cities
- Phipps Conservatory Designed for Maximum Biophilic Impact
- A Frosty Story of The Moving of A Modular Green Roof
- New York's Department of Environmental Protection Revises Grant Program
- Liberty Square Green Wall – A Peaceful Reminder at the Site of 9/11
- How the Living Architecture Performance Tool Will Lead to Better Maintenance
- Best Practices in Leak Detection

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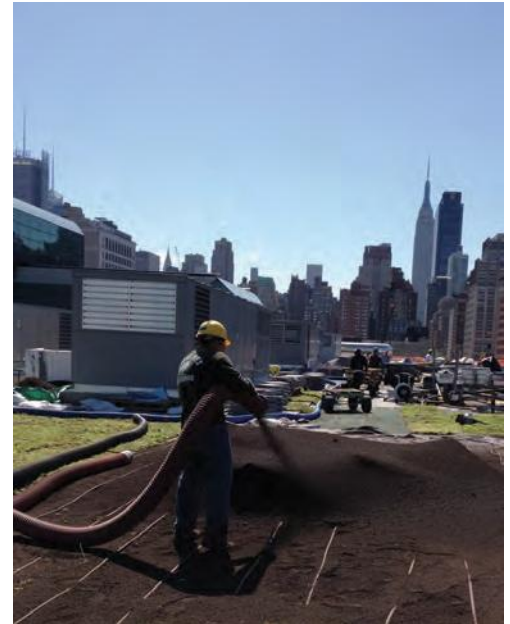
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Green Roofs for Healthy Cities' mission is to develop and protect the market by increasing the awareness of the economic, social and environmental benefits of greenroofs, green walls, and other forms of living architecture through education, advocacy, professional development and celebrations of excellence.

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BIOPHILIC DESIGN: A POSITIVE FORCE FOR HEALTHIER BUILDINGS

One of my favorite movies growing up was *Cool Hand Luke*, starring a very young Paul Newman. He plays a rebel and a leader who gets ground down by the southern U.S. penal system. During the movie, Paul Newman's character is forced into solitary confinement where he is deprived of light and contact with the outdoors for trying to escape. Most people can only withstand several days of this type of punishment before they start to break down mentally – even though they receive food and water daily. This type of environment is devoid of the things that maintain our well-being.

In British Columbia a few years ago, I spent four hours climbing through a dark cave to finally emerge through a crack into a forest. The green leaves, the dappled sun light, the wind and sounds of the birds at first appeared utterly miraculous. The positive psychological impact of this instant transformation from a dark and dreary cave to lush forest was stunning. I felt instantly better! Now, the scientific study of biophilia, our innate attraction or love of nature, is helping us to understand what we love and hate, about our surroundings and why. What makes us tense, what helps us to relax, to focus, to heal, to be more productive. This knowledge of patterns or elements that we desire in our surroundings gives us the basis for biophilic design practice which is ushering in a movement towards the integration of living and non-living elements of the built environment – living architecture.

Many great designers like Frank Lloyd Wright and Frederick Law Olmsted understood biophilic design implicitly. Humanity, having evolved in response to the natural world, is attracted to natural light, running water, prospect, fire, bird song, and vegetation – particularly if they are diverse. For the presence of these and other elements have, over hundreds of thousands of years, contributed directly to our ability to survive. E.O. Wilson, an eminent biologist who coined the term, “biophilia” in his 1984 book so named, argues that what we call “beauty” is actually our word for the perfection of those qualities that have contributed most to our survival.

Clearly there is little of beauty in the depths of a dark cave or locked in a dark cell. There is also a disturbing lack of ‘beauty’ or biophilic design in much of the architecture which fills space in our cities and in the cities themselves. In this Biophilic issue, Dr. Timothy Beatley, James Brown and Dr. Judith Heerwagen share their thoughts on challenges and trends in this field. More biophilic design of buildings is an indicator of the trend towards more restorative, living buildings. Green roofs and walls, in combination with other elements, such as water features and the ability to have direct contact through gardening, can be a powerful element in the overall design of a biophilic building. We've included biophilic design into the Living Architecture Performance Tool, which provides a framework for evaluating

the performance of green roof and/or wall projects. The case study of the Phipps Conservatory and Botanical Gardens featured in this issue also provides a wide range of biophilic elements that together, make a powerful statement. The love of their green roof in New York, was a driver in convincing employees of Cook Fox Architects to move the green roof to their new location – thanks to the modular system they installed more than a decade ago. The green roof and wall in Liberty Square New York provide a quiet, almost serene atmosphere and vantage point to contemplate the tragedy of 9/11.

Biophilic design can bring us back to a place that we left decades ago, when we forgot to include human health and well-being at the center of our built environment. Let us move swiftly in this direction with the knowledge that we can significantly improve our physical and mental well-being and better prepare for the survival challenges to come.

Sincerely yours,



Steven W. Peck,
GRP, Honorary ASLA
Founder and President

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Architecture 2030 published the ZERO Code for new building construction, which integrates cost-effective energy efficiency standards with on-site and/or off-site renewable energy resulting in Zero-Net-Carbon (ZNC) buildings.

While there have been worldwide improvements in building sector energy efficiency, as well as growth in renewable energy generating capacity, these have not been nearly enough to offset the increase in emissions from new construction. As a result, building sector CO2 emissions have continued to rise by nearly 1% per year since 2010.

To meet Paris Agreement targets, action is needed today to implement the ZERO Code worldwide. The ZERO Code, which can be adopted immediately, results in ZNC buildings. It accomplishes this by incorporating current and cost-effective energy efficiency standards with on-site and/or off-site renewable energy provisions.

The ZERO Code includes prescriptive and performance paths

for building energy efficiency compliance (based on current standards that are widely used by municipalities and building professionals worldwide) and is supported by compliance tools and simulation software.

While the ZERO Code incorporates the latest ASHRAE Standard 90.1-2016 requirements for minimum building efficiency, other existing or new prescriptive and performance standards can also be accommodated, such as the International Green Construction Code (IgCC), ASHRAE Standard 189.1-2017, or any building energy efficiency standards that are more stringent than ASHRAE Standard 90.1-2016. To learn more visit zero-code.org



AWARDS OF EXCELLENCE IN SUSTAINABILITY

The American Planning Association Sustainable Communities Division honored the San Francisco Planning Department & San Francisco Department of the Environment with a 2018 Award for Excellence in Sustainability for San Francisco's Better Roof Ordinance.

The Awards for Excellence in Sustainability is an annual program that honors projects, plans, policies, individuals, and

organizations dedicated to supporting sustainable communities. Each year, the award winners are announced during the annual National Planning Conference.

The Better Roof Ordinance became effective in January 2017 and mandates solar and living roofs on most new construction. San Francisco became the first U.S. to implement a regulation of this kind. For more information visit sf-planning.org/san-francisco-better-roofs



WORLD GREEN BUILDING COUNCIL RELEASES THE REPORT "DOING RIGHT BY PLANET AND PEOPLE: THE BUSINESS CASE FOR HEALTH AND WELLBEING IN GREEN BUILDING" AND URGES COMPANIES TO MAKE GREEN IMPROVEMENTS.

The Report examines case studies of 11 facilities around the globe that have one or more green certifications including LEED, Green Star and BREEAM. The report evaluates health and wellbeing features that were integrated into the facilities, such as: enhanced fresh air ventilation, acoustic privacy, increase of daylight penetration and use of biophilic design elements such as green walls and extensive indoor plants. To read the full report visit <http://ow.ly/1hme30korZY>

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ON THE ROOF WITH...

EXPERTS ON BIOPHILIC DESIGN

INTERVIEW BY STEVEN W. PECK, GRP, HONORARY ASLA

Biophilic Design continues to emerge as an important body of practice which is increasingly shaping the way in which we design buildings and communities. Three experts share their views on a wide range of topics which hold the promise of delivering much healthier and more sustainable buildings and communities.

Tim Beatley (TB): Biophilia is an essential insight into what it means to be human, especially in the age of cities. Contact with nature is not something optional, but absolutely essential to meaningful urban lives. In an era where the environmental news is discouraging, biophilia is a highly hopeful and optimistic idea—we can design and plan in ways that connect us with nature on a daily or hourly basis, something that we know produces profound benefits and likely even helps us to be better human beings (the evidence suggests, for instance, that we are more likely to be generous and cooperative in the

presence of nature). Biophilia suggests the potential to deepen and enrich our lives through the natural world, and to add important layers of meaning to the cities in which we live.

2. *What is the most important development in the emerging field of biophilic design and why?*

JH: I think the most important development is the emerging discussion around bigger themes and issues that biophilia should address in the future. For instance, how can biophilic design support human health and resilience within the larger context of climate change? How can it be

Judith Heerwagen (JH) is an environmental psychologist; Timothy Beatley (TB) is chair of the Department of Urban and Environmental Planning, University of Virginia; and James D. Brown (JB) is the Director of Research, The Biophilic Cities Project.

1. *What does the biophilia hypothesis mean to you?*

Judith Heerwagen (JH): Like all hypotheses, it means that the proposed benefits of biophilia can be rigorously tested using valid scientific methods. In the years since *The Biophilia Hypothesis* (S.R. Kellert and E.O. Wilson, Eds) was published in 1993, hundreds of studies have validated the health, well being, and performance benefits associated with being in biophilic rich environments. The benefits have been found in a diverse array of settings and for a wide range of design approaches including window views, gardens, flowers, trees, daylight, outdoor greenspace, water features, and green roofs.

James D. Brown (JB): The biophilic hypothesis identifies that we, as humans, require daily interactions with nature to allow us to have healthy, happy and productive lives. For Biophilic Cities, this means embracing this challenge not just at an individual or site level but at the scale of planning and designing cities. Increasing global urbanization provides a tremendous opportunity to cultivate nature in close proximity to a rapidly growing portion of the world's population.

deployed more equitably across urban settings? And how can biophilic design strategies – such as biophilic urban acupuncture – be used to enhance both human and environmental health? These questions go to the heart of human existence on the planet we call home.

JB: The increasing emphasis on moving from a focus on the single building site to that site's connection to larger surrounding community and landscape. Natural systems depend on connectivity and continuity across the landscape. As users of these same places, humans and non-humans alike need to be able to move across cities without experiencing a pronounced disconnect with the natural world.

TB: Biophilic design has made great progress in recent years at the building scale. I believe we need to continue to expand and extend this work to embrace a “whole of city” approach; one that understands that nature can and must be included at every spatial scale, and in every space, in cities--this is the vision of biophilic cities that we have been trying to promote, largely through the global Biophilic Cities Network. It is an immersive view of biophilic design: nature is not just to be found in designated places, such as a park or a community garden or urban forest, but rather is all around us in cities. It

is the idea that we could be living in urban neighborhoods where we are immersed in the sights and sounds and experiences of the natural world. Equally important is the need to ensure a Just Biophilia—where everyone and every neighborhood benefits from nature, and where investments in nature do not displace or economically harm existing residents.

3. What do you think the most important drivers of BD are likely to be in the future?

JH: Health promotion is a big driver in biophilic applications at both the building and urban level. For many companies, biophilic design and sustainability are perceived as a competitive advantage in attracting a young, highly capable workforce. At the city level, health benefits are also an important driver as is overall quality of life. But there is also increasing interest in how biophilic design—especially large trees—can aid carbon sequestration and improve outdoor thermal comfort during summer heat stress.

JB: Equitable access. It's neither ethically responsible nor sustainable from both an ecological perspective and from a community resilience perspective to design beautiful natural landscapes that are not accessible to the community at large. The result of embracing the goal of inclusive urban landscapes will result in broad stewardship of diverse and interesting places. A desire for stewardship only results when individuals feel a sense of connection and ownership with a place.

TB: Few drivers will be as potent as climate change and the need to make cities more resilient. Whether through urban tree planting or design of new dynamic shoreline parks that better absorb flood waters, just about any project that could make a city more biophilic will also enhance resilience. Desire for enhanced livability, and for greater meaning in our lives, will also continue to be significant drivers. We increasingly want to live and work in places that are profoundly uplifting, delightful, magical. Nature provides that sense of wonder and aliveness that many today feel is so missing in their lives, and city design and planning in the future will increasingly reflect this priority.

4. How does biophilic design relate to human health and well-being in your view?

JB: The concept of biophilia refers to the evolution of humans in concert with nature. A departure from a more symbiotic relationship has obvious consequences for the environment, but maybe less apparent are the more personal consequences for humans as individuals. Well-being is derived from a sense of safety and place within your surroundings. If we can nurture our innate connection to the natural world in the places that we inhabit, we are going to find a sense of balance as opposed to stress, which is critical to our physical and mental health.

TB: Biophilic design and planning play a critical role in enhancing health in the future. There is mounting evidence about the health-enhancing and healing power of nature. Not just in hospital and healthcare design, of course, but there is growing recognition of a larger suite of community health benefits associated with contact with nature (recent evidence, for instance, of the role of nature in moderating depression).

5. How do green walls and roofs contribute to biophilic cities. How important are they in the grand scheme of things?

JH: Both green walls and green roofs take advantage of unused or underutilized surfaces to add green space in urban settings. This in itself adds beauty and pleasantness to the concrete environment. Green roofs have additional environmental benefits - attracting pollinators, reducing heat gain in buildings, absorbing rain water, and reducing the urban heat island effect.

JB: Green roofs and walls are critical tools to extend natural landscapes in cities of high density. When space is scarce they provide an opportunity to expand the green footprint of cities to serve utilitarian functions like filtering air, sequestering carbon and capturing storm water, but also to capture the imagination of urban residents. Elements of cities that were previously devoid of life, such as walls and roofs, become living landscapes where humans and other living creatures are invited to occupy and experience.

"HEALTH PROMOTION IS A BIG DRIVER IN BIOPHILIC APPLICATIONS AT BOTH THE BUILDING AND URBAN LEVEL."

- JUDITH HEERWAGEN

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JUDITH HEERWAGEN

Judith Heerwagen is an environmental psychologist whose work focuses on the behavioral, psychological, and health impacts of building design and operations. She has written widely on biophilic design, sustainability and the links between human health, the built environment, and nature. She is co-editor of the award winning book, *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*. She is an affiliate faculty member in Architecture at the University of Washington.

JAMES D. BROWN

In his role as Program Director for Biophilic Cities, JD facilitates the connections between the partner cities of the Biophilic Cities Network and the individuals and organizations advancing the theory and practice of planning and designing biophilic cities. With a law degree from the Georgetown University Law Center and a Masters in Urban and Environmental Planning from the University of Virginia, JD explores the intersection of law and planning through a survey of legal and policy mechanisms adopted by cities to promote abundant and accessible nature.

DR. TIM BEATLEY

Dr. Tim Beatley is the Executive Director of Biophilic Cities Project, its principal aim being to advance the theory and practice of planning for biophilic cities, through a combination of collaborative research, dialogue and exchange, and teaching. TB is the author or co-author of more than fifteen books including *Green Urbanism: Learning from European Cities*, *Habitat Conservation Planning*, *Native to Nowhere: Sustaining Home and Community in a Global Age*, and *Planning for Coastal Resilience*.

TB: Green roofs and walls are tremendously important to creating biophilic cities. Building rooftops and facades represent a huge opportunity to insert nature, to create new and important habitats in cities, often in visually prominent places. Years ago we filmed visitors walking by Patrick Blanc’s famous green wall at the Musée du Quai Branly in Paris (for a film called *The Nature of Cities*). It was a remarkable epiphany for me, as people were drawn to the wall, delighted in it, wanted to touch it, stand next to it, take pictures in front of it; it had a powerful effect on them.

6. Is there a biophilic building you are particularly fond of and why?

JH: I would put Amazon’s Spheres at the top of my list. You could argue that it is easy to have a biophilic building when it is filled with plants – but the innovative aspect of the Spheres is the way it integrates people into the experience. There are numerous nooks among the greenery that are used for meetings, quiet work, naps, and exploration of the plants. It fully engages the senses, and has one very captivating characteristic and that is discovered complexity: the more you look, the more you see. The details of the plants – the shapes, sizes, colors, patterns, textures are all so varied that you can return many times and still discover more to see.

TB: One of my favorites is the Khoo Teck Puat Hospital (KTPH) in Singapore. It perhaps the most biophilic health facility in the world, containing a remarkable list of natureful elements (several levels of green roofs, green window boxes, a waterfall and water system with native species of fish, and a rooftop urban farm, among others).

7. What do you see as the future of biophilic design?

JH: Biophilic design – in its many forms and applications – will become one of the ways we humanize our buildings. Like sustainability, it will be the norm not the exception.

JB: An ever-increasing understanding of the complementary value provided by biophilic planning and design. Cities are burdened with a wide range of problems from a lack of affordable housing to crime and pollution, which at first seem like competing obligations that drain resources that otherwise might be used for biophilic design. Planning and designing biophilic cities is an important part of the solution for all of these problems. With this understanding, cities will increasingly adopt policies that promote abundant and accessible nature on public and private lands because it is a cost effective, efficient and inspiring means to address their most pressing challenges.

TB: I am hopeful that the principles and practices of biophilic design will continue to find application at the city scale. Biophilic cities are indeed cities with lots of biophilic buildings--but they are also much more than this. Biophilic cities see the need for nature between and around buildings, and the need to protect and grow this nature at every spatial scale from rooftop to region. Biophilic urban design understands that we need cities where residents are enticed to spend time outside, where there is abundant opportunities to hike the city, where there is extensive wildlife and biodiversity to see and experience, and where residents recognize, are curious about, and deeply care about this nature around them.



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TWO BIOPHILIC PLANT SPECIES THAT SWAY IN THE WIND

BY BRADLEY ROWE, MICHIGAN STATE UNIVERSITY, EAST LANSING

As the theme of this Living Architecture Monitor issue is biophilia, I decided to cover more plants that can move or sway in the breeze and therefore catch our eye to a greater extent than those that are shorter and more static such as sedum.

In this issue, I cover the genus *Monarda*. Two that have been tested and grown on green roofs are *Monarda fistulosa* (wild bergamot or beebalm) and *Monarda punctata* (spotted beebalm or horsemint). They are both herbaceous perennials in the Lamiaceae (mint) family characterized by square stems and fragrant foliage. The genus contains the compound thymol, a natural antiseptic that has historically been used as a medicinal plant, especially by native Americans.

Monarda fistulosa (USDA hardiness zones 3 to 9) is more widespread and ranges from coast to coast across most of the US and Canada. *Monarda punctata* (USDA hardiness zones 3 to 8) has a smaller range and is native to the eastern part of the United States and Canada. They are both somewhat drought tolerant and are often found growing in well drained sandy soils in full sun to part shade. Both form clumps spreading by creeping rhizomes and also tend to self-seed. They are known to naturalize, but *M. punctata* is considered an endangered species in Ohio and Pennsylvania by the USDA Natural Resources Conservation Service. Both are susceptible to powdery mildew if plants are grown close together without adequate air circulation.

Under favorable growing conditions, plants of *M. fistulosa* may reach a height of 60 to 90 cm (24 to 36 in) with a similar,

but lesser spread. The specific epithet, *fistulosa*, means hollow like a pipe, in reference to the individual tube like flowers. The dense flower clusters, each about 4 cm (1.5 in) long containing about 20–50 two-lipped, tubular, pink to lavender flowers, appear at the ends of branches. Below each flower head is a whorl of showy, pinkish bracts. The plants have a long summer flowering period from July into September and attract bees, butterflies, and hummingbirds.

Monarda punctata is generally shorter, but can grow to 45 to 60 cm (18 to 24 in) tall with a spread of 23 to 30 cm (9 to 12 in). The specific epithet, *punctata*, means spotted, again

in reference to the flowers. Here the two-lipped yellow flowers are dotted with purple spots. In contrast to *M. fistulosa*, flower clusters do not rest at the end of the branches, but are arranged along the stems, each subtended by the showy, pink to white bracts. The bracts are actually the more ornamental feature as they are more conspicuous and last for a longer period of time. Flowering occurs during June and July. *Monarda punctata* also attracts butterflies and other pollinators, especially wasps. Although at first thought we may think of wasps as being negative, the flowers attract predatory wasps that are very beneficial as they help control



MONARDA FISTULOSA OR
BEEPALM GROWING ON AN
EXTENSIVE GREEN ROOF.

Photos courtesy B. Rowe

“MONARDA PUNCTATA ALSO ATTRACTS BUTTERFLIES
AND OTHER POLLINATORS, ESPECIALLY WASPS.”

- BRAD ROWE

grubs, pest caterpillars, and other harmful insects.

Both *M. fistulosa* and *M. punctata* were trialed at the Chicago Botanic Garden (Hawke, 2015, Chicago Botanic Garden Plant Evaluation Notes, Issue 38). *Monarda fistulosa* was tested at a substrate depth of 15 cm (6 in) and given an overall good performance rating of 4 stars (out of 5). *Monarda punctata* was grown at depths of 10, 15, and 20 cm (4, 6, and 8 in) and was given a fair 3 star rating across all depths. Plants were watered regularly during the first year to ensure establishment and then during extreme drought periods in subsequent years.

In trial at Michigan State

University (MSU), *M. punctata* was one of the species used to evaluate recycled substrates such as foamed glass and crushed porcelain against a standard heat expanded shale (Matlock and Rowe, 2016, Ecological Engineering 94:244-254). Plugs were planted in May 2013 in a substrate depth of 10 cm (4 in) and *M. punctata* was found to be one of the best performers, regardless of substrate type. Irrigation was supplied during year 1, but thereafter the plants had to rely on natural rainfall. Even after five years, some plants of *M. punctata* are still appearing every year as it has either re-seeded itself or resurrected itself from surviving rhizomes.

In contrast, in 2011, *M.*

fistulosa was planted along with 16 other herbaceous perennials and grasses at depths of 10 and 20 cm (4 and 8 in) on the roof of the Molecular Plant Sciences Building at MSU (Vandegrift, 2018, MS Thesis). Although coverage was decreasing over time, the species was still present until 2016 when there was a major die-off of most of the herbaceous species. No irrigation was supplied after year 2. Their disappearance was likely due to a drought during that spring and summer of 2016. During a 57 day period from May to July, the total rainfall was 3.28 cm (1.29 in), which was roughly a third of the normal rainfall for that time of year.

Although both of the *Monarda* species have great potential for green roofs, evidence suggests that like most herbaceous perennials, irrigation may be required during drought periods to ensure long-term survival. This is especially true for *M. fistulosa* because of its greater biomass.

Brad Rowe has been conducting green roof research at 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.

GREEN INFRASTRUCTURE: DESIGNING THE FUTURE OF RESILIENCE



CITIESALIVE

NYC | SEPTEMBER 24-28, 2018

What is the future of our city regions? Will they be unbearably hot and regularly flooded by intense rains and high tides? Will they be increasingly unhealthy and more divided between 'us and them'? Will there be a lack of green space and job opportunities? Will there even be bird song?

CitiesAlive provides green infrastructure solutions to urban challenges by bringing together designers, researchers, contractors, manufacturers and policy makers. Discover how to shape a healthier, more resilient future!



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AGENDA AT A GLANCE

TUESDAY, SEPTEMBER 25

Emerging Professionals Day: Training, Opening Plenary, Trade Show Reception, Land8 Happy Hour

THURSDAY, SEPTEMBER 27

Morning Plenary, Concurrent Sessions, Awards of Excellence & Tours, Closing Reception

WEDNESDAY SEPTEMBER 26

Morning Plenary, Concurrent Sessions, Trade Show & Sightseeing Social on the Hudson

FRIDAY, SEPTEMBER 28

Green Infrastructure Charrette & Tours



RAFAEL ESPINAL



ALAN STEEL



SUSANNAH DRAKE



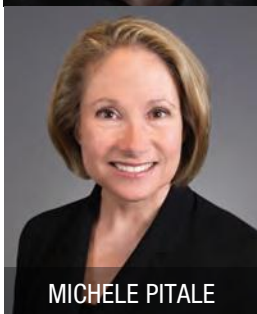
KEN YEANG



HERBERT DREISEITL



DUSTY GEDGE



MICHELE PITALE



MELISSA ENOCH

FEATURED SPEAKERS

CitiesAlive 2018 will explore topics like urban agriculture, vertical forests, coastal greening, green finance, new regulations, performance metrics, research, integrated stormwater capture and reuse and more from over 80 expert speakers.

OPENING PLENARY KEYNOTE

New York is becoming a leader in green infrastructure. Learn how both policy and the private sector are influencing the implementation of green infrastructure and strengthening the industry.

Rafael Espinal, Council Member for New York City

New York's Proposed Mandatory Green Roof Requirement for New Buildings

Alan Steel, President and CEO, Javits Center

The Future of New York's Biggest Green Roof

Susannah Drake, Founding Principal, DLANDstudio

Innovative Green Infrastructure Projects in New York City

GLOBAL LEADERS IN MULTIDISCIPLINARY GREEN INFRASTRUCTURE DESIGN

Leaders from across the globe discuss green infrastructure design and implementation strategies.

Dr. Ken Yeang, Executive Director, Principal, T. R. Hamzah & Yeang Sdn. Bhd.

Ecoarchitecture and Ecomasterplanning: Greening Skyscrapers

Herbert Dreiseitl, Director, Ramboll Liveable Cities Lab

Connecting Communities with Green Infrastructure

POLICIES AND PROGRAMS FOR GREATER GREEN INFRASTRUCTURE IMPLEMENTATION

Policy experts share new programs and incentives.

Dusty Gedge, European Federation of Green Roof and Wall Associations

Greener Cities – London, Europe and Beyond

Melissa Enoch, Program Manager, New York City Department of Environmental Protection

Framework for a Performance-Based Green Roof Incentive Program in New York City

Michele Pitale, Managing Director, Counterpointe Sustainable Real Estate

Funding Green Roof Installations with PACE Financing

WHAT'S NEW FOR CITIESALIVE 2018

TOURS & NETWORKING

MORE INTERACTIVE CONTENT

Engage in an open discussion with industry leaders in new interactive sessions. Green roof and wall designers, contractors, waterproofing experts and urban agriculture innovators tell all and answer questions from the audience.

NOT JUST GREEN ROOFS AND WALLS

Green roofs and green walls continue to play an ever important role in shaping our city regions. We've opened up the technical sessions to include all forms of green infrastructure to highlight important ideas on biodiversity, stormwater management, biophilic design, low impact development and urban agriculture.

EMERGING PROFESSIONALS DAY

Jumpstart your career in green infrastructure at the *CitiesAlive* Emerging Professionals Day. Take one of the comprehensive training courses and distinguish your skill set from the crowd. Attend the Opening Plenary and trade show reception on Tuesday, September 25, followed by the Land8 Happy Hour sponsored by Permaloc to connect with professionals in the industry.

FANTASTIC NETWORKING

With four networking receptions on the trade show floor, *CitiesAlive* will connect you to the industry's biggest actors. In addition, on Wednesday, September 26, join us for the Sightseeing Social on the Hudson where you will soak in views of Lower Manhattan and Lady Liberty while enjoying delicious food, an open bar and entertainment.

FREE TRADE SHOW & EXTENDED HOURS

We invite you to discover new products and services on the *CitiesAlive* Trade Show floor where we profile the industry's leading companies. Don't miss the opportunity to connect with green roof installers, manufacturers, suppliers and non-profits. Get your free trade show pass at citiesalive.org/exhibit

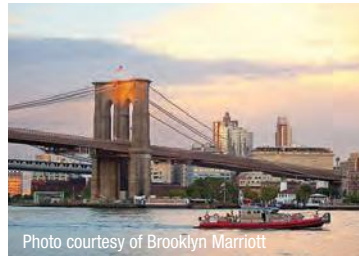


Photo courtesy of Brooklyn Marriott



Photo courtesy of Etsy

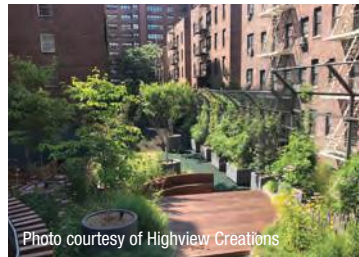


Photo courtesy of Highview Creations



Photo courtesy of Irish Hunger Memorial



Photo courtesy of Randalls Island



Photo courtesy of Brooklyn Marriott

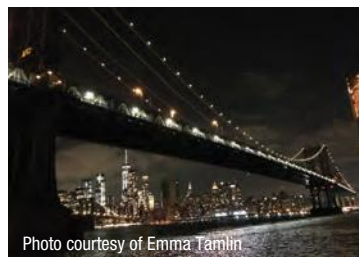


Photo courtesy of Emma Tamlin



Photo courtesy of Friends of the High Line



Photo courtesy of Brooklyn Marriott

JOIN INDUSTRY LEADERS IN THE HEART OF BROOKLYN

All programming and the trade show are conveniently taking place at the New York Marriott at the Brooklyn Bridge. *CitiesAlive* attendees receive a significantly reduced room rate of only \$309 per night for a double or single room if booked before September 5, 2018. The benefits of staying at the Brooklyn Marriott include:

- 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
- Great informal networking opportunities

Book your room at CitiesAlive.org or call 1-888-436-3759. If reserving your room by phone, please indicate you are attending *CitiesAlive* to receive the special conference rate.

EXCLUSIVE TOURS

RANDALLS ISLAND GREEN ROOFS BUS TOUR

The green roof on NYC Parks Department's Five Borough Administrative Building is the only one in the country to feature 30 distinct systems side by side. This massive rooftop landscape serves as a living laboratory that grows a variety of sedum, fruits, vegetables, herbs and berries. NYC Parks is monitoring the performance of each system to identify the types of green roofs that will thrive in NYC's urban environment. Additional sustainability features include solar panels and a rainwater collection system. The tour will discuss labor and material costs, the difference between the systems and more.

ETSY HEADQUARTERS

Etsy is the global marketplace for unique and creative goods. Their New York HQ is a biophilic masterpiece, featuring nine floors of original office plant displays, and a unique rain water harvesting system used to irrigate the office's 11,000 plants.

FRIENDS OF THE HIGH LINE WALKING TOUR

Get an insider's look at the unique design elements of the High Line from Friends of the High Line staff. Learn about the behind-the-scenes work that led to the development of the High Line and its impact locally and worldwide.

WORLD TRADE CENTER LIBERTY PARK GREEN WALL

Tour the World Trade Center's Liberty Park, an elevated, one-acre linear park built on top of a vehicular security-screening center overlooking the original footprint of the World Trade Center, now the National September 11th Memorial. One of the park's most striking features is the multi-hued 25 feet high and 336 feet long G-02® Living Wall by Plant Connection.

JAVITS CENTER GREEN ROOF TOUR

As the busiest convention center in the United States, the Javits Center is an international hub of commerce and culture. Take a tour of the iconic structure, including its green roof, and learn about a host of sustainable upgrades that have helped to reduce its energy consumption by more than 25% and transform it into a sanctuary for 26 bird species, five bat species and thousands of honey bees. (They harvest their own honey, too!)

IRISH HUNGER MEMORIAL

The Memorial represents a rural Irish landscape with an abandoned stone cottage, stone walls, fallow potato fields and the flora on the north Connacht wetlands. It is both a metaphor for the Great Irish Famine and a reminder that hunger today is often the result of lack of access to land.



NETWORKING

LAND8 NETWORKING HAPPY HOUR

On Tuesday, September 25 join Land8: Landscape Architects Network for a networking happy hour sponsored by Permaloc at The Kings Beer Hall. The event is free to anyone who RSVP's but complimentary drink tickets will be given to *CitiesAlive* registrants. A cash bar will be available for those who do not participate in *CitiesAlive*. The Kings Beer Hall is a quick 15 minute walk from the hotel, features over 30 draft beers, arcade games, and air hockey!

SIGHTSEEING SOCIAL ON THE HUDSON

The dedicated *CitiesAlive* Local Host Committee plans and hosts the Local Host Committee Reception. This year, join us on Wednesday, September 26 for a networking cruise on the Hudson River. Soak in views of Lower Manhattan and Lady Liberty while enjoying delicious food, drinks and entertainment. (Ticketed Event).

NETWORKING ON THE GRANGE

On Thursday, September 27, *CitiesAlive* in partnership with Agritecture is hosting a night of networking at the famous Brooklyn Grange, the world's leading soil rooftop farming company. Enjoy a food and drink on the roof and see the city like never before! (Ticketed Event).

Seats are limited, so register early.

TRADE SHOW RECEPTIONS

CitiesAlive delegates gain full access to four trade show receptions with delicious food and drinks. Connect with old colleagues and meet fellow industry professionals. Receptions are on Tuesday, September 25 and Wednesday, September 26.

REGISTRATION PACKAGES

EARLY BIRD DEADLINE

Register by June 29 and save \$50 on the GRP & Emerging Professional Pass, Advanced Delegate Pass, and Basic Delegate Pass.

GRP & EMERGING PROFESSIONAL PASS - \$675*

\$625 - GRHC Member. Save \$500 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Trade Show Networking Receptions
- Breakfast & Lunch
- Sightseeing Social Discount
- Awards of Excellence
- One Half-Day Training Course

ADVANCED DELEGATE PASS - \$575*

\$525 - GRHC Member. Save \$250 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Trade Show Networking Receptions
- Breakfast & Lunch
- Sightseeing Social Discount
- Awards of Excellence
- One Half-Day Walking Tour

BASIC DELEGATE PASS - \$475*

\$425 - GRHC Member. Save over \$97 over a la carte pricing

- All Technical Sessions & Plenaries
- Trade Show Access
- Trade Show Networking Receptions
- Breakfast & Lunch
- Sightseeing Social Discount
- Awards of Excellence

ONE-DAY PASS - \$225

Technical Session on Wednesday
Trade Show Access
Breakfast & Lunch

STUDENT PASS - \$99

All Technical Sessions & Plenaries
Trade Show Access

À LA CARTE REGISTRATION

Unless otherwise indicated, separate registration is required for training, the Sightseeing Social, Networking on the Grange, 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 (TUESDAY, SEPT 25 ONLY) - \$69

Includes Opening Plenary and reception on the trade show floor.

HALF-DAY PASS - \$150

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

TRAINING, WORKSHOPS & TOURS

TRAINING COURSES - \$225-\$399

Professional development opportunities covering a variety of green infrastructure topics

BIOPHILIC WORKSHOP - \$99

Review the patterns of biophilic design and the supporting science with biophilic design leader Liz Calabrese.

TOURS - FREE-\$69

Exclusive tours of local green infrastructure projects in and around New York.

NEW ONLINE GRP ACCREDITATION EXAM - \$249

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

CONFERENCE RECORDINGS

CONFERENCE RECORDINGS - \$59 - \$179

This includes 35+ hours of audio recordings - recorded sessions are synced with presentation slides.

EVENTS

EMERGING PROFESSIONALS LAND8 HAPPY HOUR - FREE

RSVP for the Land8: Landscape Architects Network networking happy hour.

SIGHTING SEEING SOCIAL ON THE HUDSON - \$59 / \$89

Join green infrastructure professionals for a cruise on the Hudson River. Ticket includes food and drink.

FREE TRADE SHOW PASSES

Includes access to the trade show floor on Wednesday, September 26 and Thursday September 27. Excludes Food and Drink.

LUNCH ON THE TRADE SHOW FLOOR - \$99

For students, half-day or trade show only pass holders who would like to have lunch with the delegates on Wednesday, September 26 from 1:00pm to 3:00pm only.

* Early bird prices listed. Rates increase by \$50 on June 29. All prices in USD.



MOVING A ROOF: UNBUILDING AND REBUILDING THE COOK FOX GREEN ROOF IN NEW YORK

BY GWEN SCHANTZ, FOUNDING PARTNER, BROOKLYN GRANGE

We've built several green roofs in New York City, and the big ones that we install with cranes over the course of several weeks always get all the attention. But it's the small roofs, on tall buildings and accessible only by stairs and elevators, that we put the most thought into.

One of the most notable small projects we've built came about in the fall of 2016, when Cook Fox Architects reached out because they were moving to a new office space. We were excited to work with them—they're one of the leading firms in New York specializing in sustainable design and LEED projects. We were also fans of their old office, a historic penthouse where the architects themselves had built a green roof in 2006, where they grew vegetables, sedum, wildflowers and even kept bees.

The staff had developed a loyalty to their green roof over the years; so a decade later, when the firm had outgrown its office and was knee-deep in the renovation of their new space thirty blocks uptown, they reached out to us, asking if we could move it for them. Their landlords at the old office didn't want to keep the 5,000 sf sedum installation, and rather than dumpstering the whole thing,

Cook Fox employees hoped to move it to the terraces of their new office. They had built this green roof themselves, had cultivated it and watched it grow for years, and throwing it out was not in keeping with their commitment to sustainability. It also didn't hurt that the cost of moving the green roof was less than the cost of dumpstering it and building a new one from scratch. Plus, they had anticipated this day when they built the green

roof, and they had prepared for it: the green roof was a modular system made with knitted polyethylene green paks.

Full disclosure: I wasn't a big fan of modular green roof systems. When we build green roofs, they tend to be intensive agricultural or meadow systems with deep growing medium, and it doesn't make sense to use modular systems for this kind of work. When we've built sedum green roofs, we like the



"THEY HAD BUILT THIS GREEN ROOF THEMSELVES, HAD CULTIVATED IT AND WATCHED IT GROW FOR YEARS, AND THROWING IT OUT WAS NOT IN KEEPING WITH THEIR COMMITMENT TO SUSTAINABILITY."

- GWEN SCHANTZ



Photos courtesy Gwen Schantz

efficiencies and savings that come with laying out green roof materials, raking out the soil, and rolling out sedum blankets.

This project gave our team the opportunity to put the green paks to the test, moving 5,000 sf of them from one roof, and trucking them 30 blocks uptown to another roof - in December. We showed up on-site bright and early on a Saturday morning as a fairly heavy snow was blanketing New York City. There was about an inch of accumulation already topping the green paks, which made it difficult to interpret Cook Fox's color code - orange, yellow, pink and green spray-painted spots indicating whether the paks contained sedum, grasses, or flowers. Based on the code, we would know where to take the paks - some would be going to a totally new location: the Starrett-Lehigh building, in Chelsea, which had agreed to take about a third of the paks to install on one of their massive terraces.

Over the course of the morning, the weather warmed above freezing - just enough for the snow to switch over to sleet, and then rain, but not warm enough to thaw the frozen green paks or our icicle fingers. We used flat shovels to pry the 80-pound, slushy and mud-filled green paks from the EPDM roof, loading them

on carts and wheeling them to the office window. Then we handed off the paks to the indoor team, threading them one by one through the window to be loaded onto other hand trucks, down a small back elevator, to the street level where we had box trucks waiting. As the trucks filled, they sped off through the slushy rain to their destinations – some just a few blocks away to Starrett Lehigh, and the rest to West 57th Street, up another small elevator, and out through the office to three terraces at the new Cook Fox headquarters.

The whole move took two long days, 22 people, two trucks, and a whole lot of planning and cleanup. It was a fun exercise calculating the necessary resources prior to the move, estimating the time, people, elevator trips, hand trucks, and moving vans that we'd need, not to mention the square feet of drop cloth we'd use to protect the office floors and elevator from all the mud. Our Director of Design/Build, Cecide Corral, spent days organizing people and ordering materials, and she and I sat together for an hour just plotting out the routes between elevators, the number of bags we could move per hour, and how many people we'd need at each station along the way. On the other side of town, Cook Fox was assessing their green paks,

marking them, and planning out how to integrate them into the design for their new site. I can attest that both of our plans worked – the job was muddy, but otherwise smooth, and the resulting garden is a thing of biophilic beauty.

I've changed my mind about modular green roofs – they work, and they're easier to move than a conventional green roof that would have to be shoveled bag-by-bag. There were 979 green paks total, and they held up remarkably well considering they were getting tossed through windows, stacked onto carts and piled in trucks.

Aside from a little growing media spillage, they performed beautifully, as designed, and they continue to perform amazingly well in their new home on West 57th Street, where we spruced them up with some additional media and a heavy dose of native wildflower seed.

By June that year, the garden looked like a well-established meadow, as if it had been there forever. Who knows if it will remain there forever—maybe it will move again in ten years. We'll take the job again if we get the call, and hope that next time it's not in December.

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90°-210°	90°-210°	90°-210°	90°-210°	90°-210°	90°-210°	—
360°	360°	210°-270° 360°	210°-270° 360°	210°-270° 360°	360°	—

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BIOPHILIC DESIGN: A LIVING CASE STUDY AT PHIPPS CONSERVATORY, PITTSBURGH

BY RICHARD PIACENTINI, EXECUTIVE DIRECTOR, PHIPPS CONSERVATORY

When we think of green roofs, many benefits come to mind such as capturing stormwater, insulating buildings and creating habitat for wildlife. One other important benefit often overlooked is that green roofs can help satisfy our innate desire to connect with nature. This desire is known as biophilia, a term coined by Erich Fromm in 1973 meaning the passionate love of life and of all that is alive.

"WE CURRENTLY SPEND AN AVERAGE OF 90 PER CENT OF OUR LIVES IN BUILDINGS, SO WHAT HAPPENS IN THEM CAN HAVE A HUGE IMPACT ON OUR HEALTH AND HOW WE RELATE TO THE WORLD."

- RICHARD PIACENTINI

Photo courtesy Paul G. Wiegman.

We currently spend an average of 90 per cent of our lives in buildings, so what happens in them can have a huge impact on our health and how we relate to the world. Unfortunately, these same buildings isolate us from nature and the other species that we share this planet with. This is exacerbated by technology. If we go outside, one does not have to walk far to see many people walking while glued to their cellphones.

Biophilic design is an emerging practice that attempts to introduce connections to nature in the places where we spend most of our time - buildings. A comprehensive view of biophilic design was

developed by the late Dr. Stephen R. Kellert, who organized a biophilic design classification system in six primary areas: 1) environmental features 2) light and space 3) natural shapes and forms 4) place-based relationships 5) natural patterns and process and 6) evolved human-nature relationships.

Incorporating biophilic elements into the built environment can have profound, measurable benefits for human performance, including improved productivity, emotional well-being, stress reduction, learning and healing. Biophilic design features can foster an appreciation of nature, which



Photo courtesy Denmark Photography, Inc.

can lead to greater protection of natural areas, species conservation and pollution prevention (Kellert, 2008).

Dr. Roger Ulrich led a ground-breaking study that launched the biophilic design movement in 1984, showing that a hospital with views of nature could reduce post-operative stays by 8.5 per cent. Views of nature have also been shown to lower blood pressure and heart rate (Brown, Barton and Gladwell, 2013) and improve mental engagement and attentiveness (Biederman and Vessel, 2006).

Morning sun was shown to result in a 26 to 30 per cent reduction in stays among bipolar patients (Benedetti et al, 2001) and access to nature led to a 17 per cent improvement in performance in ADHD patients after a 20-minute walk (Taylor and Kuo, 2008). The presence of indoor plants resulted in a 21 per cent reduction in sick building syndrome symptoms (Fjeld et al, 1998) and the presence of trees increased the willingness of shoppers to pay more for the same items by 15-25 per cent (Wolf, 2005).

Maximizing natural ventilation was shown to result in a 57 per cent reduction in sick time, 16.7 per cent reduction in doctor visits, 34.8 per cent reduction in hospital stays (Preziosi et al, 2004) and for students, it resulted in a 14.4 per cent improvement in standardized math test scores (Shaughnessy et al, 2006).

Natural daylight results in higher test scores, faster learning rate (Heschong, 1999) and improved sleep time by up to 30 minutes (Figueiro and Rea, 2012).

When the team at Phipps Conservatory and Botanical Gardens began designing the Center for Sustainable Landscapes (CSL) in 2007, we were unaware of the term “biophilic design”. However, as a botanical garden we were naturally inclined to maximize our connections to nature. After construction was completed in December 2010, the CSL became the first and remains the only building to meet the Living Building Challenge, LEED Platinum, Four Stars SITES and WELL Platinum certifications.

Through this project, we demonstrated many ways that the built and natural environments could powerfully intersect to reconnect people to nature. For example, every occupied space includes a view of nature and is within 30 feet

of an operable window. Plants are located throughout the building. The building was designed to maximize natural daylight and each of its three floors open out into peaceful garden spaces. The green roof is accessible to staff and visitors.

As the design progressed we became aware of the term biophilia and the growing volume of scientific research to support the role it plays in creating healthy spaces. We understood the importance of building a real-world model that inspires visitors at Phipps. Almost half a million visitors can experience the positive impacts these designs have on people’s lives.

After we moved into the CSL, we saw further opportunities for biophilic improvements. The atrium of the building includes a lot of

concrete to help with thermal massing. This same concrete also creates a cold and sterile space. We then realized that we could use art to help incorporate biophilia into the space. We called it the BETA project, which stands for Biophilia Enhanced Through Art. Through the BETA project, we were able to maximize the last four

elements described by Kellert: natural shapes and forms, place-based relationships, natural patterns and process, and evolved human-nature relationships. This was accomplished by incorporating the work of 23 artists in a wide variety of media, including sound, steel, glass, acrylic paint, watercolor, photography, wood, mineral

pigments, bronze, digital prints and salvaged paint.

The BETA Project's design approach was integrative and featured guided experiential visioning activities, as well as interactive learning and application processes. We were so pleased with the way the BETA project and other biophilic elements transformed the CSL that we now require biophilic design workshops at the beginning of every project, ensuring that we are creating the best spaces we possibly can.

Embracing biophilia does not simply enrich lives, it is essential to them, enhancing our love of life and all that is alive.



Photo courtesy Annie O'Neill



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For the first time ever, the GRP Accreditation Exam is now available online. Online hosting is an innovative and cost-effective way to offer the GRP exam and GRHC is focused on passing the savings onto those seeking accreditation. The exam registration cost has dropped from USD \$499 to USD \$249. GRP Accreditation has never been so convenient!

The new platform allows us to provide training and the Green Roof Professional (GRP) Accreditation Exam to architects, landscape architects, roofing consultants, sales professionals and more at a much lower cost in the convenience of their own homes or offices. GRHC can now provide low cost continuing education opportunities for existing GRPs and others working in the field of green roofs and walls.

The Living Architecture Academy features competitively priced courses, including the new complete GRP Training and Accreditation Package. This bundle includes all three GRP courses (Design and Installation, Waterproofing and Drainage, and Plants and Growing Media), digital resource manuals for each course, one attempt to complete the GRP Accreditation exam, and a one-year individual GRHC Membership, all for the low price of USD \$999.

Due to popular demand, A Biophilic Design Part II will be released later this year along with Green Walls 101. If you have not already, be sure to sign up at livingarchitectureacademy.com to take your professional development to the next level.

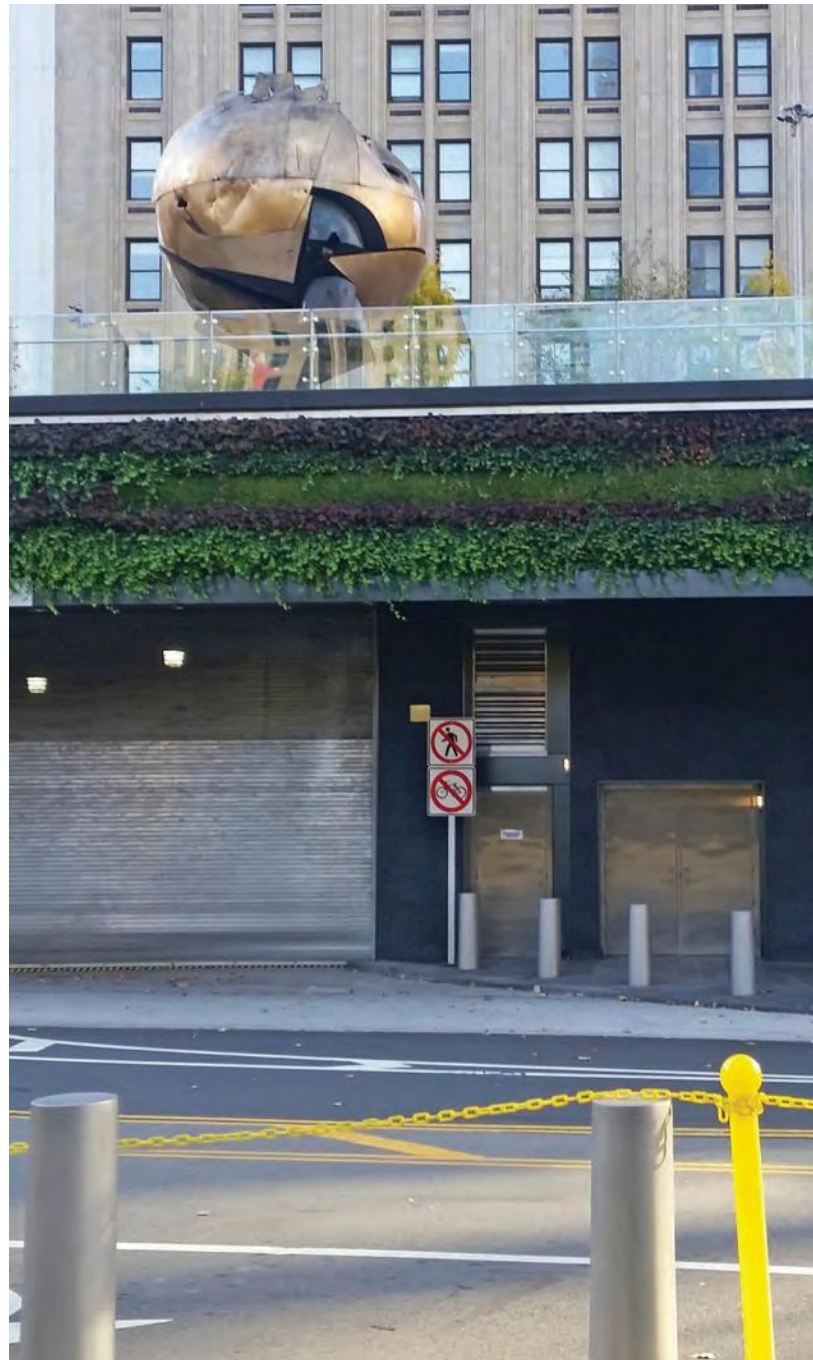
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LIBERTY PARK GREEN WALL BRINGS A MEASURE OF SERENITY TO 9/11 SITE

BY JOYCE MCLEAN, ASSOCIATE EDITOR

A well-established fact is that plants are known to bring serenity and promote well-being in people. Known as biophilia, what better place to use that knowledge than at the now opened World Trade Centre's Liberty Park – part of the memorial for the September 11, 2001 World Trade Center victims in lower Manhattan, New York.



The green wall is designed to bring tranquility to a grief-riddled space and to foster rebirth in lower Manhattan while acknowledging the devastation of 9/11.

On June 29, 2016, Plant Connection Inc. unveiled their patented G-O2 living wall system that took about three years with expertise from architects, engineers, landscape architects, horticulturalists and designers to plan, design, engineer and install, in an understandably highly

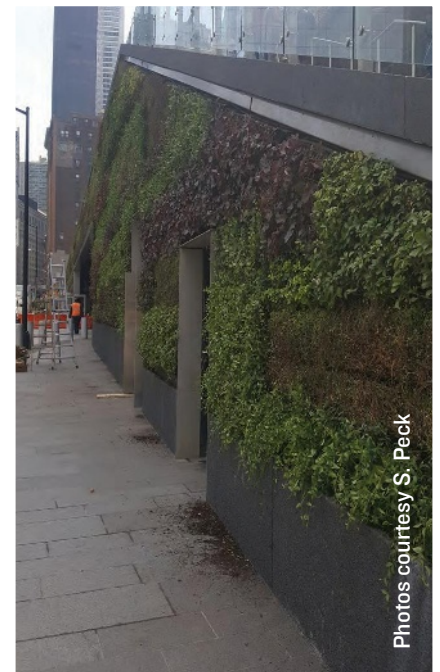
scrutinized environment.

The park itself, designed by landscape architect Joseph E. Brown for the New York Port Authority, is a one acre elevated space that takes a page from the nearby iconic High Line. The park features many trees, shrubs, perennials and unique seating that provides a place for visitors to relax, reflect and re-imagine amidst the bustling scene of lower Manhattan. An enormous sculpture sits atop the green roof. Called "The Sphere" by

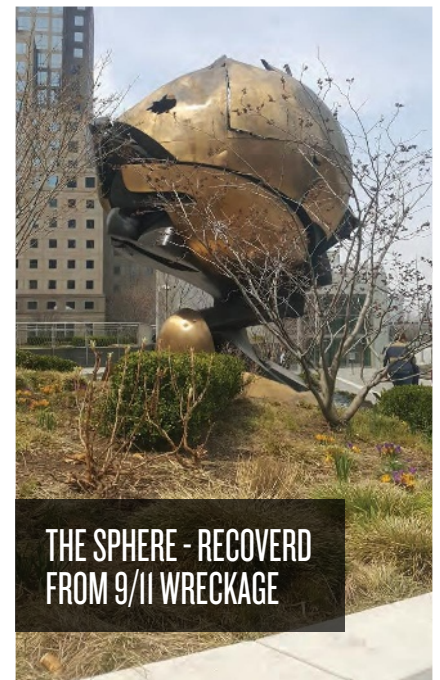


**"THE GREEN WALL IS DESIGNED TO BRING
TRANQUILITY TO A GRIEF-RIDDLED SPACE."**

- JOYCE MCLEAN



Photos courtesy S. Peck



**THE SPHERE - RECOVER
FROM 9/11 WRECKAGE**

artist Fritz Koenig, it was recovered from the wreckage of 9/11 and its damaged form provides a potent reminder of recent events at the site and those who died.

The Liberty Park green wall stands 25 feet high and extends 336 feet long. The greenery helps soften the hard street edges and provides a focal point for visitors. The plantings were staggered along a horizontal grid to complement the 9/11 memorial, with broad bands of color incorporated to provide visual interest.

The green wall system comprises over 20,000 evergreen ground-cover and perennial species including Japanese Spurge, Wintercreeper, Coral Bells, Baltic Ivy and Common Periwinkle. These plants provide year-round color and texture and are capable of thriving vertically in a partially shaded environment. The plants are housed in 845 stainless steel panels. There is an extensive 18-zone drip irrigation system, which provides water for the living wall, while at the same time a sophisticated

monitoring system ensures the living wall's health. Custom-made stainless steel catch basins hang under the panels to capture any water flow.

The green wall was pre-grown in the company's Riverhead, New York nursery and monitored by a team of horticulturalists. Pre-growing the plants ensures that the roots are well established into the panels before hanging vertically.

Being around plants is natural for people. It makes us

content and feel hopeful. This is particularly important in public spaces where tragedies have occurred. Being near plants and seeing them change with the seasons is nature's way of taking care of people – even in busy metropolitan New York City.

MORE INFORMATION

Liberty Park will be the subject of a tour during the CitiesAlive Conference in New York in September 24-28.

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JOURNAL

OF LIVING ARCHITECTURE

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The Journal of Living Architecture (JLIV) is the official, peer-reviewed journal of the Green Infrastructure Foundation. The JLIV is written, reviewed, and edited by living architecture research professionals, sharing with their colleagues: successful educational applications, original research findings, scholarly opinions, educational resources and challenges on issues of critical importance to living architecture professionals and educators. The JLIV is published exclusively in the Living Architecture Monitor magazine and online at livingarchitecturemonitor.com. The magazine publishes the abstracts of each published JLIV manuscript, with a link to the full paper online.

Volume 5 Number 1 Pages 1-15

BENCH-STUDY OF GREEN-WALL PLANTS FOR INDOOR AIR POLLUTION REDUCTION

Fraser Torpy, Michael Zavattaro

ABSTRACT

Potted-plants have the potential for improving indoor air quality (IAQ), however there has been little research on the performance of green-walls as indoor biofilters. The aim of this investigation was to compare rates of air pollutant reduction with two commonly used indoor species, and to assess the effects of added substrate airflows on the capacity of green-wall modules to remove two prevalent indoor airborne contaminants - particulate matter (PM), and volatile organic compounds (VOCs), using benzene as model. The species tested were *Chlorophytum comosum* (Spider Plant) and *Epipremnum aureum* (Pothos). The results showed that each species could significantly reduce increasing doses of PM, with or without augmented substrate airflow, however benzene removal rates decreased with increasing aeration. The findings provide a first assessment of the ability of green-wall plants to reduce indoor air pollution, and responses to two types of pollutant, particulate and gaseous.

Volume 5 Number 1 Pages 16-30

EVALUATION OF A RESIDENTIAL GREEN ROOF SYSTEM FOR STORMWATER RUNOFF RETENTION

Daniel Murphy, Susan Morgan, Serdar Celik, Bill Retzlaff

ABSTRACT

While much green roof research has been directed towards commercial and industrial buildings, less is known about the sloped roofs of residential buildings. The purpose of this study was to evaluate a pitched residential green roof system and determine its ability to retain stormwater runoff. In order to do this, 18 shingled roof models were constructed on three slope angles - 1°, 20° (5/12 pitch), and 40° (10/12 pitch) of which 9 were randomly fitted with a modular green roof system across three replications. The 42.1% mean stormwater runoff retention for the green roof systems was significantly greater than the 18.3% for shingled roof decks. A residential product (Steep Paks®) performed within the conventional range of previous stormwater retention studies. The residential green roofs effectively reduced stormwater runoff during periods of light precipitation compared to periods of heavy precipitation. No difference was found in percent stormwater runoff retention between the three residential green roof slope angles.

Read more at livingarchitecturemonitor.com

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GIF PARTNERS WITH NON-PROFIT HOUSING PROVIDERS ON SEATTLE GREEN INFRASTRUCTURE VISION

BY ROHAN LILAUWALA, PROGRAM MANAGER, GREEN INFRASTRUCTURE FOUNDATION

The Green Infrastructure Foundation is pleased to announce the release of the report *Community, Equity, and Placemaking with Green Infrastructure in Seattle: A Visualization and Cost-Benefit Analysis*. The report is the result of the legacy project of the *CitiesAlive* 2017 Annual Green Roof and Wall Conference.

The report was an effort by GIF, in partnership with Seattle-area non-profit housing providers Capitol Hill Housing and InterIm CDA, and looked at the transformative potential of green infrastructure in three Seattle-area neighborhoods: Capitol Hill, Japantown/International District, and White Center.

Teams of interdisciplinary experts and local stakeholders convened for a one-day exercise where they reimagined their

communities using green infrastructure. A cost-benefit analysis was conducted on the results, showing a compelling argument for green infrastructure.

The analysis from one site, in the Capitol Hill neighborhood of Seattle, found that a \$1.01 million investment in construction, with an annual maintenance cost of \$21,700, would provide a net benefit of \$3.52 million over 50 years, while creating 33 job-years of employment over that period.

This project was generously supported by the King County Department of Natural Resources and Parks Wastewater Treatment Division, Arup, MIG | SVR, GGLO Design, CMG Landscape Architecture, and Urban Horticulture Consulting. Read the report at greeninfrastructurefoundation.org/resources

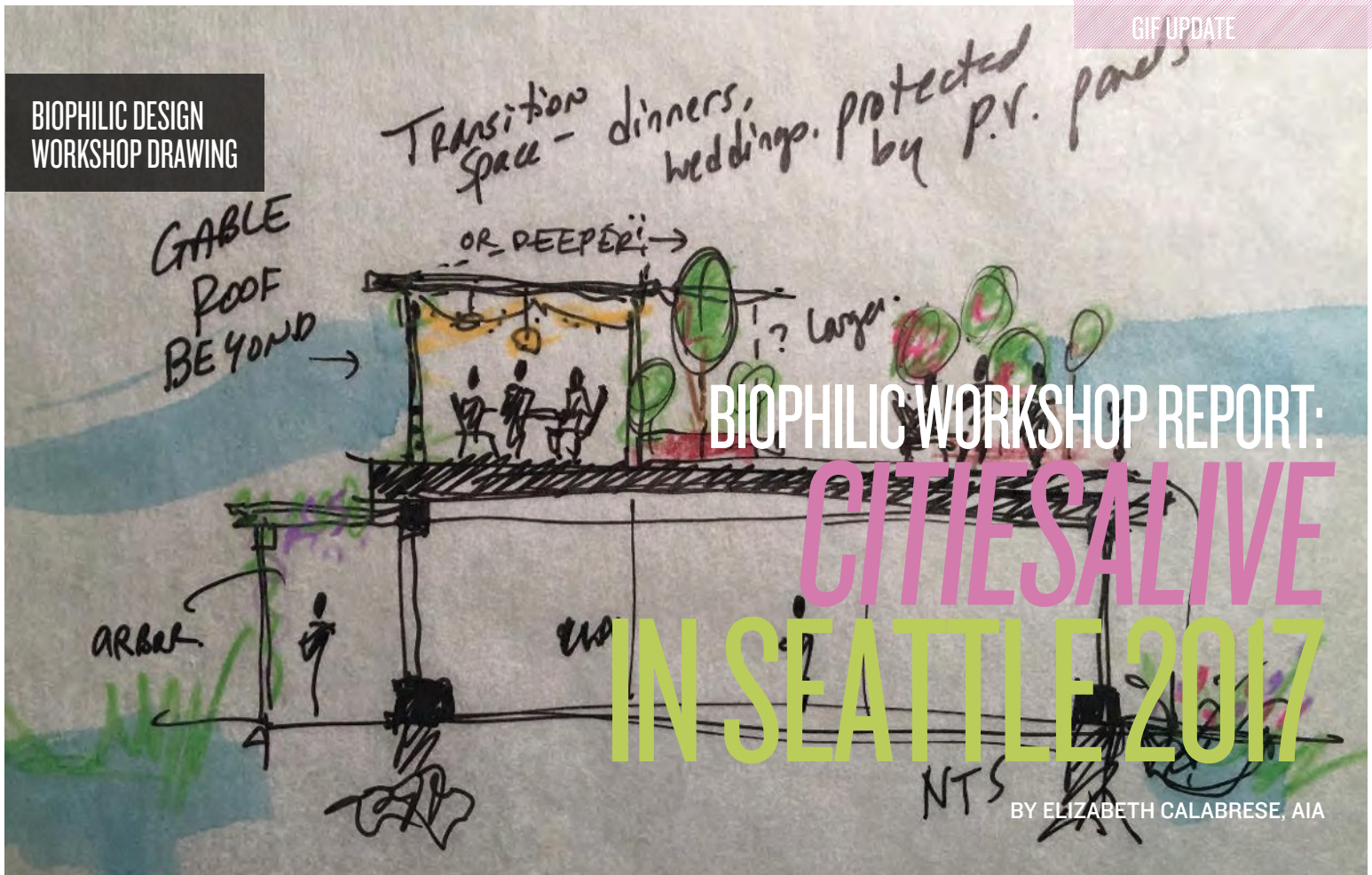
LIVING ARCHITECTURE PERFORMANCE TOOL PROPELLED INTO PILOT PROJECT PHASE

The revolutionary new Living Architecture Performance Tool is currently soliciting projects for its pilot phase. The consensus-based rating system for green roofs and walls was developed over five years, and featured the input of over 50 experts from a diverse array of fields.

Participants in the pilot phase have a chance to be among the first to be recognized as leaders in the field, can use the tool to optimize the performance of their green roof and wall

projects, and have access to personalized support and consultation, including access to a workshop at Chicago City Hall on July 13.

For more information or to register, visit greeninfrastructurefoundation.org/lapt
Rohan Lilauwala is the Program Manager at the Green Infrastructure Foundation. rlilauwala@greenroofs.org

BIOPHILIC DESIGN
WORKSHOP DRAWING

A Biophilic Design Workshop was offered during the *CitiesAlive* Conference in Seattle last September led by Bill Browning of Terrapin Bright Green and myself. The workshop was an excellent way to explore the essence of bringing cities to life where humans and nature co-exist symbiotically.

The term biophilia means love of that which is living and addresses our evolutionary need to connect with nature, and natural systems and processes in order to flourish as a species.

Although the term biophilia is relatively new, we have lived biophilically much of our existence as homo sapiens. Only recently, with the mass production of goods and services, modern electricity and other technology have we disconnected from nature in the built environment. This disconnect is causing both

mental and physical health related issues in humans while promoting our alienation and the subsequent degradation of the natural environment - we don't typically care for things we don't experience.

The workshop began with Bill Browning explaining some of the scientific research which shows that being in and around natural settings both directly and indirectly promotes our mental and physical wellbeing. Biophilic environments can help reduce stress, and improve our mood,

cognition, productivity and creativity. Terrapin has published several monographs outlining the latest research. The 14 Patterns of Biophilic Design and The Economics of Biophilia are two of several publications and papers by Terrapin. The links for the publications are listed below.

I then explained the Principles of Biophilic Design and review them here. Projects that are considered biophilic:

- foster repeated and sustained engagement with nature
- focus on human adaptations to the modern world that over evolutionary time have advanced people's health, fitness, and wellbeing
- encourage emotional attachment to particular settings and places
- promote positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for the human and natural communities
- encourage mutual reinforcing, interconnected and integrated architectural and engineered solutions (Kellert & Calabrese 2015)



Photo courtesy Elizabeth Calabrese

BIOPHILIC DESIGN WORKSHOP ATTENDEES

Workshop attendees then had an opportunity to put theory into practice by diving into the conceptual design of a either green roof or an atrium space. Trace paper, markers, colored pencils and tape were provided - everything a creative heart could desire. While both spaces were initially void of life, over the next few hours the conceptual green roofs were teaming with spaces for people to gather, vine covered trellises providing prospect and refuge, flower and vegetable gardens, walking and jogging paths, beehives, bird habitats, and endless opportunities to watch sunrises and sunsets. The atrium space fostered a sense of community as the heart and soul of the structure, connecting people to nature and to each other, opening up to the sky, with the sounds and smell of water features, dynamic patterns of light streaming through leaves, tendrils of vegetation, and indoor park spaces.

Once the sketches were complete, the attendees presented their concepts to the whole group. Biophilic workshops allow us to pause and consider how to design in conjunction with nature,

to use technology as a tool to further connect us with natural systems and processes rather than separate us from them, to celebrate nature's brilliance, its power to heal and to inspire. I look forward to leading another biophilic workshop at the upcoming *CitiesAlive* conference in Brooklyn in September and hope you will be able to join us.

FIND OUT MORE

Elizabeth Calabrese, ALA can be reached at Liz@CalabreseArchitects.com. To find out more about the Biophilic Design Workshop at *CitiesAlive* in New York in 2018. www.citiesalive.org

References:

<https://www.biophilic-design.com/>

<https://www.terrapinbrightgreen.com/report/14-patterns/>

<https://www.terrapinbrightgreen.com/reports/tbe-economics-of-biophilia/>

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NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION FINE TUNES GREEN ROOF GRANT PROGRAM

BY EMMA TAMLIN, ASSISTANT EDITOR

In New York City, an estimated 20 billion gallons of sewage and polluted stormwater runoff flows into the Hudson River and other waterways each year.

New York City recognizes the value of green infrastructure and the Department of Environmental Protection (DEP) has budgeted \$1.5 billion for green infrastructure to reduce combined sewer overflows (CSOs) and improve water quality by 2030. The challenge they face is that as much as 50 per cent of the land in priority areas where CSOs occur is owned by the private sector and the DEP is running out of places to build bioswales.

Despite the numerous approaches to managing stormwater, green roofs have become a top priority for the DEP and highly regarded by City Councilors. “Green roof investments pay dividends not just for building owners, but for the city and the environment as a whole,” said Manhattan Borough President Gale A. Brewer. Congressman Joe Crowley (D-Queens, the Bronx), Chairman of the House Democratic Caucus says “Our city’s roofs are an untapped resource in reducing stormwater runoff and making our homes more energy efficient”.

During the *CitiesAlive* Conference in 2015, city officials received criticism about difficulties in accessing funding under the existing grant program. Since then, the Natural Resources Defense Council and NYU Stern Center for Sustainable Business conducted extensive research for the DEP on how to better leverage the private sector for green infrastructure implementation. *Catalyzing Green Infrastructure on Private Property: Recommendations for a Green, Equitable and Sustainable New York City* was published in 2017. The report contains recommendations for the creation of a new grant program that is transparent, simple and flexible, and the restructuring of water and sewer rates to include a separate stormwater fee and create strong rules that require stormwater management.

On Earth Day 2018, the DEP announced that the Green Infrastructure Grant Program would now offer a streamlined funding schedule for green roof projects. The goals of the new grant program revisions are to incentivize more private property owners to install a green roof by streamlining the approval process. Green roof funding is now determined by green roof area and growing media depth, where projects with 4 inches or more in growing media depth can earn up to \$30 per square foot.

CitiesAlive 2018 returns to NYC in September to further the conversation and bring the design, research and policy communities together. Melissa Enoch, the Program Manager for Private Incentives at the NYC DEP, will be presenting “Framework for a Performance-Based Green Roof Incentive Program in New York City” to draw attention to the need to develop a green roof incentive framework that accounts for differences in green roof performance and maximizes incentive cost effectiveness.

RESOURCES

For more information read the 2017 NYC Green Infrastructure Report.
Green Roof Grant Program: <https://a826-web01.nyc.gov/GIGrant/Default.aspx>



NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION'S GREEN INFRASTRUCTURE GRANT PROGRAM

GOALS OF THE POLICY

- To protect the NYC waterways and improve water quality
- To beautify the city, provide green space, and improve the quality of life for residents
- To reduce CSO by 1.67 billion gallons of stormwater a year by 2030

CHANGES TO GRANT PROGRAM

- 90 day approval of green roof designs from submittal date
- More upfront information provided to applicants in advance
- Up to \$30 per square foot for projects between 3,500 and 20,000 square feet and four inches or more of soil depth (There is a sliding scale for lower depths of soil, down to \$10 for 1.5-199 inches)
- No restrictions on the type of plantings

IMPACTS TO DATE

- 467 Greened Acres from 2010-2017
- 140-180 Projected Additional Greened Acres in 2018
- 4,320 total green infrastructure assets
- DEP has constructed over 4,000 rain gardens across the City



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ELECTRONIC LEAK DETECTION ESSENTIALS OFTEN A FAILURE TO COMMUNICATE?

BY PETER BROOKS, PRESIDENT, IR ANALYZERS/VECTOR MAPPING

Many of us are familiar with the iconic 1967 film *Cool Hand Luke* and one of the most famous lines in American cinema – “What we've got here is a failure to communicate,” spoken by the warden - played by Strother Martin, and later thrown back at him by Paul Newman as Luke, a rebellious prisoner.

Of course, conditions in the roofing and waterproofing industry are not nearly as dire as in the sweltering southern prison camp depicted in the movie. However, many Electronic Leak Detection (ELD) specifications fail to adequately communicate the design requirements for constructing a testable assembly, the experience of service providers, the testing procedures required and specific deliverables. ELD involves the use of electrodes to generate an electronic field that can be used to detect leaks on the surface of waterproofing.

As designers have become familiar with ELD's many advantages over flood testing, and membrane integrity testing with ELD has rapidly become the first

choice for owners, manufacturers, architects, specifiers, consultants, and contractors around the world. ELD on roofing and waterproofing membranes is proving faster, safer, more accurate and often less expensive than flood testing. However, as with all new technologies, there are growing pains. This article addresses some of the factors affecting the testability of common roofing and waterproofing assemblies, and the necessity of specifying alternative grounding media in certain systems.

When first introduced, ELD was largely utilized for membrane integrity testing on vegetative roofing assemblies and other Inverted Roof Membrane Assemblies (IRMA) with overburden above the waterproofing membrane. Over time,

WHEN SPECIFYING ELECTRONIC LEAK DETECTION, IT'S IMPORTANT TO UNDERSTAND THAT THREE CONDITIONS ARE REQUIRED FOR ACCURATE TESTING:

1. A ground beneath the membrane to receive the electrical test currents (typically a structural concrete deck, metal deck or alternative grounding medium).
2. A membrane that is electrically nonconductive to separate the two sides of the electric circuit (+ / -).
3. No electrically insulating materials between the membrane and the ground.

Electronic Leak Detection has proven so effective on IRMA roofs that many design firms now incorporate Electronic Leak Detection in their construction documents as a standard practice. However, with so many roofing and waterproofing materials and constructions available, there is often confusion as to what constitutes a testable assembly. Also, architects, consultants and designers frequently employ boilerplate specifications utilized on previous projects, and ELD service providers often see specifications that do not adequately address the conditions of the new project. In particular, specifications designed for testing IRMA roofs are not adequate for conventional insulated roofing assemblies. Increasingly, ELD service providers are being asked to perform integrity testing on systems that can be difficult or impossible to test as specified.

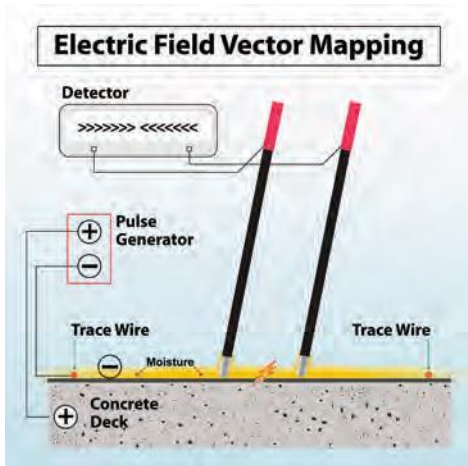


FIGURE 1: When the membrane is applied directly to a structural concrete deck, the concrete provides excellent grounding for the test currents.

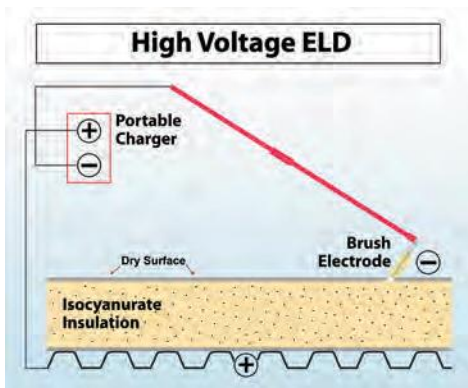


FIGURE 2: Whether conducting High or Low Voltage testing, breaches will not be detected when there are electrically insulating materials between the membrane and the conductive deck.

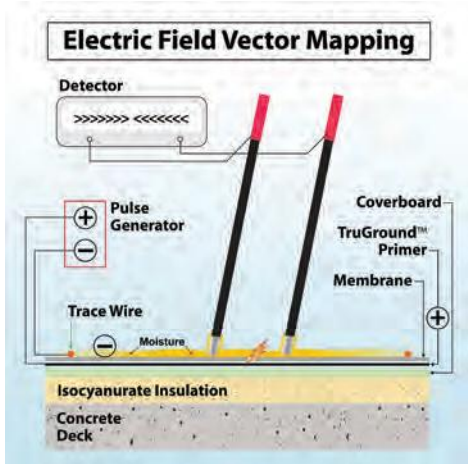


FIGURE 3: Insulated assemblies can be accurately tested when there is an alternative ground installed directly below the membrane to accept the test currents.

IRMA VS CONVENTIONAL INSULATED ASSEMBLIES

ELD testing is straightforward and extremely reliable when the membrane is applied directly to a highly conductive substrate such as a structural concrete deck (see Figure #1). The test currents travel through any breaches and easily connect to a readily available ground. However, ELD is also becoming the go-to integrity test on conventional roofing systems, with insulation installed between the membrane and the conductive deck. The same properties that make insulations and coverboards thermal insulators also create electrical resistance to the current utilized with ELD (see Figure #2). The presence of these poorly conductive and nonconductive materials prevents the test currents from reaching the conductive deck. These assemblies cannot be reliably tested unless an alternative grounding material is placed directly under the membrane to receive the test currents (see Figure #3). When the alternative ground is needed but not specified there can be significant confusion for all parties, since roofing and waterproofing contractors will need to purchase and install an alternative grounding product that is not in the specification.

SPECIFYING ALTERNATIVE GROUNDS

In 2014 ASTM released Standard D7877, providing guidelines for ELD testing on these conventional insulated systems:

“In roof assemblies where the membrane is installed over electric insulating material such as insulating foam or a protection board, or both, the electric path to any conductive deck is interrupted. The situation can be remedied by placing a conductive material directly under the membrane. The conductive material provides the return path for the test currents.”

To ensure compliance with the ASTM Standard, the design community can specify similar language in the design documents, for example:

“In assemblies where the deck is not electrically conductive or there are nonconductive materials installed between the waterproofing membrane and the conductive deck, e.g. insulation, coverboards, vapor retarders, etc., an alternative grounding medium must be installed directly under the membrane to accept the Electronic Leak Detection test currents.”

By requiring an alternative ground in the assembly, specifiers can ensure that a thorough and accurate Electronic Leak Detection survey can be performed.

BETTER SPECS MAKE BETTER TESTING

ELD specifications also often fail to adequately define the requirements for a high-quality survey, regardless of the type of assembly being tested. As with any other aspect of construction, ELD specifications should be robust, and include requirements for provider experience, equipment employed, testing procedures followed and deliverables.

In many instances, several of these important aspects are incomplete or absent, and in some cases documents may only contain one line referencing this critical integrity test (e.g. “Perform an electric integrity test of the membrane.”).

If in doubt about the how to specify Electronic Leak Detection for a certain assembly, architects, engineers and designers can request the assistance of experienced ELD service providers. Independent third-party firms can help specifiers navigate alternative ground options and the different types of leak detection testing available. With this valuable assistance, specifications can be written to ensure that experienced personnel employ appropriate technologies, correct leak detection procedures are followed, and a high-quality report will be delivered. Properly specified and applied, ELD testing will help us all deliver higher quality, more trouble-free assemblies.

1. *ASTM D7877-14, Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes. ASTM International*
Peter Brooks has been performing nondestructive testing for over 36 years and is a former Director of Roofing Consultants Institute Region I. peterb@iranalyzers.com.

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LIVING ARCHITECTURE PERFORMANCE TOOL TAKES ON OUR INDUSTRY'S ACHILLES HEEL — PROPER MAINTENANCE

BY CHRISTIAN MAHLSTEDT, PRESIDENT, GINGKO SUSTAINABILITY

The lack of proper maintenance in the green roof and wall industry is our Achilles heel - otherwise fantastically designed and executed projects can, within a few weeks in the case of green walls and a few years with green roofs, go significantly off the rails. Plants die or fail to thrive, weedy plants move in, drainage systems become clogged and growing media washes away. Often when we are called in to rescue projects, it's when the plants are either dead, or dying from a wide variety of causes.

Some of the primary maintenance challenges we face as an industry, based on our extensive experience, include the following:

- Having a knowledgeable contractor on the job who can perform the required maintenance, and in the case of green roofs on new buildings, often repair the damage to the green roof by other trades who are working to complete the building. Advanced Green Roof Maintenance is a half day course we have helped to develop that is now available online at www.greenroofs.org
- Having owners that know what the maintenance requirements are for a project, and who have documentation about the green roof and wall. Worst case scenario is that we've been called to buildings where, believe it or not, the facilities manager wasn't even aware of all the green roofs that they had on their building.
- Having owners that have set aside a sufficient budget for the ongoing maintenance of the project. Often, for many projects, there is a lack of communication between the capital side of an organization and its operations side, resulting in the building of projects for which no maintenance budget has been allocated. When initial short-term warranty periods run out in a year or two, these projects are often left on their own and can begin to fail. Good design should include the develop and pricing of a maintenance plan.
- Having contractors keep good records of the work that has been done, the problems fixed, and the changes made, is extremely useful to building owners who may wish to contract out future maintenance work to different teams. Information about the design, installation and maintenance of green roofs and walls should be kept by the building owners.

Five years in the making, the Living Architecture Performance Tool (LAPT) is a voluntary performance standard for green roofs and/or green walls launched in April. It is to green roofs and walls, what LEED is to green buildings. There are 110 points that can be earned across eight different areas of performance including stormwater retention and even biophilic design. Providing documentation of a five-year maintenance contract, a detailed maintenance plan and a budget, is a prerequisite for earning project certification. The LAPT is in pilot project phase and the Green Infrastructure Foundation is looking for 25 projects to become certified over the next year or so. To download the LAPT go to www.greeninfrastructure-foundation.org. If widely adopted, building owners will have a greater level of certainty over the maintenance of their projects and policy makers will have another tool to ensure that these projects performance as designed over the long term.

Christian Mablstedt is the Treasurer of GRHC, President of Gingko Sustainability which maintains more than 200 green roof and wall projects in the Toronto Area and works in the U.S. through Stormwater Capture Co.



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