DENVER JOINS GROWING LIST OF WORLD CLASS CITIES MANDATING GREEN ROOFS FOR PUBLIC HEALTH AND RESILIENCY

LIVING ARCHITECTURE MONITOR®

A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION VOLUME 20 / ISSUE 4 / WINTER 2018

DON'T MISS THE GREY TO GREEN CONFERENCE
TORONTO, APRIL 4-5, 2019

THE BUSINESS CASE ISSUE

- ON THE ROOF WITH... Eco-Architect Ken Yeang Talks About Integrating Ecology, Architecture and Engineering.
- GREEN ROOF MANDATES AT THE CITY SCALE: How Good Practice is Good Economics and Good Economics is Good Policy, By Jeff Joslin, Director, Current Planning, City of San Francisco
- A HEALTHY PRESCRIPTION FOR HOSPITALS: The Benefits of Green Roofs on Hospitals – St. Louis Children's Hospital and Cincinatti's Mercy Hospital, By John Robinson, Sika Corporation
- WHAT TO LOOK FOR WHEN SELECTING TREES FOR INTENSIVE GREEN ROOFS: By Dr. Darby McGrath, Vineland Research and Innovation Center
- THE BUSINESS CASE FOR BIOMIMICRY: How Green Walls Deliver in Tempe Arizona, By Reuben Freed, Resource Coordinator, greenscreen
- FOUR NEW REGIONAL CENTERS OF LIVING ARCHITECTURE ANNOUNCED: By Joyce Mclean and Dr. Bill Retzlaff

GREEN ROOFS. THE BENEFITS KEEP GROWING.

HEADLANDS INTERNATIONAL DARK SKY PARK WATERFRONT EVENT CENTER AND OBSERVATORY – MACKINAW CITY, MI

Green Roof Systems from Sika benefit you and the environment by reducing building energy consumption, extending the life of the waterproofing membrane and reducing storm water runoff. Unparalleled performance–designed to meet your sustainability goals of energy efficiency, environmentally preferable products, greenhouse gas reduction, and waste minimization–make Sika the choice for facility managers, roofing consultants, architects, and contractors alike.

To learn more about how our products can help you achieve your sustainability goals, visit usa.sarnafil.sika.com/greenroofs.html.

SUSTAINABILITY CERTIFIED NSF
Platinum Certified
NSF/ANSI 347
Sustainable Single-Ply Roofing

ASTM INTERNATIONAL
Standards Worldwide

SIKA CORPORATION – ROOFING
Phone: 800-576-2358
usa.sarnafil.sika.com

Sarnafil®

BUILDING TRUST

Sika®

VOLUME 20
ISSUE 4
WINTER 2018

INSIDE

On the cover: A list of cities that have embraced green roof and wall regulations driving industry growth.

LIVING ARCHITECTURE MONITOR®

VOLUME 20 / ISSUE 4 / WINTER 2018

LIVING ARCHITECTURE MONITOR IS PUBLISHED FOUR TIMES PER YEAR IN PRINT AND DIGITAL FORMATS BY GREEN ROOFS FOR HEALTHY CITIES (GREENROOFS.ORG) 2019 IS OUR 20TH ANNIVERSARY OF PUBLISHING!

MISSION

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 green roofs, green walls, and other forms of living architecture through education, advocacy, professional development and celebrations of excellence.

FEEDBACK

We welcome letters, story ideas, industry news, feedback and comments to the editor. Contact editor@greenroofs.org.

CHANGE OF ADDRESS

editor@greenroofs.org T: 416-971-4494 F: 416-971-9844

A DAY WILL COME WHEN THE MAJORITY OF OUR ROOFS AND WALLS WILL SERVE HUMANITY

Denver's recent leap to the forefront of policy in support of green roofs, green infrastructure and greener buildings is truly inspirational on several fronts. First, there is the dedication of a citizen and restaurant manager, Brandon Rietheimer, who wanted his city to 'walk the talk' on its sustainability promises and found Toronto's Green Roof By-Law online. Second, there is the system which allowed him and his volunteers to collect over 7,000 signatures and get a vote on the municipal ballot to make green roofs mandatory on new and existing buildings. Then there is the will of the people, a majority of whom voted in favor of the Green Roof Ballot Initiative, despite the scaremongering of the opposition.

Finally, there is the compromise of many different interests that served on the Technical Task Force, which hammered out a workable solution, in a political time when compromising is increasingly seen as consorting with the enemy. Congratulations to the many leaders in Denver who contributed to the new Green Roof Ordinance!

Governments, particularly local governments, have an incredibly important role to play to move our cities and regions toward sustainability. On the cover of this Business Case Issue, we recognize many of the local governments worldwide that have acknowledged the huge potential of wasted roof and wall spaces in our communities and through policy measures have implemented hundreds of millions of square feet of green roofs and walls. The public policy case for living architecture is laid out in this issue in an article by Jeff Joslin, Director, Current Planning, City of San Francisco and our newest board member. The City and GRHC won an American Planning Association Award for their work on the Better Roofs Ordinance which came into effect in 2017.

Not all building owners require mandates for green roofs, as John Robinson's article on hospital green roofs demonstrates. Despite the lack of mandates, healing garden rooftops in hospital environments are becoming increasingly common and deliver tangible and bankable benefits for patients and staff. Reuben Freed's piece on a green façade in Tempe Arizona also demonstrates that green walls can deliver bottom line cooling benefits in increasingly hot and arid climates.

The scientists of the world tend to be a conservative lot. They have grossly underestimated the impacts of climate change and overestimated how long they will take. Now they are sounding an even more desperate alarm about the necessity for a rapid transformation away from fossil fuels in order to avoid cataclysmic climate change which, like a runaway train, may become unstoppable in 12 short years. Runaway climate change will make the destruction of Great War and WWII look like a walk in the park by comparison!

"WHAT GOOD ARE SHAREHOLDER RETURNS, INSURANCE, OR EVEN NET WORTH, IN A WORLD THAT IS INCREASINGLY UNSTABLE, CHAOTIC AND AT WAR WITH ITSELF AND A RAGING ENVIRONMENT?"

- STEVEN W. PECK

It is argued that we are the last generation able to put the brakes on the increasingly dire climate cataclysm that has already begun to unfold through rising seas, extreme hurricanes, drought and fire. The cost of inaction, is hundreds of billions and climbing. If we fail to put the brakes on - then what of the business case? Unless one believes one is not drowning, a drowning person does not bother to count ones quarterly profits or calculate ones ROI on a future project. What good are shareholder returns, insurance, or even net worth, in a world that is increasingly unstable, chaotic and at war with itself and a raging environment? No one will remain immune.

For more than 20 years I have dreamt and worked towards the realization of a world in which all of our buildings roofs and walls would provide the ecosystem services which support all life on earth. Eco-Architect Ken Yeang, our On The Roof With feature guest interview, has embodied this dream in his work for more than 50 years. This shared dream is transformational and when mixed with hope, it has the power of significant change.

Denver is an example that transformational change can come quickly and cities can change course. It gives me hope. Despite the dire United Nations warnings of the runaway climate train barreling down the tracks, I believe we all must dream of healthy, resilient, and just buildings and communities, and direct our energy, passion and business skills to their realization. We owe it to ourselves, to those who have come before, and particularly to those little souls that are laughing and singing so innocently in the playground nearby.

Sincerely yours,

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

NEW YORK CITY/JAVITS GREEN ROOF VIDEO

This NPR you tube video provides an overview of the many benefits of the Javits Center in New York and what the benefits of widespread green roof implementation in New York City would be. https://www.youtube.com/watch?v=FlJoBhLnqko. A mandatory green roof policy for new buildings is currently in Committee in NYC.

CASE STUDY ON BENEFITS OF GREEN ROOFS IN KANSAS CITY RELEASED

The EPA is also introduced a new case study demonstrating the environmental and health benefits of green roofs in Kansas City, Missouri, Estimating the Environmental Effects of Green Roofs. The case study lays out a replicable analytical framework that state and local decision makers can use to assess the multiple benefits of green roofs, including stormwater runoff reductions and public health improvements.

NEW EPA WEB SITE ON URBAN HEAT ISLANDS

Check out the newly sprouted webpage, Using Green Roofs to Reduce Heat Islands! The Heat Island Reduction Program recently enhanced the green roofs webpage to include new research, information on the co-benefits and costs of green roofs, and the difference between green roofs and cool roofs. The page also has updated graphics and a photo gallery of projects.

PROCEEDINGS FROM THE NEW YORK *CITIESALIVE* CONFERENCE ARE NOW ONLINE

Learn from more than 35 hours of presentations (slides synced to audio) from the keynotes, design, policy and research tracks for only US$179.00. https://greenroofs.org/greeninfrastructurestore/2018-citiesalive-conference-recordings

GREEN PAGES INDUSTRY DIRECTORY FOR 2018-19 IS NOW AVAILABLE

Get your copy of the Green Pages: Green Roof and Wall Industry Directory by downloading it from our web site.

https://greenroofs.org/green-pages-industry-directory/

ON THE ROOF WITH...
ECO-ARCHITECT KEN YEANG

INTERVIEW BY STEVEN W. PECK, GRP, HONORARY ASLA

In the 1970s' he was labelled a crazy hippie architect from London. Based in Malaysia, Eco-Architect Ken Yeang of Hamzah & Yeang has worked to integrate architecture and ecology for more than 50 years. One of the early pioneers of ecological design and planning, Ken has approached the design of buildings and communities through the lens of ecosystem services. This, he says, is still a work in progress. The Guardian has named him one of the 50 people who could save the planet. After his keynote presentation at CitiesAlive in New York, I caught up with Ken to ask him a few questions about the past and his views on the future of architecture and planning.

LAM: *Ken, you have spent most of your career trying to create works of living architecture. Generally speaking, where has the most progress been made over the past 30 years?*

Ken Yeang (KY): The most progress I think is firstly in the various green accreditation systems which have provided a common basis for evaluating green buildings. However, architects today have taken these accreditation systems as far as they can, and this is excellent progress. These systems have also proselytised green design to a wider public audience. This is the other key success of the accreditation systems.

The second progress is in eco-engineering. Back in the early 90s' we had great difficulty getting engineers to help us with green design (especially with energy, water and sewage systems). But today most if not all mechanical and electrical engineers claim to do eco-engineering systems. This is again wonderful progress.

The next generation of green design needs to be driven by the science of ecology. However, most architects who hold senior positions of influence in architect and engineering firms today are not ecologically literate. We need to design differently. It may be too late for my own generation, many of whom are too set in their ways of designing to adapt. I am hopeful for the next generation of architects and engineers.

LAM: *What do you consider to be your greatest accomplishment as an architect over the past 30 years?*

KY: My model figure is Ian McHarg who developed and advanced designing with ecology at the master planning level, but was, I think, unable to take it to the level of architectural design, although he sought to do this as best as he could. One of the

reasons may be that he was a landscape architect and not an architect. Without hubris, I think my own achievement is in taking ecology to architectural design, but I am not fully there yet.

LAM: *How do you address the issue of costs and benefits when it comes to implementing living architectural elements into your designs?*

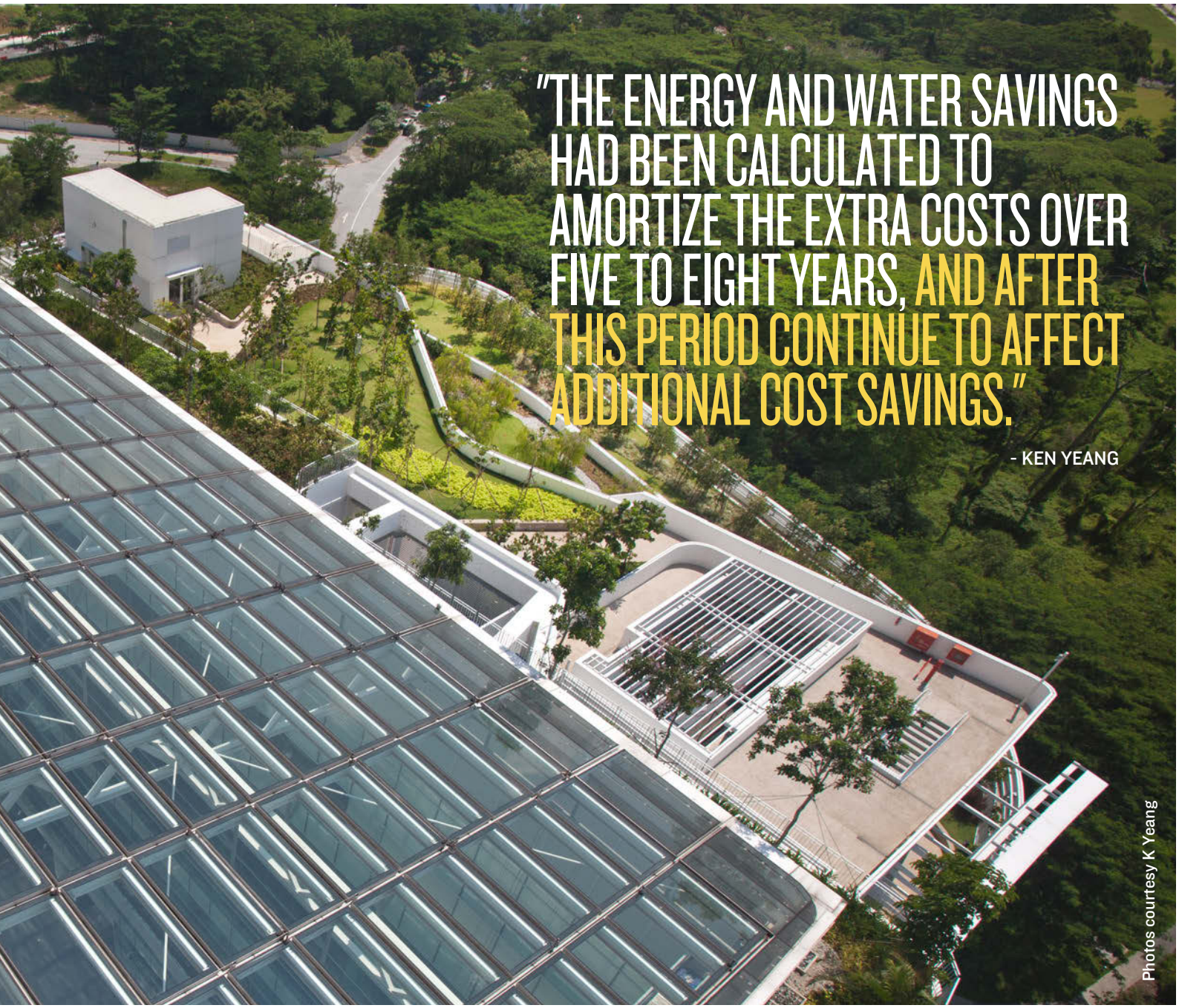
KY: I usually ask a client to budget 10 to 15 per cent (or more) over industry's standard construction costs for that building type to make the building green, and I then work within this budget. We delivered the Solaris office building in Singapore, rated Green Mark Platinum at a cost of 6.3 per cent over industry's standard costs for this building type.

The energy and water savings had been calculated to amortize the extra costs over five to eight years, and after this period continue to affect additional cost savings.

LAM: *What do you think is going to be the leading edge of living architecture practice over the next 10 to 20 years?*

KY: The leading edge living architecture practice over the next 10 to 20 years is to redesign and remake our built environment to be human-made ecosystems to benignly and seamlessly bio-integrate with the ecosystems and the planet's biogeochemical cycles. These systems must emulate and replicate the properties of ecosystems (attributes derived from systems ecology) and provide ecosystem services

THE SOLARIS BUILDING



Suasana Putrajaya is a mid-rise development that has a number of vegetated zones that are created as habitats at different areas within the entire development (eg. at the ground plane, in the skycourts, in the 'eco-cell', etc.) to attract selected native fauna to the locality whether for feeding, breeding, refuge or seeking of water. These habitats are matched with selected native flora in the various habitats to attract the fauna. The goal is to enhance the locality's biodiversity, guided by a 'biodiversity matrix' prepared as the basis for the design of its landscape areas.

within all our built environments and urban realms, likely by augmentation by nature of our urban systems. Successfully achieving this is the next level of innovation.

LAM: *What advice would you give to young design professionals, just starting out in their careers?*

KY: The general advice is 'focus'. The secret of success for me is 'focus', meaning you cannot do everything well, but you can do a few things extremely well, and at the same time practise 'Kaizen' or constant improvement. If you want to go into business as a profession, then learn how to do business by getting an MBA as you are not taught business at architectural school.

For more information please visit https://www.hamzahyeang.com/ Take in Ken Yeang's Keynote Address at CitiesAlive by purchasing proceedings. https://greenroofs.org/greeninfrastructurestore/2018-citiesalive-conference-recordings

NOTABLE PROJECTS

PLAZA ATRIUM, Kuala Lumpur, 1981

ROOF-ROOF HOUSE, Kuala Lumpur, 1985

MENARA BOUSTEAD, Kuala Lumpur, 1986

MENARA MESINIAGA, Subang Jaya, Malaysia, 1992

MBF Tower, Penang, Malaysia 1993

TTDI THE PLAZA AND RESIDENCE, Kuala Lumpur, 1996

UMNO TOWER, Penang, 1998

MUTIARA MESINIAGA PENANG, Penang, 2003

MEWAH OILS HEADQUARTERS, Malaysia, 2005

NATIONAL LIBRARY OF SINGAPORE, Singapore, 2005

LIMKOKWING UNIVERSITY OF CREATIVE TECHNOLOGY (Main campus, Cyberjaya), Malaysia, 2006

TA2 Tower, Kuala Lumpur, Malaysia, 2005

DIGI TECHNICAL OFFICE, Shah Alam, Malaysia, 2010

SOLARIS, Singapore, 2010

GANENDRA ART HOUSE, 2010

PUBLICATIONS

1995 DESIGNING WITH NATURE:
The Ecological Basis for Architectural Design, Mcgraw-Hill

1997 SKYSCRAPER, BIOCLIMATICALLY CONSIDERED:
A Design Primer, Wiley-Academy

2000 THE GREEN SKYSCRAPER:
The Basis for Designing Sustainable Intensive Buildings, Prestel

2002 REINVENTING THE SKYSCRAPER:
A Vertical Theory of Urban Design, Academy Press

2008 ECODESIGN:
Eco Skyscrapers, Images Publishing

2008 ECODESIGN:
A Manual for Ecological Design, Wiley

2009 ECODESIGN:
EcoMasterplanning, Wiley

Photo courtesy of Brad Rowe

SYMPHYOTRICHUM ON THE MICHIGAN STATE UNIVERSITY MPS BUILDING

ASTERS PROVIDE EXCEPTIONAL FALL AESTHETIC APPEAL

DR. BRADLEY ROWE, MICHIGAN STATE UNIVERSITY, EAST LANSING

It may be more difficult to assign a dollar value to visual appearance than it is to quantify stormwater management or energy savings, but aesthetic appeal is important to a large number of people. Using plants that extend the flowering season can prolong aesthetic value and thus help make the business case for green roofs. Aster is a genus of herbaceous perennials that fit this description. They get their name from the Greek word for 'star' due to the shape of their flowers. Many are popular garden plants because of their attractive and colorful flowers.

Two that we have been tested and grown on green roofs are *Aster laevis* (smooth aster, smooth blue aster) and *Aster oolentangiensis* (sky-blue aster, azure aster, or prairie heart leaved aster).

Symphyotrichum laeve is native to a large part of Canada and the United States within USDA hardiness zones 3 to 8, whereas S*ymphyotrichum oolentangiense* has a smaller range from Ontario and Minnesota south to Georgia across to Texas. They are both considered drought tolerant and are often found growing naturally in dry, shallow, well drained sandy to rocky soils in full sun. They self-seed profusely and are known to naturalize a given area. They are subject to no serious insect or disease problems, but

powdery mildew may occur without adequate air circulation.

When mature, *Symphyotrichum laeve* can reach a height of 120 cm (4 ft). Stems are usually unbranched with alternate variable leaves ranging from 3 cm (1.2 in) to 20 cm (7.9 in) in length and 1 cm (0.4 in) to 2.5 cm wide (1 in). They are usually hairless and leaf edges can vary form sharply toothed to smooth. Flowers appearing in September and October attract butterflies, are up to 2.5 cm (1 in) across, and are arranged in clusters (panicles) with violet blue to purple rays and yellow center disc florets. Similar to dandelions, seeds have bristles attached to their tips that allow for easy wind dispersal. The description for *Symphyotrichum oolentangiense* is almost identical except that the plant does not get as tall (usually up to 90 cm (3 ft); basal leaves are hairier; and the ray flowers are more blue than violet in color.

Both *Symphyotrichum laeve* and *Symphyotrichum oolentangiense* were trialed at the Chicago Botanic Garden (Hawke, 2015, Chicago Botanic Garden Plant Evaluation Notes, Issue 38). *Symphyotrichum laeve* was tested at a substrate depth of 20 cm (8 in) and given an overall good performance rating of 3 stars (out of 5). *Symphyotrichum oolentangiense* was grown at a depth of 10 cm (4 in) and was given a fair two to three star rating, but 10 cm is very shallow for herbaceous perennials. Plants were watered regularly during the first year to ensure establishment and then during extreme drought periods in subsequent years.

In a trial at Michigan State University (MSU), both *Symphyotrichum* laeve and *Symphyotrichum oolentangiense* were planted in 2011 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. Although coverage was decreasing over time, the species was still present in the 20 cm deep section until 2016 when there was a major die-off of most of the herbaceous species. No irrigation was supplied after the second year. Their disappearance was likely due to a drought during the 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 *Symphyotrichum* 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.

Dr. 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.

GREEN ROOF MANDATES AT THE CITY SCALE:

GOOD PRACTICE IS GOOD ECONOMICS, GOOD ECONOMICS IS GOOD POLICY

BY JEFF JOSLIN, DIRECTOR OF CURRENT PLANNING, SAN FRANCISCO

There's no doubt that city-scale deployment of green roofs can be an effective component in the arsenal to combat the impacts of climate change. Green roofs have the unique capacity to advance numerous broad environmental objectives simultaneously, including: augmenting biodiversity, diminishing energy demands, reducing heat island impact, improving viewsheds, and minimizing stormwater infrastructure. And they do so by employing what has historically been an expansive area of ignored and previously valueless real estate. Green roof proliferation is accelerating.

It's been the law of the land in numerous European cities for decades, with highly instructive and transferable experience and results. What's been demonstrated there is not just good practice, but also good policy. And it's no longer a European phenomenon, as an increasing number of North American cities are following suit with policies and mandates of their own.

IT'S GOOD POLICY, BUT IS IT GOOD ECONOMICS, AND FOR WHOM?

The introduction of any new regulatory requirement invariably leads to a conversation about economics. Those concerned about mounting costs of requirements advocate against. Those in support of specific measures, particularly if environmental benefit is a primary

POTENTIAL PUBLIC BENEFITS RESULTED FROM SAN FRANCISCO'S RECENTLY ADOPTED BETTER ROOFS ORDINANCE, WHICH REQUIRES BETWEEN 15 AND 30 PER CENT OF ROOF AREA ON NEW CONSTRUCTION INCORPORATE GREEN ROOFS AND/OR SOLAR PANELS, INCLUDED:

$15-100 million in tax revenues as a result of improved property and biophilic value.

Between 60,000 and 385,000 tonnes of carbon emissions avoided or sequestered over 15 years. This is the equivalent of the sequestration resulting from 3,600-24,000 acres of forest, the energy used by 400-2700 homes, or taking 800-5400 cars off the road.

(San Francisco Living Roof Cost-Benefit Study, ARUP, 2016)

driver, argue – sometimes with the benefit of analysis and sometimes without – that societally we can't afford not to implement such measures.

Recent North American efforts to advance green roof policies or mandates have prompted such dialogue in each city they've been considered. This is how it should be: the added value and cost of any regulation is critical not just to its immediate support, but also to long term sustainability and effectiveness. Premature or overly ambitious requirements can do more harm than good in building support for related efforts down the road.

It's for this reason that the business case is intrinsic to the advancement of any new green roof policy. Analysis is not a simple matter. Useful determinations need to incorporate local climate conditions, real costs based on local expertise and trades, product availability, and be grounded in place-based real estate economics. Furthermore, such financial analysis must be applied to an array of building typologies likely to be subject to such regulation. Resulting documentation needs to be accessible, credible and defensible.

So, just who is this analysis for? If the analysis principally addresses public benefits, that doesn't help address real estate value concerns. If the analysis is skewed towards the project outcome, it doesn't necessarily help buoy the policy argument.

The answer is: it's for both. An ideal outcome would demonstrate added value at the community scale, but would also provide building owners and developers demonstrable proof that the cost of green roofs provides a return on investment that fully rationalizes the cost.

The good news is that recent analyses developed for two very different settings, San Francisco and Denver, demonstrated the cost effectiveness of green roofs for an array of building types at both the community and project scales. Determinations of positive value accrued to building owners and tenants in San Francisco were impressive enough that constituencies for all building and housing types had no concerns. Similar results in Denver helped counter opposition, leading to voter mandated requirements.

CARROTS VERSUS STICKS: THE MOST EFFECTIVE POLICY IS THE BEST POLICY

Incentives have played a huge role over the last decade or so in building localized professional capacity, establishing best practices, and evolving available systems, thus setting the stage for efficient and rapid deployment of green roofs wherever markets emerge. This was particularly necessary when the added value and cost-efficacy of green roofs was not yet present or proven,

"THE DIFFERENCE BETWEEN INCENTIVES (CARROTS) AND REQUIREMENTS (STICKS) IS THIS: WHILE INCENTIVES CAN ENCOURAGE MARKETS TO EMERGE, REQUIREMENTS ESTABLISH MARKETS."

- JEFF JOSLIN

A SIMILAR ANALYSIS FOR DENVER REVEALED THAT ITS VOTER MANDATED GREEN ROOF INITIATIVE WHICH PROPOSED GREEN ROOFS ON ALL NEW AND EXISTING BUILDINGS IDENTIFIED SIMILARLY IMPRESSIVE RESULTS OVER 15 YEARS, INCLUDING:

The creation of 25,000 jobs.

Over $200 million in energy savings.

Nearly $100 million in real estate benefits.

(Denver Cost Benefit Report, Green Roofs for Healthy Cities, 2017)

NOTE: The Denver initiative has since been modified to afford additional compliance paths so this analysis is no longer current, but still useful in understanding the magnitude of positive environmental impact and economic benefits resulting from a clear mandate.

neither of which is the case today.

Incentives make sense as a principle compliance path if it's the only politically viable means available. The reason is fundamental: the difference between incentives (carrots) and requirements (sticks) is this: while incentives can encourage markets to emerge, requirements establish markets. Mandates provide a predictable demand that professionals and suppliers can ramp up to. This predictability results in more rapid local job growth, and a dramatic drop in the cost of delivery over the shortest period of time.

Additionally, mandates are simpler, and therefore cheaper and quicker to administer. They result in a lower municipal budget impact, are therefore less vulnerable during darker budgetary cycles, and ensure a clearer and more efficient path for projects.

BENEFITS ARE SCALABLE AND IMPRESSIVE

The reason to care about this at the city-scale is because the benefits are substantial and yield benefits beyond those quantified at the project level. Such analysis can help buoy the argument for legislating green roofs, and also help to place those contributions in the context of a city's broader sustainability goals and strategies. See above charts.

Armed with the predictable outcomes that mandates provide, infrastructure planning can right-size and minimize associated systems. For cities with the appetite and sophistication, resulting savings can be interpolated into incentives, which can further expedite acceptance and incorporation into projects of all scales.

There's no need to invent that analytical wheel. San Francisco developed its methodology in a manner that's now available to other municipalities, and in a form that's readily modifiable to incorporate local conditions and appropriate assumptions. Denver's analysis was generated by Green Roofs for Healthy Cities and the Green Infrastructure Foundation, and is similarly available and adaptable for other future settings.

Defensible analysis should support any effort to advance a green roof regulatory effort. The question will be posed sooner or later, so it's best to have those answers ready. Established ordinances and implementation tools are also readily adoptable to help efficiently and effectively advance the next generation of ordinances.

THE PATH IS CLEAR, AND THE TIME IS NOW

Municipal green roof policies now have a clearly defensible and marketable basis. Implementation roadmaps and toolkits await. The path is clear for green roofs to play a much broader role as an integral approach for cities seeking to quickly and effectively move towards a more sustainable future. Additional cities are queuing up their deployment efforts. What green roofs do for individual sites, they achieve more effectively at the city scale. There's been no better opportunistic time for cities to adopt assertive policies, which is precisely why more cities are stepping up to actively advance such initiatives across the continent and globally.

Jeff Joslin, Director of Current Planning for San Francisco, has recently been appointed to the Board of GRHC. San Francisco's Better Roofs Ordinance won an American Planning Association Award for Excellence in Sustainability in 2017. For more information:
San Francisco Cost-Benefit Study - http://default.sfplanning.org/Citywide/livingroof/SFLivingRoofCost-BenefitStudyReport_060816.pdf
Better Roof Ordinance Summary - http://default.sfplanning.org/legislative_changes/new_code_summaries/160965.pdf
Green Roof Cost Benefit Study for Denver – https://static1.squarespace.com/static/58a5ddae6a49639715bab06d/t/5a7230400852291044ab4783/1517432898351/Denver_Cost_Benefit_Report_Final.pdf

Bringing Green Design to Life

ON ROOFS AND WALLS

LiveRoof®

LiveRoof.com 800-875-1392

LiveWall®

LiveWall.com 877-554-4065

CHOOSING TREES AND GROWING MEDIA FOR INTENSIVE GREEN ROOFS

BY DARBY MCGRATH, PHD, VINELAND RESEARCH AND INNOVATION CENTRE

TREES PRUNED FOR ROOFTOP APPLICATION

Photo courtesy D McGrath

Incorporating trees into green roof designs and building facades is not only appealing, but there is more demand than ever to plant rooftop trees. The Bosco Verticale (a.k.a. "vertical forest") in Milan, Italy is home to 700 trees, 4,500 shrubs as well as 15,000 herbaceous plants. Designing for tree survival and longevity, however, is challenging.

Intensive green roofs, which can include trees and shrubs, require deeper planting mediums and more maintenance than extensive green roofs. The new vertical forest design movement integrates trees, shrubs and other plant material into multiple façades of a building and requires treating each floor differently because of variable micro-climate conditions.

Harsh microclimatic conditions can include varying sun and wind exposure, which result in higher rates of evapotranspiration. Low nutrient availability due to the absence of natural soil-derived inputs and limited soil volumes make the planting medium critically important. As more buildings are designed with trees taking centre-stage, arborists, urban foresters and landscape architects will be tasked with creating conditions that can support tree growth, as well as selecting trees that can withstand other conditions not easily ameliorated. Here are some key considerations for selecting growing media and trees for rooftop projects.

GROWING MEDIA QUALITY AND VOLUME

Growing media quality is a primary determinant of the success of tree plantings. Substrates should have the right air and water balance, which is easily achieved by ensuring mixes have adequate amounts of organic matter. Organic matter is also a critical component of plant-microbial interactions which help trees access nutrients and tolerate challenging conditions (e.g. drought stress). The substrate needs to be dense enough to anchor tree roots in fixed volumes, as well as light enough to fit the design requirements. The width of the growing space is critical for the structural roots of trees to become properly anchored in the soil. Therefore, space for lateral root spread is more important than having a very deep container. Tree selections should be made with this volume in mind; compact, non-tap-rooting species are preferable. The substrate volume has to match the trees requirements in terms of rooting space required and moisture regime. According to James Urban, FASLA, mature shade trees require at least 30 m3 of soil to

meet their physiological requirements in the built environment.

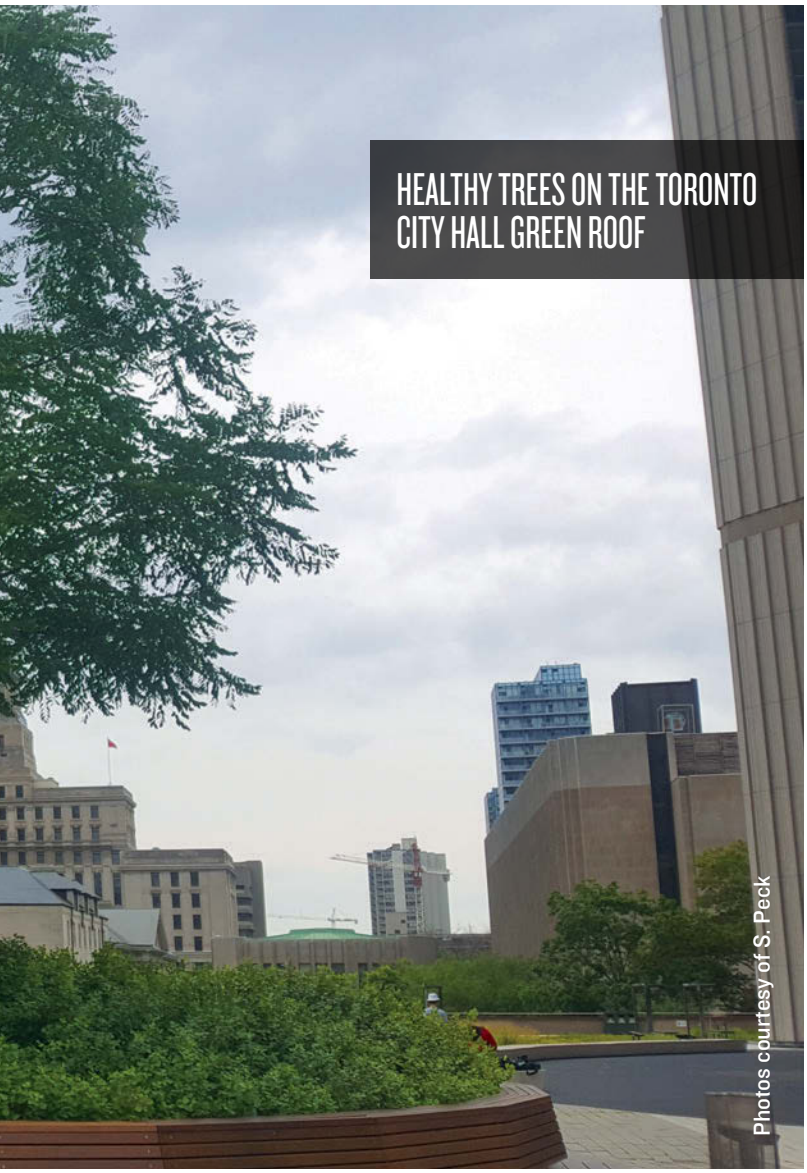
Trees in settings where root extension is impeded by restricted soil depth or width are container trees. Water losses can often exceed stored water in a container and quickly result in water stress. Calculating the required soil volume for the candidate species can be accomplished using climatological data and provides important thresholds for irrigation.

ROOT QUALITY AND TREE ARCHITECTURE

For all installations, but especially when trees are being transplanted onto roofs or balconies, close attention should be paid to cultivation practices. Proper tree root quality starts in the nursery and influences survival in the landscape. For instance, in Sweden, nursery growers have standards for "pre-establishing trees" dictating root management. Repeated root pruning is one way to ensure good root quality, effectively removing circling or otherwise malformed structural roots, increasing fine root mass. Trees that receive root pruning treatments suffer less transplant shock and establish more quickly. Nursery suppliers should be able to provide information about what pre-conditioning techniques have been used and are often willing to share their knowledge on characteristics of different candidate species. In Europe, nurseries commonly provide information and guidance on selections of trees for green roof use.

Nursery stock should also be evaluated for proper pruning to maintain good branch architecture, spacing and to encourage strong branch unions. Research has shown that properly pruned trees experience less damage in wind storms (sensu Gilman et al. 2008). Structural pruning to manage branch aspect ratio, branch union strength (branches smaller than trunk form stronger unions) and maintain narrower and more balanced canopies is essential for trees slated for green roof use.

Trees with narrower, more balanced canopies or multi-trunk



HEALTHY TREES ON THE TORONTO CITY HALL GREEN ROOF

Photos courtesy of S. Peck

selections are used prominently in green roofs in Europe. Multi-stem trees are especially preferred in areas where wind is factor. Generally, trees chosen need to be amenable to pruning but preference should be given to lower maintenance trees in some scenarios. Topiary trees are commonly used in Europe on green roofs, but require frequent pruning to maintain their shape. Therefore, consideration should be given before using on private balconies or areas with restricted access. Species that are susceptible to pests and diseases due to open wounds or that experience stress after pruning should be avoided.

SPECIES SPECIFIC TRAITS TO CONSIDER

Drought tolerance, light levels, heat and cold tolerances all need to be considered for tree selections. Planting selections from the Bosco Verticale were made floor-by-floor to account for changes in humidity, temperature and wind exposure. A deeper understanding of the environmental conditions from the ground to the top of a building may require floors to be treated as distinct planting zones with different micro-climates. In areas where wind and evapotranspiration is high, designers should consider trees with anatomical leaf characteristics that are well-suited to these conditions. For example, research has shown that alpine plants possess a thicker leaf epidermis when found growing at higher altitudes. Species that capable of adapting to changing environmental conditions at higher elevations should be considered.

Finally, but not of least importance, is the socio-ecological benefit that can be derived from trees in the design. Form and aesthetic quality are, of course, important. Trees that do not readily reproduce from seed or root suckers should be chosen. Flowers and fruits are often desirable for aesthetic as well as ecological reasons, as habitat for birds and pollinators, but careful selection should be made to avoid allergens to residents and minimize risks from falling debris.

Dr. Darby McGrath is the Program Lead for Greening the Canadian Landscape at Vineland Research and Innovation Centre and is the Research Scientist for Nursery and Landscape. Her work integrates nursery production research with ecological restoration principles to address challenges of urban tree survival. Darby.mcgrath@vinelandresearch.com

References:

Bengtsson, L. Grahn, L. and Olsson, J. (2005). Hydrological function of a thin extensive green roof in southern Sweden. Hydrology Research. 36, 351-360.

Buckland-Nicks, M. Heim, A. and Lundholm, J. 2016. Spatial environmental heterogeneity affects plant growth and thermal performance on a green roof. Sci. Tot. Environ. 553, 20-31.

DeGaetano, A.T. 2000. Specification of soil volume and irrigation frequency for urban tree containers. Journal of Arboriculture. 26, 142-151

Dunnett, N. and Kingsbury, N. 2008. Planting Green Roofs and Living Walls. Portland, OR. Timber Press.

Fulthorpe et al. (2018) The green roof microbiome: improving plant survival for ecosystem service delivery. Frontiers of Ecological Evolution. 2.

Gilman, E.F. 1992. Effect of root pruning prior to transplanting on establishment of southern magnolia in the landscape. Journal of Arboriculture.18, 197-200.

Gilman, E.F. 2008. Pruning affects tree movement in hurricane force wind. Arboriculture & Urban Forestry, 24, 20-28.

Gilman, E.F. et al. 2002. Root pruning but not irrigation in the nursery affects live oak root balls and digging survival. Journal of Environmental Horticulture. 20, 122-126.

Hawke, R. 2015. An evaluation study of plants for use on green roofs. Plant Evaluation Notes. Chicago Botanic Gardens. 38, 1-22.

Urban, J. 2008. Up by Roots: Healthy Soils and Trees in the Built Environment. Champaign, IL. International Society of Arboriculture.

A HEALTHY PRESCRIPTION: THE BENEFITS OF GREEN ROOFS IN HEALTHCARE FACILITIES

BY JOHN ROBINSON, CSI/CDT, GRP, RRO, REGIONAL SALES SPECIALIST, SIKA CORPORATION-ROOFING

Green roofs can do great things to enhance the patient experience in healthcare facilities. These so called "Healing Gardens" offer bottom line opportunities to improve patient outcomes, and also present unique challenges for the designer, contractor and owner which require careful system design, installation and maintenance.

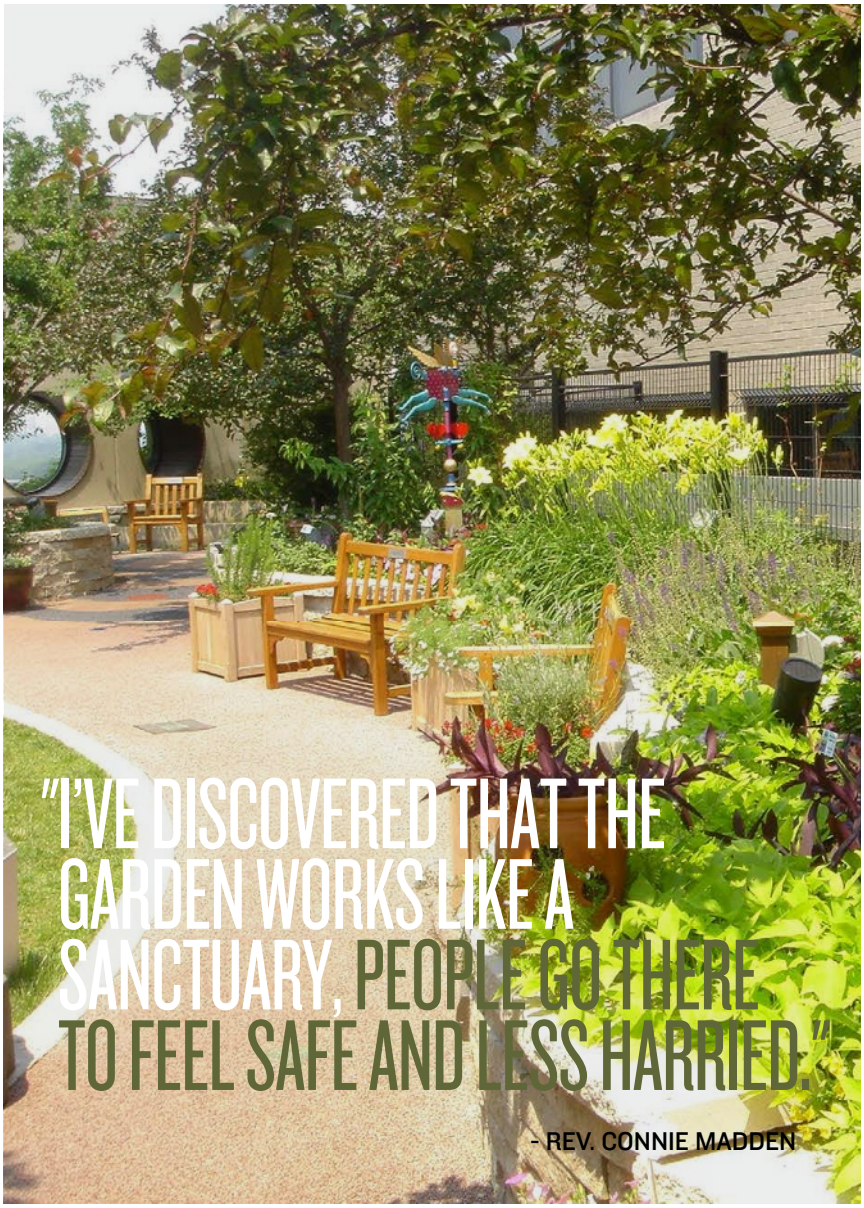
Healthcare facilities represent a large percentage of urban and suburban construction in North America. These facilities are vital to the well-being of the communities they serve. Studies have shown that the environment within these facilities can have a negative or positive impact on patient care. Facilities that incorporate accessible green and open spaces within the campus aid in the recovery of the patients as well as improving the working environment for the healthcare providers and visitors. Rooftop "Healing Gardens" have proven to be a major benefit in improving the patient experience and can directly save hospitals money by helping to reduce staff turnover.

Healthcare facilities offer some unique challenges associated with the construction of outdoor green amenity spaces over occupied or parking deck areas. Many of these facilities are located in urban areas and have been expanded several times over, since initial construction. Land is often at a premium and it is expensive to design open green space on grade. The need for improved storm water management and urban heat island mitigation are also important factors to consider. Roofing and building enclosure maintenance are also a concern.

It is essential that an experienced design and construction team be selected for these sensitive projects. Waterproofing systems with documented long lifecycle performance and low maintenance requirements should be given strong consideration. Hospitals often have access challenges and need systems that do not require excessive maintenance or repair and replacement on a regular basis. Healthcare facilities also have air quality concerns around occupied buildings. Volatile organic compounds (VOC) can find their way into air intake systems and can cause major disruptions to operations. Healing garden projects are often intensive green roofs, requiring deep growing media systems that often include pavers or other pedestrian access systems for the enjoyment of the building occupants. The green roof system selection needs to take into consideration the access and use of the area, plant integrity, human interaction as well as irrigation and other maintenance requirements. Here are two very successful projects, which illustrate some of the unique benefits of installing green roofs on hospitals.

POTENTIAL HOSPITAL GREEN ROOF BENEFITS

- Reduce patient medication
- Reduce length of patient hospital stays
- Reduce mental health patient stress
- Facilitate horticultural therapy
- Reduce staff turnover saving human resource costs
- Provide amenity space for patients, staff and visitors
- Serve as rooftop function space for fundraising events
- Improve visitor experiences



Photos courtesy of J. Robinson

SAINT LOUIS CHILDRENS HOSPITAL OLSON FAMILY GARDENS, ST. LOUIS, MO.

The Olson Family Garden on the eighth floor of the hospital is an award winning example of a healing garden. Patients, families and visitors step out of the end of a hallway into an urban green oasis of intensive roof garden containing over 7,000 varieties of plants ranging from sedums to large flowering trees. The 8,000 sq. ft. project, completed in the year 2000, was designed by EDAW of Fort Collins, Co, in conjunction with lead architect Mackey Mitchell Assoc. of St. Louis. The garden also has many other features including walking trails and a variety of places to sit and enjoy this wonderful environment. In addition to this, other features include waterfalls, swings, stepping stones, fountains, flowerbeds and a goldfish pond. There are also views of nearby Forest Park. The garden was designed to be interactive friendly, with areas for crafts, puppet shows and performances by storytellers. For patients who cannot go outside, the garden can be viewed through windows in the Child Life Services Center. The garden is also lit at night and has special decorations during the holiday season.

Hospital officials describe the green roof as a wonderful source of healing and comfort and a space where patients and families feel safe. According to hospital chaplain Rev. Connie Madden, the garden represents a place for families and staff to "re-center." "I've discovered that the garden works like a sanctuary," she explains. "People go there to feel safe and less harried." The structure below the garden is protected by a high performance thermoplastic waterproofing system ensuring many years of reliable service. This project is a prime example of the power of nature to aid in the healing process.

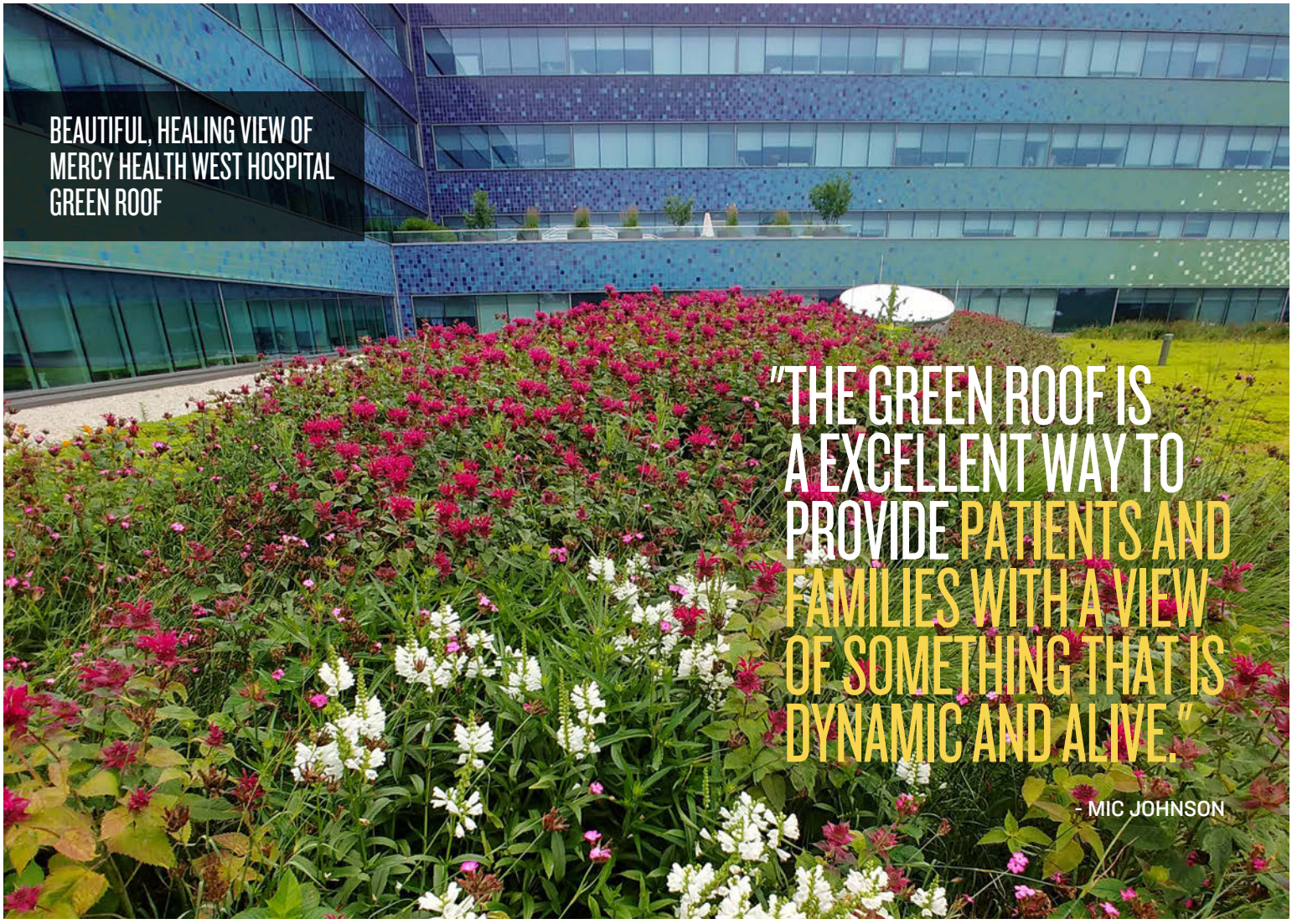
MERCY HEALTH-WEST HOSPITAL, CINCINNATI, OH

The expansive vegetative roof on the Mercy-West Hospital is another great example of implementing a green roof to support horticultural therapy. The 111,000 square foot system was designed by landscape architect Meisner Associates of Cincinnati in conjunction with lead architect AECOM of Minneapolis. The system features over 65,000 plants of various Ohio native species. The green roof is mostly semi intensive with 30 inch deep berms placed throughout to replicate the rolling prairies of Ohio. The roof also features a therapy terrace for inpatient rehabilitation where patients practice walking on different substrates as well as some stairs to improve their balance. There is a large meditation garden, visible from the chapel. Completed in 2013, the system is installed over the lower levels of the hospital so that the rooms in the patient tower overlook the green roof. The structure below the green roof is protected by a high performance thermoplastic waterproofing system that will ensure many years of reliable service.

The main benefits of the green roof system have been well documented. It has been described as an enhancement to the healing environment. Rooms overlooking the roof are in high demand and patients have many positive comments regarding the roof. Lead Architect on Mercy Health West, Mic Johnson of AECOM states: "The green roof is a excellent way to provide patients and families with a view of something that is dynamic and alive."

In addition to its healing properties, the roof is designed to capture approximately 75 per cent of the rain water that falls on it, reducing the storm water runoff by approximately two million gallons per year. The system will provide the hospital with many benefits for patients and staff for decades to come.

John S, Robinson, CDT, GRP, RRO is a Regional Sales Specialist for Sika Sarnafil Roofing Systems and a board member at large for GRHC. Robinson.john@us.sika.com or visit www.usa.sarnafil.sika.com

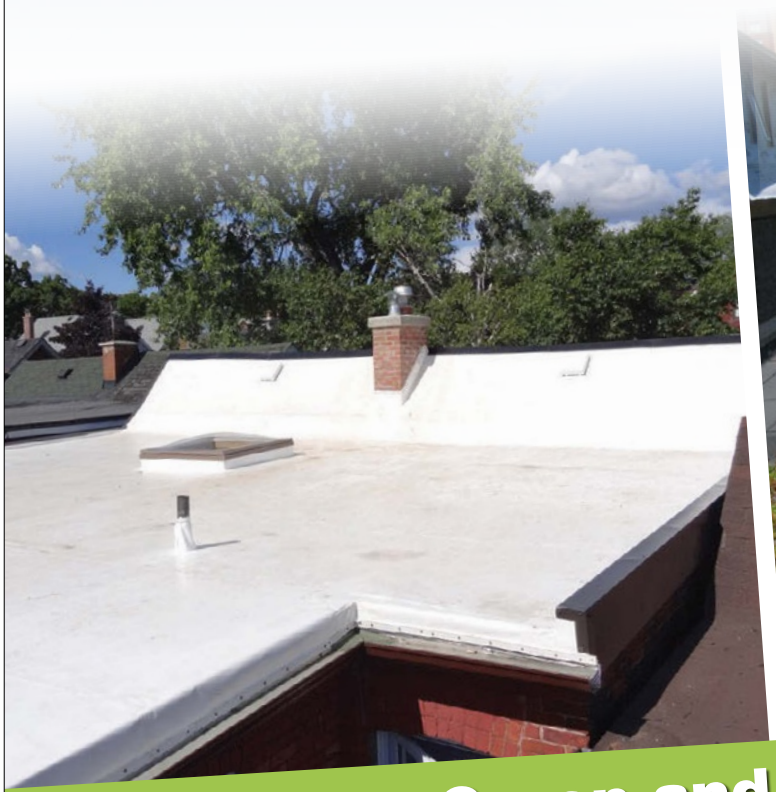


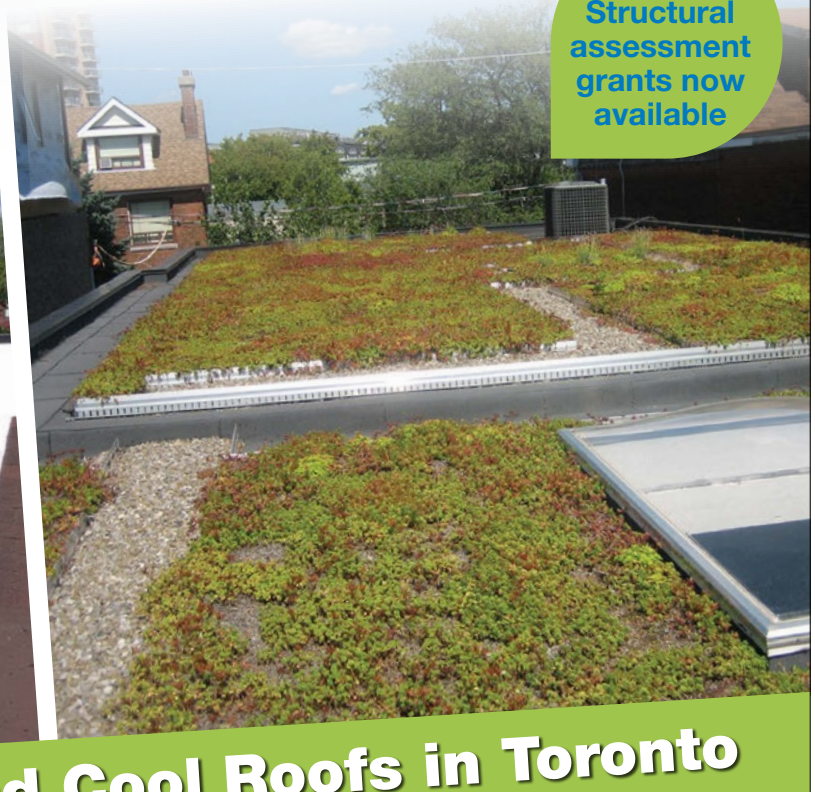
eco roof INCENTIVE PROGRAM

Get a grant for your eco-roof!

$100/m² for green roofs
$2-5/m² for cool roofs

New!
Structural assessment grants now available





Grants for Green and Cool Roofs in Toronto

Residential • Industrial • Commercial • Institutional

Why green your roof?

- Save energy
- Reduce urban heat
- Capture stormwater
- Improve air quality
- Create habitat

Apply Today!

More than 250 eco-roofs have been funded to date.

Applications must be approved before the roof is installed.

Learn more and apply online at
livegreentoronto.ca

TORONTO

Call 311

Live green Toronto

THE HARVARD BUSINESS SCHOOL'S MCARTHUR MCCOLLUM BUILDING GREEN ROOF IS ONE OF THE PROJECTS GOING THROUGH LIVING ARCHITECTURE PERFORMANCE TOOL CERTIFICATION

Photo Courtesy of Recover/Green Roofs / Omni Ecosystems

LIVING ARCHITECTURE PERFORMANCE TOOL PILOT PHASE TAKES OFF

BY ROHAN LILAUWALA, GRP, PROGRAM MANAGER, GREEN INFRASTRUCTURE FOUNDATION

The work the Green Infrastructure Foundation (GIF) has been undertaking for almost six years has entered a new phase, with the launch of the Living Architecture Performance Tool (LAPT) pilot phase. The LAPT is an innovative new performance rating system for green roofs and walls, similar to what LEED is for green buildings: it takes a very complex system of technologies, environments, and performance levels, and makes it understandable.

The LAPT is a 110-credit system that covers the wide range of potential performance benefits. The goal of this project is to improve the performance of living architecture systems by helping meet minimum standards, and act as a guide for future policy making, project design, installation, and maintenance.

Designers can use the LAPT to maximize potential benefits, identify synergies, and demonstrate leadership; building owners can certify their projects for greater assurance of performance; policy makers can use the LAPT to inform regulatory programs and policies; and product manufacturers could use the LAPT to improve and market innovative and multi-functional products. The LAPT has the potential to revolutionize the industry by raising the bar for performance and helping public and private investments in living architecture achieve their intended goals.

GIF is inviting designers of living architecture projects to submit a project for the LAPT pilot phase. We are looking for a range of projects (new and existing) in different climate regions. This is an opportunity for leaders to help refine this important tool while demonstrating leadership and joining other innovators.

Rohan Lilauwala, GRP, is the Program Manager for the Green Infrastructure Foundation. He is leading the development of the Pilot Phase of the Living Architecture Performance Tool.

For more information or to download a free copy of the LAPT framework, visit greeninfrastructurefoundation.org/lapt or email rlilauwala@greenroofs.org.

FIRST PROJECT LEADERS AND SITES FOR LAPT CERTIFICATION

HARVARD BUSINESS SCHOOL, Boston, MA –
Recover Green Roofs / Omni Ecosystems

CALGARY MUNICIPAL HALL, Calgary, AB –
Green T Design

CARROLL ROOFTOP FARM, Chicago, IL –
Omni Ecosystems

VAN NESS MEDICAL OFFICE BUILDING, San Francisco, CA –
PMB / Boulder Associates

HOLY BLOSSOM TEMPLE LIVING WALL, Toronto, ON –
Diamond Schmitt Architects / Nedlaw Living Walls

ADLAI E. STEVENSON HIGH SCHOOL, Lincolnshire, IL –
Wight and Company

KANSAS STATE UNIVERSITY MEMORIAL STADIUM,
Manhattan, KS - Jeffrey L. Bruce & Company

CONGRATULATIONS 2018 AWARDS OF EXCELLENCE WINNERS

BY BLAINE STAND, MEMBERSHIP COORDINATOR, GRHC

LEFT TO RIGHT BACK ROW:
STEVEN PECK;
BRANDON RIETHEIMER;
ROGER SCHICKEDANTZ;
BRENDAN SHEA;
RICHARD HAYDEN;
MARTA KEPHART;
JEFFREY BRUCE

LEFT TO RIGHT MIDDLE ROW:
SUE SIRRS;
PAOLA GARCIA;
KEN LARSSON;
LAURA KENNEDY;
KERRY ROSS;
JENNIFER BOUSSELOT;
SYBIL WA

LEFT TO RIGHT FRONT ROW:
NATALIIA GERZHOVA;
SARAH HANDLON;
MOLLY MEYER;
GREG WARREN

Photo Courtesy Joyce McLean

Every year, Green Roofs for Healthy Cities organizes the Green Roof and Wall Awards of Excellence for excellence in design, research, and policy to be presented at the annual CitiesAlive conference. In the Fall issue, we profiled 2018's outstanding design projects, which featured factories of the future, living walls that can survive bitter maritime winters, and spaces that utilize living systems to enhance community spaces. This issue, we present the individual awards, celebrating achievements in research, advertising, policy achievements, and corporate excellence.

CATEGORY
Advertising Award

AWARD WINNER
American Hydrotech

American Hydrotech is a recognized leader in the development, production and distribution of premium waterproofing and roofing products. Hydrotech's wide range of Garden Roof Assemblies are available to suit virtually any design requirement. They are long-time supporters of Green Roofs for Healthy Cities through their participation on the board of directors, research support; and the Living Architecture Monitor magazine providing case studies, interviews, and expertise.

CATEGORY
Research Poster Award

AWARD WINNER
Nataliia Gerzhova – Fire Behavior of Green Roof Substrate

HONORABLE MENTION
Sarah Handlon – Factors Influencing Temporal & Seasonal Variation of Nutrients in Runoff from an Extensive Green Roof

At *CitiesAlive* there is a poster session on the trade show floor in which students who research green infrastructure topics can present their work to conference attendees. The winner this year is Fire Behavior of Green Roof Substrate from Nataliia Gerzhova out of Laval University, examining fire propagation through the substrate layer of a green roof. This year's Honorable Mention award goes to Factors Influencing Temporal & Seasonal Variation of Nutrients in Runoff from an Extensive Green Roof from Sarah Handlon, University of Cincinnati, for looking at variation in nutrient runoff during from green roof installations during a variety of rainfall events.

CATEGORY
JLIV Award

AWARD WINNER
Jennifer Bousselot; Amy Schneider; and Mark Fusco – Observations on the Survival of 112 Plant Taxa on a Green Roof in a Semi-Arid Climate

This award honors the groundbreaking green infrastructure research that is being published in the peer reviewed Journal of Living Architecture (JLIV). The winner is Observations on the Survival of 112 Plant Taxa on a Green Roof in a Semi-Arid Climate by Jennifer Bousselot, Colorado State University; Amy Schneider, Denver Botanic Gardens; and Mark Fusco, Bison Innovative Products. This paper explores plant survival and health on green roof applications in Denver. In this study, 112 plant taxa were trialed, observed, and described on a low water green roof in the dry climate of the Colorado Front Range.

CATEGORY
Civic Award

AWARD WINNER
Brandon Rietheimer, Denver Green Roof Initiative

It's beyond rare that an individual single-handedly leads a major city's significant policy shift, let alone in an environment with institutional opposition. Brandon Rietheimer has done just that in the City of Denver, advancing a pioneering green roof requirement through to a successful ballot initiative. Stemming from a desire to affect meaningful change in his community and hold his elected officials accountable, Brandon and the Denver Green Roof Initiative went toe to toe with a well-established opposition and emerged victorious, thrusting the city of Denver into a role of sustainability leadership.

CATEGORY
Chairs Award

AWARD WINNER
Paola Garcia

Paola first joined Green Roofs for Healthy Cities in 2015 as a conference volunteer. Since then she has gone on to become an important volunteer member of Green Roofs for Healthy Cities' organizing team. Since 2015 she has traveled to Toronto, Washington DC, and Seattle, each time bringing an unparalleled level of drive, passion, focus, and leadership to everything she does. Paola is an activist, leader, educator, student, and accredited Green Roof Professional. It is difficult to fully express how much dedication she has shown, and continues to show GRHC, and to the industry. We look forward to continue working with her for years to come.

FOUR NEW REGIONAL CENTERS OF LIVING ARCHITECTURE EXCELLENCE ANNOUNCED AT *CITIESALIVE* TO ADVANCE INDUSTRY

BY JOYCE MCLEAN AND DR. BILL RETZLAFF

Research and education play a critical role in the development and advancement of the green roof and wall industry throughout North America. Faculty and students have developed the performance knowledge and understanding in support of the validation of standards, the establishment of public policy, and product performance. Academic institutions also provide the human resources required for future innovation and advancement of the growing living architecture industry.

Photos courtesy of B Retzlaff

Academic institutions are able to leverage multiple streams of resources to conduct research and they possess space to hold events and engage student interest to power innovation. Green Roofs for Healthy Cities, and its charitable arm, the Green Infrastructure Foundation have developed products and services that are designed to provide professional training in support of the Green Roof Professional (GRP) designation. They engage policy makers, academics, manufacturers and designers in innovative programs such as the Green Infrastructure Charrette, and the Living Architecture Performance Tool. To build on these efforts and those of leading academic institutions, Steven Peck spearheaded the development of a program with the support of many colleagues in industry and academia to establish collaborative, multi-disciplinary Living Architecture Regional Centers of Excellence. The Centers will build upon much of the work in living architecture already underway at these universities and set the stage for new developments in collaborative research and innovation, while helping students prepare to enter this growing industry.

A call for proposals was held in the summer 2018, and the following Centers of Living Architecture were announced at CitiesAlive in New York this September. The Centers will be multidisciplinary in their nature. The leading academic partners and the lead academics for each Center are as follows:

ILLINOIS
Southern Illinois University Edwardsville, Dr. Bill Retzlaff, Associate Dean, CAS, Distinguished Research Professor, Biological Sciences

NEW JERSEY
Stevens Institute of Technology, Dr, Elizabeth Fassman-Beck, Associate Professor, Department of Civil, Environmental and Ocean Engineering

COLORADO
Colorado State University, Dr. Jennifer Bousselot, Special Assistant Professor, Department of Horticultural and Landscape Architecture;
University of Colorado Denver, Leila Tolderlund, Assistant Professor
College of Architecture and Planning.

GREATER OHIO
Kent State University, Dr. Reid Coffman, Associate Professor, College of Architecture and Environmental Design;
University of Cincinnati, Professor Virginia Russell, Director, Horticulture/Landscape Architecture/ Professor Landscape Architecture and Dr. Ishi Buffam, Department of Biological Sciences;
Heidelberg University, Mark E. Mitchell, Biological and Environmental Sciences.

THE OBJECTIVES OF THESE CENTERS

To support the development of living architecture research, professional training and policy development at a regional scale

To aid academic/industry/policy interaction in ways that can better address regional environmental, market place, regulatory, and climatological realities

To provide venues to hold GRP training courses, continued GRP education, and general membership drives

To engage more students to support the employment needs of the growing industry through membership and training

To provide continuing education GRPs and support industry professionals to meet and advance policies within their region

To strengthen dissemination via the Journal of Living Architecture (JLIV) by supporting the research work completed at the centers

To facilitate academic meetings and seminars

To provide support to faculty for funding student research, directly with seed funding, and through industry partnerships

A PROFILE OF ONE OF THE NEW LIVING ARCHITECTURE REGIONAL CENTERS OF EXCELLENCE, SOUTHERN ILLINOIS UNIVERSITY EDWARDSVILLE

The Green Roof Environmental Evaluation Network (G.R.E.E.N.) was established at Southern Illinois University Edwardsville (SIUe) in 2004. The goal is to evaluate the performance of green roof and wall technology and to make the results available to users for development/establishment of green systems in the urban/suburban environment while training future experts in environmental systems research and innovation. Since inception, G.R.E.E.N. has been co-directed by Dr. Bill Retzlaff (Distinguished Research Professor of Biological Sciences and Associate Dean of the College of Arts and Sciences) and Dr. Susan Morgan (Professor of Civil Engineering and Associate Dean for Research and Graduate Studies in the Graduate School). Drs. Retzlaff and Morgan along with Dr. Serdar Celik (Associate Professor in the Department of Mechanical Engineering) coordinate the efforts of other faculty, student researchers, and collaborators as they evaluate green roof and wall and other green infrastructure performance in labs and at six campus field sites.

We estimate that more than 150 students at SIUe have worked on green infrastructure projects through G.R.E.E.N., including undergraduate and graduate students from the Departments of Biological Sciences, Civil Engineering, Mechanical Engineering, and Environmental Sciences. In addition, research findings from G.R.E.E.N. have been incorporated into direct and indirect teaching at SIUe.

All research studies are fully replicated scientific experiments that incorporate repeated evaluations in replicated study plots over extended time periods. Examples of their work include:

- The evaluation and identification of many suitable plant species and growing media for green roof systems have been identified. This work continues to expand the list of possible plants and growth media blends, including those with recyclable materials.

- Quantity of storm water runoff from green roof systems planted with either sedums or native plants from the Midwest region have been evaluated over multiple seasons. Published data from the students' research projects demonstrate that sedum green roofs in the Midwest can retain up to 80 per cent of the precipitation that falls during the growing season and on average retain 45-50 per cent annually depending upon precipitation amount and green roof construction and design.
- Storm water runoff quality from green roof systems has been assessed. Published data from student research projects has demonstrated that green roof systems are not sources of nitrogen or heavy metals if properly designed.
- Traditional maintenance plans for green roof systems have been evaluated and published. In addition, we are working on developing new maintenance practices using mechanical weeding and robotics.
- Thermal evaluations of green roof systems (whole on-roof systems, in the research lab with individual green roof components, as well as theoretical/empirical simulations) have demonstrated that green roofs can increase the thermal performance and, further, that plant species and growth media choices contribute to thermal differences. We are currently examining whether green roof maintenance influences the thermal performance of green roof systems.
- Wind tunnel work funded by the National Roofing Contractors Association at SIUe that evaluated wind-uplift of green roof systems has been used with other research data to develop an ANSI standard (RP-14) for wind-uplift of green roof systems in the international building code.

Current and future research projects include evaluating living architecture systems in areas such as volume and quality of storm water runoff; plant performance (including native plants, roof-top vegetable production and food access in urban deserts); maintenance issues (including the use of robotics); biodiversity; thermal characteristics; weight loads; wind uplift; and new green roof technologies.

The research philosophy, built upon many collaborative experiences, is to engage students, colleagues, and public and private entities to address environmental problems of local, regional, national and international scales. The opportunity that designation as a Living Architecture Regional Center of Excellence provides to increase our collaboration and our impact is exciting.

For more information on the work of the center at SIUe please contact Dr. Bill Retzlaff, wretzla@siue.edu.

THE BUSINESS CASE FOR BIOMIMICRY: PRESCIENT LEADERSHIP & INNOVATION

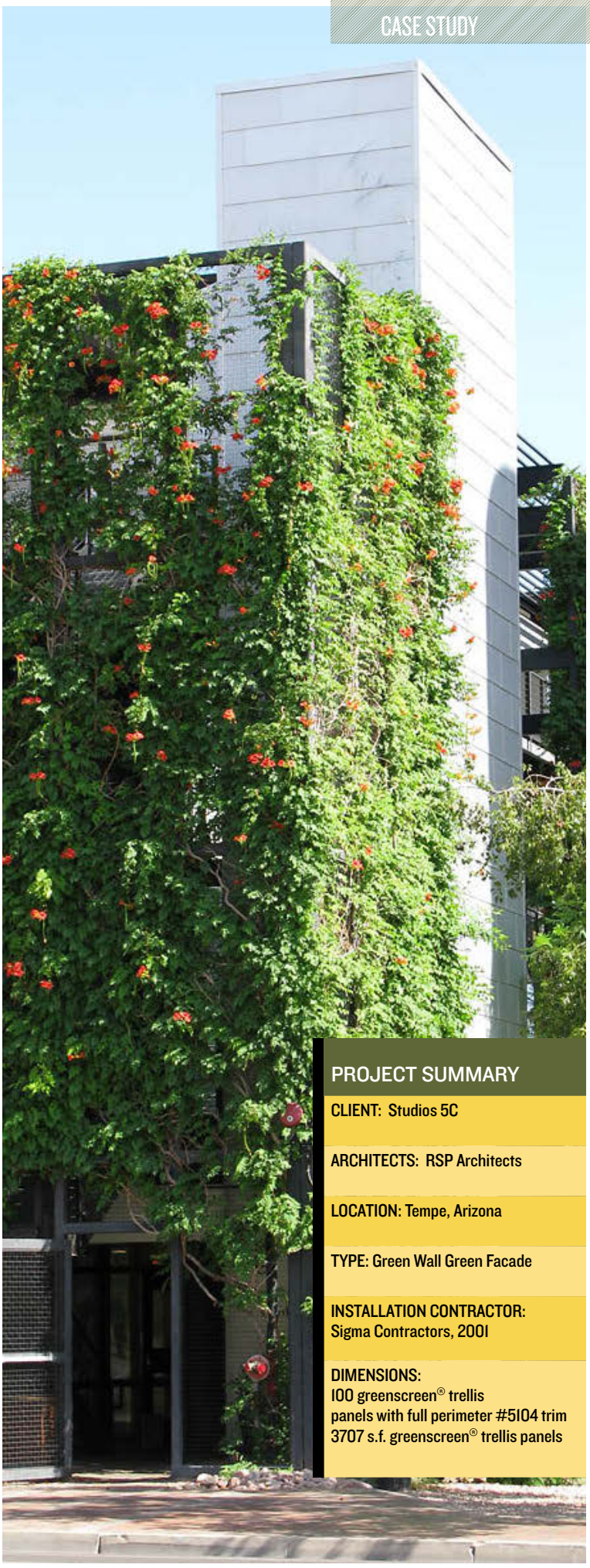
BY REUBEN FREED, greenscreen

Designed in 2000, Studios 5c is an urban mixed-use, 3-story glass office building in the Mill Avenue District of Downtown Tempe, Arizona. The building includes a ground floor brew pub with a sidewalk patio, offices for a major architectural firm, and a series of executive suites which cater to design professionals.

DESIGN OBJECTIVES

The environmental challenges of a desert environment motivated creativity, innovation and a sustainable approach by the designers, RSP Architects. Primary design goals were to minimize heat loads in air-conditioned spaces and provide a biophilic element to the design. The solution chosen was to shade and cool horizontal and vertical circulation paths between suites and floors, located outside the perimeter of the glazed building envelope, by passive and sustainable means.

In a simple demonstration of vines used for passive climate control, the 'structured landscape' design approach of Studios 5c includes greenscreen® trellis panels on the south and west sides to intentionally shade and cool circulation areas and glazed walls. The panels provide a supportive host for native red trumpet vines, evergreen in the local climate, and an iconic application of biophilic principles as an example of sustainable design in an urban, desert climate.



PROJECT SUMMARY

CLIENT: Studios 5C

ARCHITECTS: RSP Architects

LOCATION: Tempe, Arizona

TYPE: Green Wall Green Facade

INSTALLATION CONTRACTOR: Sigma Contractors, 2001

DIMENSIONS:
100 greenscreen® trellis panels with full perimeter #5104 trim
3707 s.f. greenscreen® trellis panels

IMPLEMENTATION / PERFORMANCE

At the core of this strategy is the partnership between the vines growing from ground-level beds, and their host structure of greenscreen® trellis panels in a three-storey high structural steel framework. The steel frames on two sides of the stairwell and at the edge of the floor slabs form a structured, vertical landscape. Between the 'ribs', regular openings accommodate 4 foot x 12 foot trellis panels and define the perimeter of the building. At the base of the panels, 14 inch narrow soil beds were prepared and trumpet vines with drip irrigation lines were installed. As the vines matured, reaching the tops of the frames at 40 feet in a few seasons, they formed a flourishing, semi-opaque tapestry of foliage punctuated by orange and red blooms.

The exterior staircase, with its entry on East 5th Street, is cloaked with foliage on two sides and its volume is shaded, resulting in a column of air appreciably cooler than ambient outside temperatures. The effects of passive solar shading and evaporative cooling by the leaf canopy combine to create a microclimate that mitigates heat gain and delivers useful, shaded circulation space, while providing the biophilic benefits of a visual connection to nature.

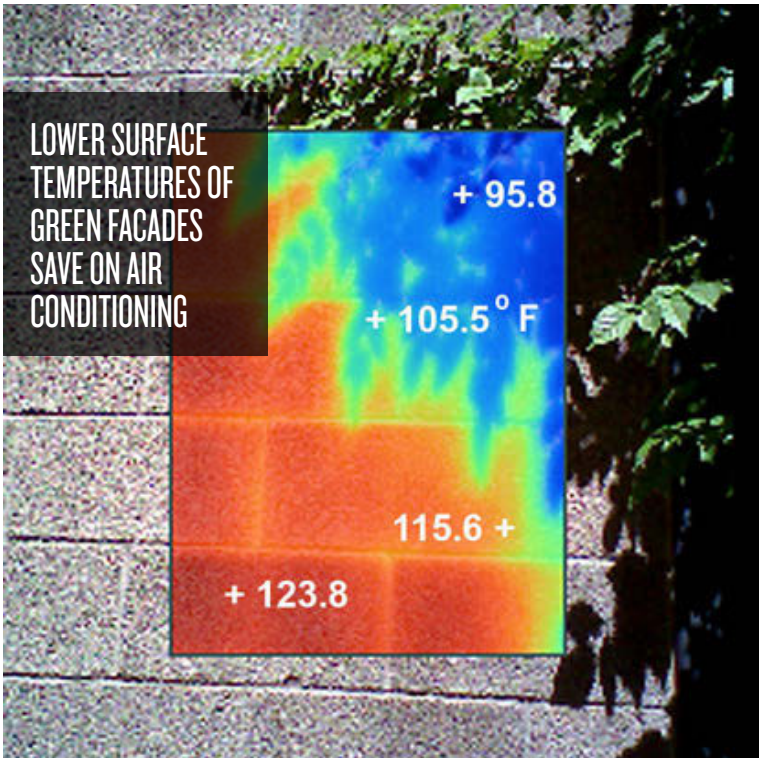
WATER / ENERGY BUDGET

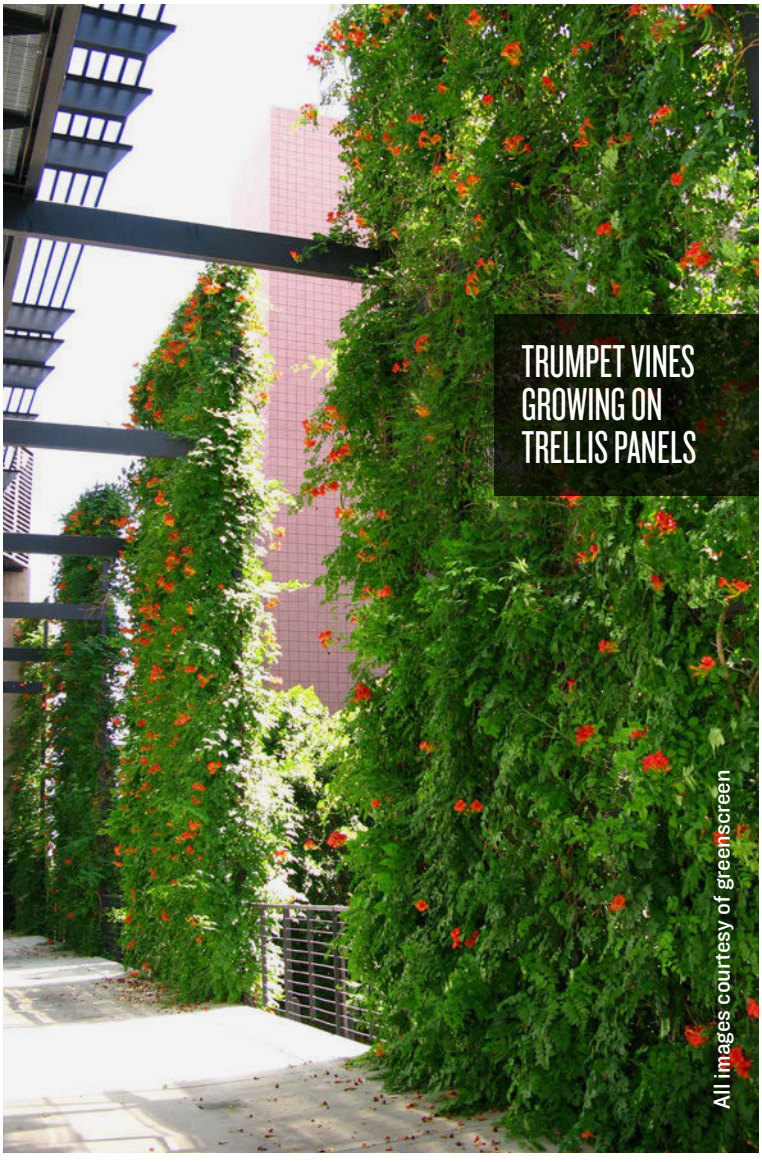
As designed, the strategy is very successful in keeping a comfortable temperature range between the green façade and the glazed skin of the core building. Infrared photography studies reveal how temperatures of masonry surfaces collect and radiate heat, while shaded areas and plant leaves are considerably cooler (See image). Leaf surface temperatures are at or near the ambient air temperature during evapotranspiration and, at the hottest time of the year, are three to five 5 degrees C cooler. At air intake grilles, strategic placement of trellised vines cool the ambient intake air, thereby reducing the cooling load on the air conditioning system. The owner of Studios 5c estimates that the costs / energy savings due to the cooling effect of the green façade amount to 10 to 20 per cent less than those of a comparable, conventionally glazed office building without a green façade or passive architectural shading system in the urban desert climate.

As of September 2018, the rich tapestry of leaves and flowers on the green façade continues to perform the ecosystem functions. Maintenance in the form of pruning takes place about twice a year. Vine beds have a mulch layer of crushed granite and irrigation is by means of dripline, frequency as required.

Since the completion of Studios 5c in 2001, the application of green facade walls to help control heat gain has been expanded to other urban projects in Arizona including the Phoenix Light Rail system and the Tempe Transit Center, with emphasis on appropriate vines for each unique application and the harsh climate.

Reuben Freed is the Resource Coordinator for greenscreen. For more information please visit greenscreen.com or reuben@greenscreen.com





HOW TO HELP ENSURE YOUR ROOF GARDEN IS SUSTAINABLE OVER ITS LIFE CYCLE

ALEX DRESCHER, ROOF GARDEN MANAGER, CARLISLE CONSTRUCTION MATERIALS

If you have any experience with green roof systems—especially if it's your responsibility to specify those systems—you know they are complicated. Green roof systems are complicated not only because of the plethora of components they contain; they are also complicated because of their incredible ability to protect and extend the life of a rooftop, saving you money. Why is this complicated?

Because it means that before you specify a green roof system, it is essential that you make sure the underlying roofing system is up to the challenge. Is it going to outlast—or at least match the lifecycle of—the green roof? If not, you may be digging up that green roof before you know it.

So how can you make sure that your roofing system will perform, and your green roof will remain intact for its lifecycle and deliver cost savings? Fortunately, there are a few simple, practical ways you can ensure that the lifecycle of a roofing system doesn't compromise the long-term performance, energy-efficiency, and environmental benefits of its green roof components.

A green roof can last between 20 and 40 years if not longer, when properly installed and maintained, which is why it is important to consider a number of design enhancements when specifying a roofing system that will feature a roof garden. We recommend the specification of the following design enhancements, all of which are included in a typical 20-year warranted roof system. If you're specifying a roof garden, you need your roofing membrane to last at least 20 years if the roof garden is to remain intact with its performance uncompromised.

THICKER ROOFING MEMBRANE

Using a thicker EPDM, TPO or PVC membrane on your roof system can significantly enhance the durability, weatherability, and puncture-resistance of the rooftop for a minimal cost increase that is more than made up for in lifecycle performance. Choosing a 75-, 80-, 90- or 145-mil membrane, for example, can increase the lifecycle of your roofing system by as much as 33 per cent and will cost as little as four per cent more than a thinner, less durable membrane. Using a thicker membrane can also increase seam strength by up to 25 per cent and enhance the wind-uplift performance of the rooftop, further enhancing its durability and stability.

COVERBOARD INSULATION

In addition, the use of a coverboard insulation, at a minimum half inch thickness can increase the compressive strength and thermal efficiency of your roofing system. Adequate compressive strength is essential to protect the building and roofing system from damage during or after installation of the green roof, ensuring they can stand under the pressure of the green roof components and occupants. Adding insulation will also enhance the energy efficiency of the building while lowering its operating costs, both significant benefits to the building owner.

FLASHING ACCESSORIES

We also recommend using pressure-sensitive flashing accessories, to ensure the long-term waterproof performance of the roofing membrane and its components. A 90-mil-thick flashing can provide this added protection, especially when double-wrapped around all flashing details. Any material or labor cost this additional detailing might incur, is more than outweighed by the benefit of knowing the roofing system is virtually impenetrable and able to confront the forces of nature.

WIDER SPLICES

The membrane seams on a rooftop present one of the greatest potentials for failure of the roofing system. If a seam is compromised; if membranes are not spliced together properly with splice tape, the entire roofing system is set up for leakage and ultimate failure. Using a six-inch-wide splice tape, instead of the typical, industry-standard three-inch splice tape, drastically reduces the potential for leakage and significantly increases not only the water-tightness of the system but the peel and shear strength of the membrane as well.

All of these design considerations are vital when specifying a green roof system, not only because they will enable you to

"A GREEN ROOF CAN LAST BETWEEN 20 AND 40 YEARS IF NOT LONGER, WHEN PROPERLY INSTALLED AND MAINTAINED."

- ALEX DRESCHER

ensure that the roofing system will last beyond its warranty, but also because they provide additional protection to the roofing system during and after installation of the green roof. The installation of green roof systems places additional burden on waterproofing membranes and other system components. You want to avoid the potential for damage to occur during or after installation, which could require the removal and reinstallation of the green roof system.

If you want to specify green roof systems that will provide the long-term aesthetic, energy-efficient, environmentally conscious benefits building owners are looking for, take the time to design a roofing system that will not only protect and sustain those benefits but will also protect the building underneath for decades to come. Choosing the right design enhancements for your green roof system is the key to specifying green roof systems that last, providing life cycle economic benefits, and that effectively reduce our buildings' carbon footprint—and isn't that one of the main reasons for having a roof garden in the first place?

Alex Drescher is the Roof Garden Product Manager for Carlisle Construction Materials, located in Carlisle, Pennsylvania. Passionate and technically oriented, Alex has assisted with the development of numerous green roof projects and contributed to improving Carlisle's various stormwater management technologies since beginning to work with green roofs in 2015. alex.drescher@carlisleccm.com or visit carlislesyntec.com

Permaloc GeoEdge aluminum edging restraints are the universal standard on which architects, contractors, and greenroof system manufacturers depend for greenroofs.

Get more familiar with GeoEdge by visiting **permaloc.com** or calling **800.356.9660**.

permaloc®
SUSTAINABLE EDGING SOLUTIONS

GRHC BUYERS GUIDE

AMERICAN HYDROTECH INC
303 E. Ohio St. #270, Chicago, IL 60611, hydrotechusa.com

CARLISLE SYNTEC
1285 Ritner Highway, Carlisle, PA 17013, carlislesyntec.com

CITY OF TORONTO ECO-ROOF INCENTIVE PROGRAM
55 John St., 2nd Floor, Toronto, ON M5V 3C6
toronto.ca/livegreen/ecoroofs

DOWNES TREE SERVICE
65 Royal Ave., Hawthorne, NJ 07506, downestreeservice.com

ETERA
14113 River Bend, Mount Vernon, WA 98273, etera.com

HUNTER INDUSTRIES
1940 Diamond St., San Marcos, CA 92078
hunterindustries.com

JAKOB
955 NW 17th Ave, Unit B, Delray Beach, FL 33445
jakob-usa.com

JELITTO PERENNIAL SEEDS
125 Chenoweth Ln. #301, Louisville, KY 40207, jelitto.com

LIVEROOF LLC
PO Box 533, Spring Lake, MI 49456, liveroof.com

PERMALOC
13505 Barry Street, Holland, Michigan 49424, permaloc.com

RECOVER GREEN ROOFS, LLC
9 Olive Square, Somerville, MA 02143, recovergreenroofs.com

ROOFLITE
P.O Box 159, Landenberg, PA, rooflitesoil.com

SIKA SARNAFIL
100 Dan Rd., Canton, MA 02021, sustainabilitythatpays.com

STORMWATER CAPTURE COMPANY
Ste 23A, 1330 Ave of the Americas, New York, NY 10019, USA
stormwatercaptureco.com

SUPPORT THE ADVERTISERS THAT BRING YOU THE LAM

For more information on any of the advertisers listed above, please visit goo.gl/pDzbvL.

The 2019 Media Guide is now available! Help us celebrate our 20th Anniversary of Publishing!

To obtain a copy of the Media Guide please go to:

https://static1.squarespace.com/static/588221e420099e47b8fe06d8/t/5bbf92d353450a249e122df3/1539281623106/2019_media_guide.pdf
or call 416 971 4494 ext. 233.

NEW MEMBERS

GREAT GROWIN'S | GREATGROWINS.COM
Great GrowIN's is committed to building a better quality of life for all humans by offering a variety of grow systems, garden expertise and green services that allow all of us to enjoy healthier, more vibrant indoor & outdoor environments.

VALERIAN LLC | VALERIANLLC.COM
Valerian is a landscape architecture and irrigation design firm established in 1990. Since its creation, Valerian has developed a strong reputation as a leader in the industry for sustainable, creative and thoughtful design for both public and private sector clients.

UPCOMING TRAINING

ONLINE TRAINING 24/7 AT THE LIVINGARCHITECTUREACADEMY.COM
Special Offer: Earn your Green Roof Professional designation and become and Individual Member for only US$999 – Only Until January 1, 2019

- New Zero Water for Buildings & Sites, Jeffrey L. Bruce, JLB & Associates
- Biophilic Design Lecture, Bill Browning, Terrapin Green
- Advanced Green Roof Maintenance, Christian Mahlsteadt,
- Valuing the Benefits of Green Infrastructure (Through Green Infrastructure Foundation)
- GRP Online Exam

Visit greenroofs.org/education for more information and to register

GREY TO GREEN CONFERENCE SERIES

In 2019, *CitiesAlive* will be replaced by three regional Grey to Green conference events! The first Grey to Green Conference: Adapting to Climate Change will be in Toronto on April 4-5, 2019. Grey to Green conferences are planned for Minneapolis in October and Washington DC / Baltimore in November. See www.greytogreenconference.org for sponsor, exhibitor, registration information. Contact Chrystal Henning for more information. chenning@greenroofs.org

UPCOMING LOCAL MARKET DEVELOPMENT SYMPOSIA/SEMINARS

HOUSTON, TX
December 10th, 2018

CLEVELAND, OH
(Ohio Center of Living Architecture Excellence) | Tues, May 21st, 2019
@ Cleveland Urban Design Collaborative

THE IMPORTANCE OF GROWING THE INDUSTRY TOGETHER

BY MATTHEW BARMORE, GRP, MBA, VICE PRESIDENT, GREENRISE TECHNOLOGIES, CHAIR, GRHC

It's my honor to serve Green Roofs for Healthy Cities as the new Chair as we work together for success across the industry in multiple, vital channels by:

- Raising the visibility of the value and benefits of green roofs and walls to building owners and developers
- Promoting and encouraging green roof and green wall research in the academy
- Supporting and recognizing innovation in green roof and wall design, technology, and products
- Working for new and better public policy that supports living architecture
- Developing support for and acceptance of green roof and wall measurement tools and evaluative standards like the Living Architecture Performance Tool
- Broadening the "industry umbrella" so that all who work in living architecture feel at home in GRHC

In this Business Case Issue of Living Architecture Monitor, you'll find a number of important, well-constructed arguments for the value of green roofs and walls. These are vital arguments to make, and to learn about! Without the sale of living architecture products and services, none of us could be engaged in this industry. Growth in any part of our industry means growth for the entire network of green roof and wall products and services (including the academy – more job opportunities means more students enrolling in educational programs). I am sure that where I work is much like where you work: we strive both for success today, and for long-term growth; we want to grow in what we do, every month, every year, in every way, without an expiration date in sight.

Helping the industry as a whole to grow is simply good business practice, because it broadens the scope of opportunity for each of us. This is why we believe so strongly in consistent engagement with GRHC, and why I am unabashed in asking you to join in an active role in GRHC through your membership, participation, advertising and sponsorship. Look through this issue, and head back to the greenroofs.org website, to find those places where you can plug in to the many ways you can be part of growing our industry!

I believe that together we are, helping to build a greener, more breathable, less polluted, more beautiful, less stressful and healthier world. Maybe it's corny to say it, but the work we do holds deep significance. I look forward with excitement and joy to the hard work we have ahead of us, and ask you to join in fully as grow our industry together!

Kind Regards,

Matt Barmore,
GRP, MBA, Vice President, Greenrise Technologies
Chair, Board of Directors, Green Roofs for Healthy Cities


YOU CALL ME RAIN.
HYDROTECH CALLS ME OPPORTUNITY.
ORDINARY ROOFS WASTE ME.
HYDROTECH ROOFS LEVERAGE MY POTENTIAL.
THE GARDEN ROOF® ASSEMBLY.
INTRODUCED OVER 20 YEARS AGO, PROVIDING:
stormwater management solutions: reduce - retain - delay
extended roof longevity
additional usable space
full assembly warranty
Learn more today at hydrotechusa.com/power-of-rain
HYDROTECH
HELPING YOU HARNESS THE POWER OF RAIN™

Rooted in **Experience**

CARLISLE
SYNTEC SYSTEMS

» Carlisle's industry-leading, single source warranties protect the Roof Garden components as well as the underlying roofing systems.

» Carlisle offers a diverse line of traditional and modular systems, as well as a wide variety of vegetation options to fit project requirements and design aesthetics.

» The MiraDRAIN® G4 Drainage Composite all-in-one product increases the installation rate and contractor confidence while decreasing the risks associated with a multiple step application.

Scan here to learn more about Roof Gardens

Experience the Carlisle Difference | 800-479-6832 | www.carlislesyntec.com

GRHC MEMBERSHIP APPLICATION

For a full list of all membership categories and benefits, or to apply online, please visit www.greenroofs.org/membership.

Date: Name: Company:

Address: City:

State/Province: Postal/Zip Code: Country:

Telephone: Fax: Email:

MEMBERSHIP APPLICATION FOR (PLEASE CHECK ONE):

○ Supporter $55 US ○ Individual $160 US ○ Individual Affiliate $100 US ○ Corporate (see below)

○ Individual GRP $160 US ○ GRP Renewal $207.50 US

IF YOU WISH TO BECOME A CORPORATE MEMBER, PLEASE CHOOSE THE MOST APPROPRIATE CATEGORY (IN US DOLLARS):

○ Charitable/Not-for-Profit ($550) ○ Government & Institutional ($550) ○ Professionals ($550) ○ Nurseries ($750)

○ Green Walls ($1,250) ○ Distributors & Suppliers ($3,800) ○ Manufacturers ($5,200) ○ Corporate Leaders($12,700)

PLEASE CHOOSE THE TITLE THAT BEST DESCRIBES YOU OR YOUR ORGANIZATION:

○ Architect	○ Association Professional	○ Biologist	○ Botanist	○ General Contractor
○ Developer	○ Educator	○ Government	○ Energy Consultant	○ Engineer
○ Environmental Consultant	○ Facilities Manager	○ Horticulturalist	○ Consumer	○ Landscape Architect
○ Landscape Designer/Consultant	○ Roofing Consultant	○ Manufacturer or Supplier	○ Media	○ Not-for-profit
○ Policymaker	○ Planner	○ Researcher	○ Student	○ Sustainability Manager
○ Water Specialist	○ Irrigation Designer	○ Other		

CHOOSE A PAYMENT METHOD

○ MasterCard ○ Visa

Name on Credit Card:

Credit Card #:

Expiry Date (month/year) & 3 Digit Security Code:

Signature:

GREEN ROOFS
FOR HEALTHY CITIES
www.greenroofs.org

○ I prefer to pay by enclosed (forthcoming) cheque payable to:

Green Roofs for Healthy Cities
406 King Street East, Toronto, Ontario M5A 1L4
Canada

Fax: 416-971-9844 Attention: Blaine Stand

FLASH OF GENIUS

THERE ISN'T A WAY TO KNOW EVERYTHING ABOUT CRE ... OR IS THERE?

"THIS SHOW WILL REALLY **MAKE YOU THINK!"**

"AN ABSOLUTE MUST **FOR EVERY CRE PRO."**

"BRILLIANT ACTION. IF YOU GO TO ONLY ONE EVENT THIS YEAR, **MAKE IT THIS ONE."**

"CE CREDITS TOO **—INCREDIBLE!"**

STARRING
MELANIE BELLINGER
PROPERTY MANAGER
COPAKEN BROOKS

BOMA 2019

INTERNATIONAL CONFERENCE & EXPO
Presented by BOMA International and *BUILDINGS*

JUNE 22-25 | SALT LAKE CITY, UT

In an industry where no two days are the same. Where tenants are your top priority—but so is your building ... and your career. It's about improving your bottom line. It's about understanding the technology that will take your building from good to great. It's about leading your team to the top. And it's all up to you to make it happen. Now's the time to fine-tune your expertise and burst into action. There are no limits to what you'll learn—and all the new possibilities you'll unleash.

Register Today.

BOMACONFERENCE.ORG