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VOLUME 15 / ISSUE 1 / SPRING 2013

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VOLUME 15
ISSUE 1
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ON THE COVER: Duke green roof design
Image provided by: Duke University Health System

INSIDE

LIVING ARCHITECTURE MONITOR™

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LIVING ARCHITECTURE MONITOR IS PUBLISHED FOUR TIMES PER YEAR BY GREEN ROOFS FOR HEALTHY CITIES (WWW.GREENROOFS.ORG)

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HUMAN HEALTH, RESILIENCY AND LIVING ARCHITECTURE

In 2011, the United States experienced a record of 14 extreme weather related disasters, each causing in excess of $1 billion in damages and many more on a smaller scale. Recently, Hurricane Sandy pummelled New Jersey and New York so hard that the economic impact will likely top $60 billion. In this issue, we examine several aspects of the relationship between resiliency in the face of disaster, human health and living architecture. On page 12, several of our colleagues share with us short stories of how their green roof and wall projects fared under the punishing winds and rains of Hurricane Sandy.

Disasters like Sandy and Katrina in 2005 have an enormous impact on our grey infrastructure, on ecosystems and on the human health, livelihood and well-being of those affected. Scientists are now in full agreement that climate change intensifies extreme weather events. Many scientists and engineers have been stressing the need to adapt to climate change by focusing on reducing exposure and vulnerability, and increasing our resiliency to the negative impacts of climate extremes like hurricanes, droughts and flooding. A 2012 report, "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policy Makers," prepared by the United Nations Intergovernmental Panel on Climate Change, states that under current modeling scenarios, a 1-in-20-year hottest day event is likely to become a 1-in-2-year hottest event for most regions in North America by the end of the 21st century. Moreover, the 1-in-20-year extreme maximum daily temperatures will likely increase from 2 to 5 degrees C across much of North America by the late 21st century (10). More energy contributes to more intense rainfall and shorter duration. The report states "on a range of emissions scenarios…a 1-in-20-year annual maximum daily precipitation amount is likely to become a 1-in-5 to 1-in-15 year event by the end of the 21st century in many regions." At a regional level, these impacts may be ever more pronounced, according to a study by the City of Toronto. See chart from the City report on climate change projections by 2040.

Expected Changes .... Some Examples

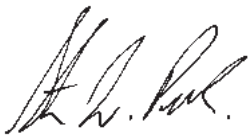
WEATHER EXTREMES	PARAMETER	UNITS	2000-2009	2040-2049
Extreme Rainfall	Maximum Amount in One Day	mm	66	166
	Number of Days with More Than 25mm	days	19	9
	Mean Annual Daily Maximum	mm	48	86
Extreme Heat	Maximum Daily (in °C)	°C	33	44
	Number of Days with Temperature greater than 30 °C	days	20	66
	Number of Heat Waves (3 or more Consecutive Days with Temperatures greater than 32°C)	3-day events	0.57	2.53

Living architectural systems have the capacity to contribute multiple solutions to many (not all) of the problems posed by climate extremes. For example, the cooling effects of green roofs and walls are well documented in their ability to help reduce the urban heat island effect, which reduces energy consumption and air pollution. The ability of green roofs to delay, slow, capture and retain stormwater is well established. Moreover, both of these technologies can be designed to produce food, and help to purify water, which during a time of crisis, could come in very handy.

The direct healing benefits of living architecture are also well documented, and described in our On the Roof With… interview (pg. 4) with visionary leader Gail Vittori, co-director of the Center for Maximum Potential Building Systems, who developed the *Green Guide for Health Care* in 2001. The Clients' Speak (pg. 14) is a new piece that explores living architecture benefits from the perspective of hospital administrators. Hospitals, it turns out, may in fact be the ideal places to utilize living architecture to establish 'islands of resiliency' in the face of community disaster—places where citizens can go to find clean water, food and power, even as flood waters rise, fires burn or buildings topple!

We have only begun to turn our thoughts to adapting to the emerging extreme climate challenges we are certain to face this century. At *CitiesAlive* in San Francisco this October, we will share what we know about living architecture and community resiliency. We are far from fully understanding the hidden potential of how living architecture systems can help our communities cope when various disasters strike.

Sincerely,



Steven W. Peck
Founder & President, GRHC

FIND OUT MORE

Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policy Makers
http://ipcc-wg2.gov/SREX/images/uploads/SREX-SPM-brochure_FINAL.pdf

BOOKSHELF

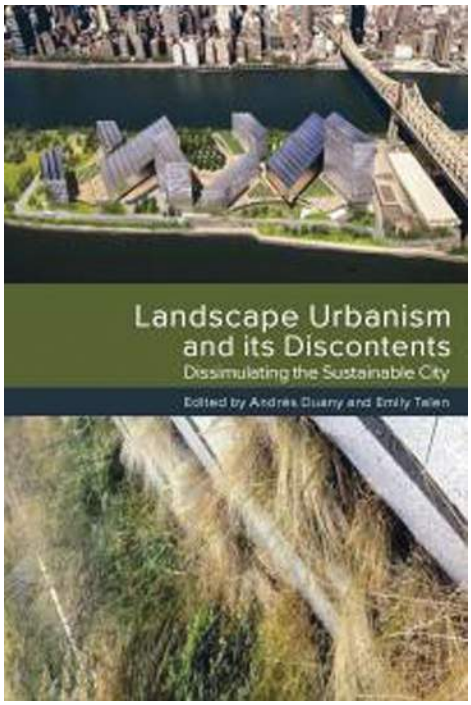
LANDSCAPE URBANISM AND ITS DISCONTENTS: DISSIMULATING THE SUSTAINABLE CITY

BY ANDRÉS DUANY AND EMILY TALEN

In contemporary Western society, urban development is regarded as an unfortunate blight from which nature provides a much-needed respite. This apparent dichotomy ignores the interdependence between human settlement and the natural world. In fact, one of the most pressing problems facing urban theorists today is determining how to resolve the tension between the built and natural environments, in the process creating truly sustainable cities.

Landscape Urbanism and its Discontents is a collection of essays exploring the debate over urban reform, often polarized around the two competing paradigms of Landscape Urbanism and New Urbanism. Landscape Urbanism is conceived as a more ecologically-based approach, while New Urbanism is more concerned with built form. Well-known and influential urban theorists such as Andrés Duany and James Howard Kunstler delve into the impact of the tension between the two perspectives on:

- Smart growth
- Neighborhood design
- Sustainable development
- Creating cities that are in balance with nature.



While there is significant overlap between Landscape Urbanism and New Urbanism, the former has assumed prominence amongst most critical theorists, whereas the latter's proponents are more practically oriented. Given that these two sets of ideas are at the forefront of sustainable urban design, the analysis—and potential reconciliation—offered by *Landscape Urbanism and its Discontents* is long overdue.

FIND OUT MORE:

http://www.newsociety.com/Books/L/Landscape-Urbanism-and-its-Discontents

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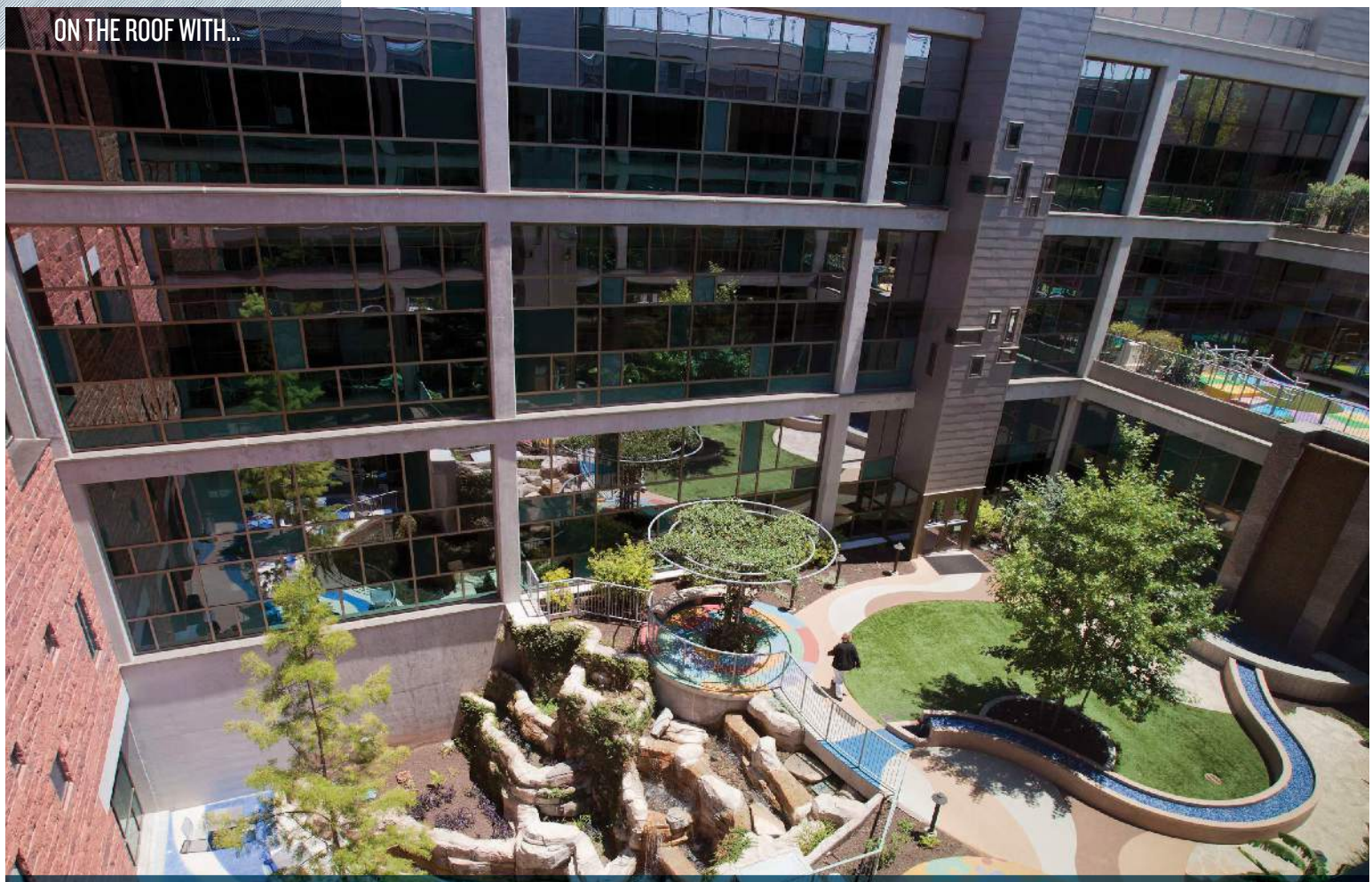

ON THE ROOF WITH ... GAIL VITTORI

UNDERSTANDING THE BENEFITS (AND CHALLENGES) OF GREEN HEALTHCARE INFRASTRUCTURE WITH GAIL VITTORI

The theme of this issue of the *Living Architecture Monitor* is "community health." As we explore how green infrastructure contributes to the overall health and well-being of the community, who better to interview than Gail Vittori—a green building pioneer, who has worked on health issues for more than three decades?

Vittori is the co-director of the Center for Maximum Potential Building Systems, a non-profit research and design firm in Austin, Texas dedicated to sustainable planning and design. In 2001, she developed the *Green Guide for Health Care* (GGHC), a best practices guide used by healthcare facilities (available at www.gghc.org). The GGHC was convened by the Center for Maximum Potential Building Systems and overseen by Vittori, three other coordinators, a diverse steering committee, staff and volunteers. The GGHC grew to more than 38,000 website registrants and 328 projects; significantly influencing the development of the USGBC's *LEED for Healthcare*, and the design, construction and operations of healthcare facilities in North America and around the world.

Vittori also served on the board of the US Green Building Council for eight years—and was the chair in 2009. Furthermore, she was featured as an Innovator: Building a Greener World in *TIME Magazine*. Vittori, more than anyone, understands the benefits of "greening" our hospitals and the importance of "design[ing] buildings to be resilient." I spoke with Vittori to find out more about her work and the public health benefits (and challenges) of green healthcare infrastructure.

INTERVIEWED BY: JENNIFER FODEN WILSON

ABOVE: Gail Vittori, co-director of the Center for Maximum Potential Building Systems
Image provided by: Ave Bona

OPPOSITE: Dell Children's Medical Center of Central Texas, the first LEED Platinum-certified hospital in the world. Vittori oversaw the sustainable design and LEED certification process.
Image provided by: Marc Swendner, Seton Healthcare Family

YOU'VE BEEN A GREEN BUILDING ADVOCATE FOR MORE THAN THREE DECADES. WHAT IS YOUR PROUDEST ACCOMPLISHMENT/PROJECT?

Establishing the conceptual framework for what became the Austin Green Building program in 1989; based on the flows of energy, water, materials and waste, that set into motion a new way of understanding the built environment and opportunities to view it as a dynamic player within an ecological metabolism.

And then, in a related but different way, convening the *Green Guide for Health Care* in 2001 and collaborating with a brilliant team to revolutionize a way of thinking about the design, construction and operation of the healthcare's built environment as being a fundamental contributor to defining health, wellness and productivity at the building, regional and global scales.

One of the key lessons from the *Green Guide* experience was to establish 'health' as an explicit consequence of every prerequisite and credit, whether in the site, water, energy, material or environmental quality category—and in doing so, begin to elevate the awareness that all of these provide opportunities to enhance health outcomes. This surprised some who approached 'health' as being addressed in a single 'health' credit—so the awareness-building, education and connecting the dots to establish the fundamental understanding that the spectrum of actions relating to the built environment can define the conditions for health. In addition, as designers and other practitioners involved in the built environment, we are in a unique role to always insert the lens of whether a decision is aligned with the principle to create conditions conducive to health. It's surprising how this helps to accelerate clarity in decision-making. Because if the answer is no, that's a troubling burden for a project to absorb.

Another key lesson was to let ourselves imagine what was possible; so rather than be constrained by existing rules, protocols and standards, we created 'free space' to engage in working outside of established boundaries. We knew that much of the content within the *Green Guide* was out of the range of what was achievable at the time we were developing it, but the team knew if we put out some big ideas, it would send the market signals that needed to be communicated—such as chemical avoidance in materials and products, or places of respite for patients and staff and local and organic food procurement. Remarkably, our hunch resonated with a global audience, and before long, more than 20,000 people had signed on to the *Green Guide* website, 25% from outside the United States, and the *Green Guide* became a foundational reference document to the development of *LEED for Healthcare*, released in 2011.

> "AS VISIBLE EXPRESSIONS OF GREEN DESIGN, GREEN ROOFS AND LIVING WALLS CONNECT PEOPLE WITH NATURE. AND, AS WE HAVE LEARNED FROM THE FIELD OF BIOPHILIA, THEY FULFILL OUR INTRINSIC NEED TO RELATE TO NATURAL SYSTEMS."

WE OFTEN DISCUSS THE ENVIRONMENTAL BENEFITS OF GREEN BUILDINGS. CAN YOU TALK A BIT ABOUT THE PUBLIC HEALTH BENEFITS OF GREEN INFRASTRUCTURE?

I like to contrast the terms 'dead' infrastructure with

'living' infrastructure—living or green infrastructure enlivens and enriches ecosystems; it provides visible cues of whether it's working well or not; it adds vibrancy to urban environments, filtering water and air pollutants, producing oxygen, providing visually stimulating landscapes, enhancing habitat and biodiversity—and doing so with biological methods that are, generally, low embodied energy and free of chemicals of concern.

YOU REVOLUTIONIZED THE HEALTH CARE INDUSTRY WHEN YOU ASSEMBLED THE *GREEN GUIDE FOR HEALTHCARE*. HOW HAS THE SUSTAINABLE DESIGN, CONSTRUCTION AND OPERATION OF HEALTHCARE FACILITIES IMPACTED THE WELL-BEING OF THE PATIENTS INSIDE?

There is a growing body of evidence that correlates patient outcomes with healthcare facilities—as one example, providing views of nature can reduce patient length of stay and medication needs; similarly, providing windows in nurses' break rooms has been found to reduce medical error. Creating places of respite for patients, staff and visitors has become a hallmark of green healthcare facilities, introduced in the *Green Guide for Health Care* and now represented in two credits in *LEED for Healthcare*.

In addition, avoiding chemicals of concern in medical devices and building products, such as a shift away from PVC in IV bags, medical tubing and flooring; employing green housekeeping; and integrated pest management practices create healthier environments. And an emerging trend of on-site food production and procuring local, organic food provides better nutrition for patients while also creating healthier ecosystems. Healthcare's measure of success should be promoting health and wellness rather than treating disease. The end game is health for all!

WHAT ARE SOME OF THE COMMON CHALLENGES THAT HEALTHCARE FACILITIES ADOPTING SUSTAINABLE PRACTICES/POLICIES FACE? HOW DO THEY OVERCOME THOSE CHALLENGES?

One hurdle is the misconception that green healthcare facilities cost more to build and operate; another is that the practices are unproven, or that they conflict with infection control considerations. In the case of cost, a study from 2009 assessed first cost premiums associated with some of the first LEED-certified healthcare facilities and found that capital cost premiums ranged from 0% to 5%; 3.5% including incentives. Project teams that included these design features and products as part of 'basis of design' attributed no additional first cost, an encouraging signal of a transformation in healthcare design that is beginning to establish green building as standard practice.

The second area concerns uncertainty with product performance and green strategies. For example, we find that the use of appropriately treated reclaimed water—from collected rainwater to greywater—is being used in hospitals and other healthcare facilities internationally, but rarely in the United States due to infection control concerns. Sharing these best practices and providing real world experience is increasingly important to lead to a reset of fundamental material, product and resource dependencies that will be imperative in this century. So we need to do an excellent job in providing data that establishes the case for adopting the new 'pattern language' for healthcare design and operations, and the evolved supply chain that it relies on.

HOW DO GREEN ROOFS AND GREEN WALLS IN PARTICULAR CONTRIBUTE TO HUMAN HEALTH—IN HOSPITALS AND BEYOND?

As visible expressions of green design, green roofs and living walls connect people with nature. And, as we have learned from the field of biophilia, they fulfill our intrinsic need to relate to natural systems. In a performance sense, living walls can filter air resulting in measurably improved air quality, and green roofs provide visual relief from stark and barren

"WE NEED TO DESIGN BUILDINGS TO BE RESILIENT, TO WEATHER THE STORM, AND PARTICULARLY HEALTHCARE BUILDINGS WHICH SHOULD BE SANCTUARIES AT THE TIME OF GREATEST NEED."

roof tops, while also providing habitat, stormwater runoff mitigation, sound attenuation, and improved thermal performance, among other attributes.

WHAT INNOVATIVE LIVING ARCHITECTURE PROJECTS WOULD YOU LIKE TO SEE ON HEALTHCARE FACILITIES IN THE NEXT TEN YEARS?

In many parts of the United States and internationally, healthcare is the largest employer so it has the potential to influence an enormous number of people's awareness about the built environment. That's important. So in a sense it creates an opportunity for hospitals and other healthcare facilities to steward the intersection of the built and natural environments, and to be a positive force within that metabolism.

It's also essential that we recognize resilience as an underlying theme of living buildings—and it is the nature-inspired part of 'living' that provides this compelling pedagogy. Again, as with 'creating conditions conducive for health', we need to design buildings to be resilient, to weather the storm, and particularly healthcare buildings which should be sanctuaries at the time of greatest need. So, from a systems view, the entire building should function like a living system: be able to breathe as one simple rule, with the ability to spring back and continue to function in the wake of disasters, whether they be hurricane, tornado, flood, drought, extreme temperature, pandemic or even terrorist attack. The civic nature of healthcare creates the context for this design imperative; the good news is that we are beginning to see a portfolio of hospitals, clinics and other healthcare facilities inspired by this vision. If it exists, it is possible. Imagine what is possible so that it will exist.

Jennifer Foden Wilson is the editor of the Living Architecture Monitor *magazine.*

FIND OUT MORE

www.cmpbs.org

Demystifying First-Cost Green Building Premiums in Healthcare, www.ncbi.nlm.nih.gov/pubmed/21165840)

FOLLOW THE GREEN BUILDING CODE

HOW LIVING ARCHITECTURE FITS INTO CALIFORNIA'S NEW GREEN CODE

BY: JEREMY SIGMON AND WES SULLENS

Welcome to sunny, cutting-edge and care-free California. The state is home to four Major League Baseball teams, some of the nation's most stunning mountains and coastline, a rich culture of art and innovation and also one of the world's most visited vegetated roofs at San Francisco's California Academy of Sciences. California exceptionalism is certainly in the water, in the air, and in its rich, even if often arid, soil. This uniqueness extends into the very fabric of law and society in California. Even the building code is exceptional.

Title 24 of the California Code of Regulations has made a name for itself as a greatest-hits list of expectations and requirements for building design, construction and alteration. Title 24 is best known for its much-admired Part 6, the California Energy Code. Under the hood, Part 6 relies on an annual, maximum energy budget for any structure built in a given California climate zone—unsurprisingly, the state identifies sixteen climate zones where the U.S. Department of Energy only finds five. And look at the results: per capita energy consumption in California buildings has flat-lined for the last thirty years, while the rest of the nation has doubled.

With these and other similar outcomes in hand, California has proven to the world that beyond 'health and safety', building regulations can achieve impressive results at scale. So with the largest and most advanced green building marketplace in the Western Hemisphere, it comes as no surprise that California is the first to pioneer in the next direction—to develop, adopt and implement a green building code.

The California Green Building Standards Code, better known as CALGreen, now occupies Part 11 of Title 24. Following in the footsteps of green building rating systems like LEED and a popular local program, GreenPoint Rated, CALGreen codifies a series of green building ideas for new commercial and residential construction. The code leverages the consistency of statewide building regulations and the existing code enforcement process to ensure that minimum and reasonably common green building measures are required in almost any permitted building across the state. Mandatory statewide implementation of the code began on January 1, 2011.

The mandatory measures for non-residential buildings, including additions and alterations, span fewer than twenty pages, and half that for residential. These are the most basic of the green building measures that the code drafters deemed fit for minimum requirements. These include a handful of measures across four sections: 'Planning and Design' (e.g. managing construction site run-off); 'Water Efficiency and Conservation' (e.g. plumbing fixture efficiencies and irrigation controls); 'Material Conservation and Resource Efficiency' (e.g. construction waste management and O&M manuals); and 'Environmental Quality' (e.g. pollutant control during construction and low-emitting materials). The 'Energy Efficiency' chapter adds no additional minimum requirements beyond the California Energy Code in Part 6.

Importantly, commissioning of building systems is required for new construction of non-residential buildings in Section 5.410.2. Another advancement is the code's applicability to additions and alterations greater than 2,000 sq. ft. or $500k in non-residential construction. And the 2013 version of the code, expected to take effect January 1, 2014, will engage even smaller projects.

To be sure, this is great news for tomorrow's buildings, their occupants, and California's overall environmental health and safety. So what about green roofs and walls?

While there are certain measures in the code that comfortably endorse living

OPPOSITE: California Academy of Sciences green roof
Image provided by: Rana Creek

building surfaces under the umbrellas of stormwater management, alternative water harvesting and heat island reduction, you won't find them in the main body of the text. The majority of code's content is in its voluntary appendices, organized for adoption by more ambitious local jurisdictions in the form of two additional 'tiers.'

In the appendix of non-residential voluntary measures, project teams seeking to comply with CALGreen in a community that has adopted a tier can find three notable places (and arguably others) where living architecture may fit in. Green roofs are referenced as a potential compliance pathway for 'low-impact development' in A5.106.3 and should contribute to stormwater management in A5.106.2. Vegetated roof area will be exempted from cool roof requirements in Section A5.106.11.2 of the 2013 code. The 2013 version will fall short of requiring any structural, drainage or space planning for future vegetation; however it will introduce a similar requirement for future photovoltaics. Also, exterior wall shading through trees or other vegetation (like in A5.106.7 and in A5.204.6) may satisfy the intent of the appendix measure for optimizing building orientation in A5.106.9.

As a multidisciplinary chapter amongst an otherwise full set of building standards, CALGreen may cede certain 'green' or efficiency measures to other parts of Title 24. Upcoming changes to the California Plumbing Code (Title 24 Part 5), for example, lessen the design costs and compliance burden for certain greywater and rainwater systems throughout California.

Significantly, the code raises the floor for all buildings, making beyond-code programs like LEED more achievable than ever. This complementary alignment opens the door for all projects across the state to consider the benefits of additional green building measures that either the code describes in its appendices or that LEED and other programs reward through third-party verified credits.

We're enthusiastic about a bright green building future for the always exceptional Golden State and for those that follow in its footsteps. The ability for Title 24 (CALGreen or otherwise) to require practices and methods that advance the many additional benefits of living architecture—from roof durability, thermal insulation, evaporative cooling, habitat restoration and beyond—may only be limited by two things: practical application as code and knowledgeable professionals that engage in the process. So what are you waiting for?

Jeremy Sigmon is the director of technical policy for the US Green Building Council.

Wes Sullens is the program manager for StopWaste.Org of Alameda County.

FIND OUT MORE

Non-residential CALGreen standards:
www.bsc.ca.gov

Policy tools and analysis:
www.stopwaste.org/calgreen

USGBC tools and analysis:
www.usgbc-ncc.org

INDUSTRY RESEARCH COLLECTION

WHAT GREEN ROOF AND WALL RESEARCH HAS BEEN PUBLISHED IN THE LAST QUARTER?

NOVEMBER 2012

Chiquet, C., Dover, J.W., & Mitchel, P. (2012). Birds and the urban environment: The value of green walls. *Urban Ecosystems*. http://link.springer.com/article/10.1007%2Fs11252-012-0277-9

This paper presents preliminary findings of the value of green walls for urban birds.

DECEMBER 2012

Clark, M.J., & Zheng, Y. (2012). Evaluating fertilizer influence on overwintering survival and growth of sedum species in fall-installed green roof. *HortScience*, *47* (12), 1175-1781. http://hortsci.ashspublications.org/content/47/12/1775.full

The objectives of this study were to identify both the effect of P and K fertilizer rates on *Sedum spp*. survival over the first winter and the response of *Sedum spp.* growth to fertilizer rates when applied at installation.

D'Orazio, M., Di Perna, C., & Di Giuseppe, E. (2012). Green roof yearly performance: a case study of highly insulated building under temperate climate. *Energy and Buildings*, *55*, 439-451. http://dx.doi.org/10.1016/j.enbuild.2012.09.009

Optical properties of the roofs covering materials were experimentally measured, and the thermal transmittance of the roofs was experimentally evaluated.

Dvorak, B.D., & Volder, A. (2012). Plant establishment on unirrigated green roof modules in a subtropical climate. *AoB Plants*. http://aobpla.oxfordjournals.org/content/early/2012/12/20/aobpla.pls049.abstract

The study summarized the results from a study of plant establishment on modular green roof in south-central Texas.

Farrell, C., Mitchell, R.E., Szota, C., Rayner, J.P., & Williams, N.S.G. (2012). Green roofs for hot and dry climates: Interacting effects of water use, succulence and substrate. *Ecological Engineering*, *49*, 270-276. http://dx.doi.org/10.1016/j.ecoleng.2012.08.036

The study evaluated the effects of severe drought (113 days without water) on growth, water use and survival of five succulent species *(Sedum pachyphyllum*, *S. clavatum*, *S. spurium*, *Disphyma crassifolium* and *Carpobrotus modestus)* planted in three different green roof substrates (growing media) differing in water holding capacity.

Fassman, E.A., & Simmcock, R. (2012). Moisture measurements as performance criteria for extensive living roof substrates. *Journal of Environmental Engineering*, *15*(6), 841-851. http://dx.doi.org/10.1061/%28ASCE%29EE.1943-7870.0000532

Extensive living roof substrate design to promote storm-water management while balancing structural load and maintaining nonirrigated plant cover is investigated through linked laboratory and field experiments in Auckland, New Zealand.

Speak, A.F., Rothwell, J.J., Lindley, S.J., & Smith, C.L.(2012). Urban particulate pollution reduction by four species of green roof vegetation in a UK city. *Atmospheric Environment*, *61*, 283-293. http://dx.doi.org/10.1016/j.atmosenv.2012.07.043

The study aims to quantify the effectiveness of four green roof species – creeping bentgrass *(Agrostis stolonifera)*, red fescue *(Festuca rubra)*, ribwort plantain *(Plantago lanceolata)* and sedum *(Sedum album)* – at capturing particulate matter smaller than 10 µm (PM10).

Sutton, R., Harrington, J., Skabelund, L., MacDonagh, P., Coffman, R., & Koch, G. (2012). Prairie-based green roofs: Literature, templates and analogs. *Journal of Green Building*, 7(1), 143-172. http://dx.doi.org/10.3992/jgb.7.1.143

Reviewed the ecological literature on prairie and grassland communities with specific reference to habitat templates from stressed environmental conditions and examined analogs of prairie-based vegetation on twenty-one existing green roofs.

Whittinghill, L.J., & Rowe, D.B. (2012). The role of green roof technology in urban agriculture. *Renewable Agriculture and Food Systems*, *27*(4), 314-322. http://dx.doi.org/10.1017/S174217051100038X

The use of green roof technology in urban agriculture has the potential to alleviate some of these problems, without adversely affecting the benefits provided by urban agriculture

JANUARY 2013

Helder, M., Chen, W.S., Van der Harst, E.J.M., Hamalers, H.V.M., Buisman, C.J.N., & Potting, J. (2013). Electricity production with living plants on a green roof: environmental performance of the plant-microbial fuel cell. *Biofuels, Bioproducts and Biorefining*, 7(1), 52-64. http://onlinelibrary.wiley.com/doi/10.1002/bbb.1373/abstract?deniedAccessCustomisedMessage=&userIsAuthenticated=false

The study assessed the environmental performance of the P-MFC system with an early stage life cycle assessment (LCA).

FIND OUT MORE

For more research articles on living architecture (published before November 2012, December 2012 and January 2013), visit: http://livingarchitecturemonitor.com/index.php/extras-extended-articles/extras-extended-articles

Interested in green roof and living wall research? Green Roofs for Healthy Cities is launching *The Journal of Living Architecture* in 2013. http://livingarchitecturemonitor.com/index.php/extras-extended-articles/journal


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LIVING ARCHITECTURE MEETS HURRICANE SANDY

INDUSTRY LEADERS SHARE HOW THEIR GREEN ROOFS AND WALLS HELD OUT AGAINST SUPERSTORM SANDY

BEN FLANNER, BROOKLYN GRANGE

The Brooklyn Grange's rooftop farms held up well through Hurricane Sandy. Our farm in the Brooklyn Navy Yard sits atop an eleven-story building along the East River coastline, where the winds were among the strongest in the city. To prepare, we spent a day wind-proofing—ensuring that irrigation lines were tacked down, sinks tipped over, tables collapsed, piles weighted and chickens protected. We then obeyed the mandatory evacuation orders from Flood Zone A.

Had the storm come in mid-summer, our farm would have sustained thousands of dollars of crop loss due to the winds. However, being in October, we had a limited amount of crop value in the ground.

The next morning when we arrived, the power outage sent us climbing eleven flights of stairs. We found that bits of soil did erode, however not substantially; and that the green roof infrastructure had held up with fortitude. However, living vegetables were whipped up from the wind. Rainbow chard looked like it had been through the washing machine, and some of our few remaining turnips and radishes were nearly pulled out by the roots. Most plants grew back.

RYAN MILLER, GREEN ROOF TECHNOLOGY

In the spring of 2012, Green Roof Technology introduced the first Sun-Root™ System to North America, installing a 1kW producing system atop the New York City Parks & Recreation's administrative office building on Randall's Island. The system is the first non-penetrating PV mounting system that utilizes an extensive green roof layer as ballast. The green roof provides a cooling element that increases the output of the solar panels, while storm-water runoff from the panels provide irrigation.

Recent Superstorm Sandy made landfall in late October 2012, only six months after installation, and left without moving the system an inch. New York City reported maximum sustained winds at 85 mph with some gusts reaching 92 mph. Upon visiting the site a week after the storm made landfall, we found that our original placements of the Sun-Root™ System withstood the winds without a shift. Often overlooked is the importance of roots that bind together the entire green roof.

JAMES SABLE, GREENSCREEN®

The four story Staten Island Courthouse parking structure was designed by Ennead Architects and the construction oversight was provided by T. Moriarty & Sons, Inc. in 2010. The Courthouse was designed to achieve LEED Gold status and the adjacent parking structure includes green facade systems. Green facade designs that occur in the hurricane zones of the Eastern Seaboard require specific engineering for extreme wind loading that could exceed 160 MPH, depending on exposure. This project also included detailing for ice and snow loads in addition to wind loads. Manufacturers of green facade systems must provide data for engineers showing mounting details that exceed these values, especially for public structures. Strict adherence to construction details, proper placement of system connections, and verification by an onsite inspector were part of

THIS PAGE: Staten Island Courthouse parking structure green facade before & after Sandy (top, before / bottom, after)
Image provided by: greenscreen®

OPPOSITE PAGE: NYC Parks & Recreation's administrative office building green roof before & after Sandy (top, before / bottom, after)
Image provided by: Green Roof Technology

the construction process.

The photo (above) showing the facade after Hurricane Sandy reveals that plants were scrubbed of their foliage and have entered a dormant state that is typical for this season. The frangible nature of vines is part of the engineering computations for how vertical green facade systems are designed. The static 18,850 square foot green facade structure provided by greenscreen® did not suffer any damage during Hurricane Sandy and with prescribed maintenance, plant recovery is expected.

ROBERT LITTLETON, COLUMBIA GREEN

Columbia Green Technologies (CGT) provides both tray and built up green roof technologies, of which many are installed around the Eastern Seaboard. Visual observations were made of CGT green roof installations in the path of Hurricane Sandy. One installation, located in Woodbine, NJ was completed just four days prior to the storm. This project consists of the CGT AVRS tray system with 5.25" of growing media, and a pre-vegetated sedum mat. No visible impacts from the storm were observed despite sustained winds estimated at 60 mph and gusts estimated at 75 mph. A detailed report on these observations will follow.

AMY FALDER, NEW YORK GREEN ROOFS

At the time the storm was expected, our crews were working on a penthouse level project in TriBeCa. The green roof build up involved 120 blocks of light weight geo foam, all of which were sitting exposed on the roof. All of our quart and gallon-sized plants were also sitting loose on the roof. Staff spent time making sure all of our materials were ballasted down and that the plants were protected. It worked. A week after the storm, we were able to get back to the site. Because of our preparedness, our materials were all still sitting where we left them and we were able to pick up where we left off.

Post Sandy, our staff spent weeks arranging access and checking on each of our sites. As we suspected, our projects remained in tact. We think this speaks volumes about preparedness and team efforts in the industry. We learned how to design and build green roofs from industry leaders and, with this in mind, continue to train our staff in the intricacies of careful process. Although the green roof industry in the US is relatively young, successful installations and long term maintenances that weather natural disasters will continue to build our profession and act as a catalyst for change to affect the good of the whole.

FIND OUT MORE

Visit http://livingarchitecturemonitor.com/index.php/extras-extended-articles/extras-extended-articles for more photos.

HOW HEALTHY IS YOUR HOSPITAL?

THE CLIENTS SPEAK!— HOW HAVE GREEN ROOFS IMPACTED YOUR LOCAL HOSPITAL?

BY: JENNIFER FODEN WILSON

There are dozens of scientific studies that illustrate the positive effects of implementing green elements into/on healthcare facilities. Everything from daylight exposure to access to plants, water and trees have impacted recovery rates, medication dependency, reduced staff and more.

Take Joanne M. Westphal's therapeutic garden design for Alzheimer patients in a long term care facility in Holt, Michigan, as an example. Westphal's two-year research study noticed a significant decrease in aggressive and non-aggressive behaviours, reduced requests for non-prescription medication and improvements in weight, heart rate and blood pressure readings for residents spending an average of ten minutes per day in the garden. Those who spent less than five minutes per day in the garden continued to maintain their behaviour or got worse.

So how does research, such as this, translate financially? Westphal's study notes that better patient behaviour not only impacts the nursing staff (they're less likely to burn out, which in turn, decreases the costs associated to hiring), it impacts how patients' loved ones view and treat staff, which impacts occupancy rates—therefore affecting the organization's bottom line.

Terrapin Bright Green released a report in 2012 called "The Economics of Biophilia: Why designing with nature in mind makes financial sense." They claim that over $93 million could be saved annually in healthcare costs as a result of providing patients with views to nature. Using Roger Ulrich's 1984 study, "View through a window may influence recovery from surgery," which concluded that giving recovery patients a room with a view to nature resulted in an 8.5% shorter hospital stay; and the average inpatient stay is 4.8 days — almost half a day (.41) is saved, when given views to nature. When applied to the average expense of inpatient care after surgery ($5,059), the savings ($2074.19) multiplied by the 44,994 comparable operation procedures that happen every year in the United States—the savings are just over $93 million. And this is just inpatients. And just in the United States.

ABOVE: A PATIENT ON THE SCHWAB REHABILITATION HOSPITAL GREEN ROOF
Image provided by: Colin Lyons (Schwab Rehabilitation Hospital)

I asked three hospital administrators who have implemented green roofs on their healthcare facilities how their "healthy hospital is affecting their patients—and their wallet. The clients speak!

Gil Pak, operations director, Penn State Hershey Children's Hospital, green roof opened in 2013

Dianne Hunter, director, public relations and communications, Sinai Health System (Schwab Rehabilitation Hospital), green roof opened in 2003

Timothy Pennigar, project manager, structural systems, Duke University Health System, green roofs opened in 2008

Q: HOW DID YOUR HOSPITAL ADMINISTRATION JUSTIFY THE INITIAL ADDED COSTS OF IMPLEMENTING GREEN INFRASTRUCTURE INTO/ON THE BUILDING?

Gil: The Penn State Hershey Children's Hospital project team felt strongly about providing appropriate outdoor spaces within the project plan. In line with a couple of existing green roof locales already on campus, the further establishment of two additional green roofs within the Children's Hospital was felt to be appropriate. Not only did these provide value for our LEED certification, but they tied into our building theme of Learning and Healing Through Nature—recognizing the importance of an environment of care that supports recovery and healing.

Dianne: Most of the initial funding for the Schwab Rehabilitation Hospital's therapeutic rooftop garden came from a green spaces grant from the Chicago Mayor's Office, along with a substantial philanthropic effort on the part of the Gittler family, who wanted to create a living memorial for their daughter, Caryn. A surviving sister, Michelle, is a physiatrist and the residency program director at Schwab.

Timothy: We're keenly aware of the environmental demands imposed by healthcare facilities—particularly, large academic centers such as Duke University Health System. Being a good steward of natural resources is, first, the right thing to do, and this desire has been deeply integrated at Duke during the past decade. But further, we find that sustainable building practices can produce enhanced life-cycle or reduced operating costs, which more than offset added first costs. It's simply good business.

Q: HOW HAVE THE GREEN ROOFS ON YOUR HOSPITAL AFFECTED THE WELL-BEING OF THE PATIENTS AND STAFF INSIDE? ARE YOUR GREEN SPACES ACCESSIBLE? TO WHOM?

Gil: Our building just opened to patients in January 2013, so we have not had direct

TOP: Duke University Health System green roof
Image provided by: Duke University Health System

BOTTOM: Penn State College of Medicine green roof
Image provided by: Darrell Peterson

feedback yet on their use—but from all the tours and comments we've held to date with families and staff, we expect these to be highlights of our new facility. One area is in a public space that allows families and their children to be outside and enjoy space to run around. The other is on a rooftop, accessible from one of the inpatient floors, allowing patients and their families to ambulate outdoors while still within the protected, and a bit more secluded, inpatient environment.

Dianne: The garden was designed for rehabilitation patients. Walkways are wide for wheelchair navigation, plants in the beds are within reach, and the always-in-bloom plants and fish provide a rich multi-sensory environment. The garden wraps around a seating area and an accessible wheelchair basketball court. We have many testimonials from patients and family members about the difference the garden has made in their lives and recovery. For example, a trip upstairs to the garden is often the first experience being outdoors that patients remember having after the incident associated with their disability or illness.

Timothy: We began experimenting with green roofing in 2006 with anticipation of a major expansion of our hospital campus. Initially, our efforts were entirely pragmatic,

"NOT ONLY DID THESE [GREEN ROOFS] PROVIDE VALUE FOR OUR LEED CERTIFICATION, BUT THEY TIED INTO OUR BUILDING THEME OF LEARNING AND HEALING WITH NATURE—RECOGNIZING THE IMPORTANCE OF AN ENVIRONMENT OF CARE THAT SUPPORTS RECOVERY AND HEALING." *GIL PAK*

focused on structural and material performance, for example. The response from patients and staff following the installation of two highly visible green roofs in 2008 was an unexpected surprise! The flowering sedums transformed a painfully uninspiring scene of concrete and stone. Occupants in surrounding reception and treatment areas voiced a strong preference for these natural views. Of course, the role of nature and biophilic design is prominent in modern healthcare—this will be a principle driver for future green roofs at our hospital.

Q: HAS THE GREEN ROOF INVESTMENT PAID OFF? CAN YOU EVALUATE THE FINANCIAL, ENVIRONMENTAL AND HEALTH BENEFITS? WOULD YOU DO IT AGAIN?

Dianne: Schwab is an acute care rehabilitation hospital, caring for patients with spinal cord injuries, brain injury and for patients who have experienced strokes or who have had amputations. From the outset, the garden was designed for them and enhancing their care. It has more than met that goal. It is a functional therapeutic environment that helps patients establish their "new normal." It's an oasis—priceless!

Timothy: Deferring costly roof replacements well beyond the industry standard of twenty years is just money in the bank—money better invested in the next breakthrough in cancer treatment or heart disease! On the other hand, the perceived health benefits, while mostly anecdotal, are very interesting. Physical and visual access to nature is associated with reduced stress and improved patient outcomes. But more, the integration of green spaces may create optimal "touch points" where patients and their families can find socialization and emotional support—both vital components in the healthcare experience.

Would we do it again? We're progressing now on the largest expansion of roof gardens and green spaces in the history of Duke Medicine. So, I guess the answer is "Yes"...

Jennifer Foden Wilson is the editor of the Living Architecture Monitor *magazine.*

FIND OUT MORE

Duke sustainability: http://sustainability.duke.edu/campus_initiatives/buildings/index.html

Penn State Hershey Children's Hospital: http://www.pennstatehershey.org/web/childrens/home/newbuilding

Schwab Rehabilitation Hospital research report: http://www.innovations.ahrq.gov/content.aspx?id=2143

Green Guide for Health Care: www.gghc.org

DEVELOPING THE URBAN CANOPY OF ENVIRONMENTAL CONSCIOUSNESS

HELLE BRODIE, GRP, LEED AP BD+C

BY: JACQUELINE WATERS

As owner of Brodie & Associates Landscape Architects Inc., Helle Brodie is planting the seed in green development. Whether it is through the area of low impact development, sustainable practices, green roofs, or in developing sustainable green spaces, Brodie & Associates has the "opportunity to improve the environment, one project at a time." A graduate from Guelph University with a degree in landscape architecture and a diploma in horticulture, Brodie has always had an interest in environmental concepts and an appreciation for the natural environment.

Brodie's designations as a LEED accredited professional and Green Roof Professional (GRP) was a natural extension of her long-standing interest in green infrastructure. Influencing development toward environmental consciousness has become her passion, as well as the corporate tag line for her business.

Prior to relocating her firm to Toronto, Brodie was founding member president of the local stewardship network in Dufferin and South Simcoe Counties where she became involved with responsible forest management practices and management of water resources. Today she remains involved in the community as an active member of stewardship groups through Evergreen Brickworks.

Brodie relishes in the opportunity to work among other green roof enthusiasts—while participating in the expansion of the Faculty of Environment at the University of Waterloo, Brodie used her professional experience to implement three-area green roof, as faculty and students' provided clear direction to integrate their wishes into the final design. The three areas include: an accessible area open to students and faculty with a variety of planters and tables with a plexiglass railing to allow for visibility of the green roof; native plantings in an 8" depth growing medium with the letters EV3 in the centre; and a more limited structural capacity roof with varied depths of growing medium, providing butterfly and pollinator habitat.

Brodie has great hopes for the future of the living architecture industry, stating that businesses like hers are "only the beginning." As the changes in our environment become more apparent, so will the positive effects of green roofs, therefore allowing the living architecture industry to flourish. For now, Brodie suggests that

HELLE HAS WORKED ON SEVERAL GREEN ROOF PROJECTS FOR A NUMBER OF DIFFERENT BUILDING TYPES, INCLUDING INSTITUTIONAL, RESIDENTIAL, COMMERCIAL AND RETAIL. PROJECTS OF NOTE INCLUDE A GO TRANSIT PROJECT, A RETIREMENT RESIDENCE AND A WEST TORONTO FITNESS CENTRE. TO SEE MORE PHOTOS OF HER PROJECTS, VISIT HTTP://BRODIE.CA/PROJECTS.PHP.

BRODIE POINTS OUT THE GREEN ROOF DESIGNED BY KIMBERLY CURRY AT THE CARROT COMMON ON DANFORTH AVENUE IN TORONTO AS AN INFLUENTIAL PROJECT SHE ADMIRES IN THE NEIGHBOURHOOD. SHE BELIEVES THAT THIS PROJECT VALIDATES THE FEASIBILITY OF URBAN AGRICULTURE ON ROOFTOPS; AND WITH THE CONSTRUCTION OF A PUBLIC ACCESS POINT, THE ROOFTOP WILL SERVE AS A SHINING EXAMPLE IN THE COMMUNITY FOR THE POTENTIAL OF URBAN AGRICULTURE. "ACCESSIBLE EXAMPLES ARE THE KEY TO DEVELOPING THIS PART OF THE LIVING ARCHITECTURE INDUSTRY."

ABOVE: University of Waterloo EV3 green roof design
Image provided by: Helle Brodie

OPPOSITE: Helle Brodie
Image provided by: Helle Brodie

the best promotion is through success. As the industry continues to increase its knowledge and experience, living architecture will become more widely accepted, and "promotion of the industry then follows naturally," she says.

She also awards credit to the initiatives already underway in the living architecture industry, such as the GRP accreditation and the Green Roof Bylaw in the City of Toronto for helping advance her business in green roofs.

Brodie's work is nothing short of inspiring. With twenty-four years' experience, she will continue to influence the progression of the field: "as we continue to increase our knowledge and experience, we will automatically contribute to the success of the living architecture industry."

Jacqueline Waters is a political science and environmental geography student at the University of Toronto and an intern at Green Roofs for Healthy Cities.

FIND OUT MORE

Read Helle Brodie's full interview at: http://livingarchitecturemonitor.com/index.php/extras-extended-articles/extras-extended-articles

NEW INDUSTRY PRODUCTS

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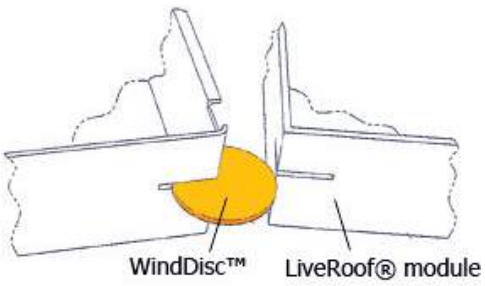
The WindDisc is a simple way to secure LiveRoof® modules together to improve wind uplift resistance. At uplift pressures exceeding 200 psf, the modules remained connected across the green roof surface with the WindDisc module connectors in place. The WindDisc technology allows for any size LiveRoof modules or RoofStone pavers to connect together across a green roof installation. www.liveroof.com



GREENSCREEN® "CONSIDERATIONS FOR ADVANCED GREEN FACADE DESIGN"

greenscreen® (www.greenscreen.com) announces the release of a white paper titled, "Considerations for Advanced Green Facade Design," utilizing over 18 years of collected knowledge, observation, implementation, and experimentation to describe successful strategies that include system selection, design, plant selection, maintenance and client/owner education. Also included are sections describing current research, designing for benefits and a bibliography with references. The white paper addresses best maintenance practices for long term survivability of the living system, access to credits from LEED® and SITES™ rating programs, and metrics for determining successes and failures.

This document gives architects, landscape architects and contractors the necessary information to successfully incorporate green facade technology as a standard building component on projects. By utilizing the "checklist" approach of considerations, greenscreen® has demystified the green facade process and provided a vehicle to set industry standards pertaining to design, installation and maintenance of green facade systems.

A condensed version of this white paper has been approved for Continuing Education credits by the American Institute of Architects, the Green Building Certification Institute and the American Society of Landscape Architects. You can read the paper at http://www.greenscreen.com/direct/Considerations/AdvancedGreenFacadeDesign_CEU_F12.pdf

SODPODMOD® PRE-VEGETATED GREEN ROOF GROWING AND DELIVERY SYSTEM

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The sodpodmod® will decompose leaving no toxic residue in the growing media and is available in the following applications: 1. Licensing agreements with roofing companies or interested franchise parties 2. Supply contracts for growing and delivery of living roofs across North America 3. Retail sales (by website locations sodpodmod.com, digg.com) and retail garden centers (currently under development). www.sodpodmod.com

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THE EDIBLE ROOF: TOMATOES AND COLLARD GREENS

IN EACH ISSUE WE PROFILE A GREEN ROOF OR WALL PLANT, EXPLORING ITS BIOLOGY, USES AND PREFERENCES

BY: MARGUERITE WELLS

The past couple of years have seen a surge in interest in growing food on roofs. Two food roofs have received a GRHC Award of Excellence in the past two years, and many more mixed-use roofs have raised beds and easy access for residents. I want to use this space to explore two of my favorite vegetables for any garden, roof, wall or otherwise.

TOMATOES

The "vegetable" that seems to ignite the most passion in gardeners is tomatoes. Every gardener has a favorite variety; a memory of the tomatoes they ate in their grandparent's garden; or a special collection of seeds they've been saving for generations. A sun-ripened tomato with a few grains of salt might as well be manna from heaven for tomato aficionados. Tomatoes are technically fruit, of course, being the seed-bearing body of reproduction for the plant. However you classify them, they do well in containers, raised beds, walls, or even hanging upside down from the edge of the roof. They thrive on roofs, because they like heat and full sun, and good air circulation prevents foliar diseases.

Tomatoes are members of the plant family *Solanaceae*—they are related to peppers, potatoes, eggplant, tomatillos and the deadly nightshade weeds. A close look at the flowers of all these plants reveals their common heritage. Medicinally, the red pigment in tomatoes—lycopene—has received plenty of attention in recent years as a powerful antioxidant. Lycopene capsules are sold as dietary supplements.

Tomatoes come in two distinct growth habits. The first is called *indeterminate*, meaning that the plant will keep growing in height for the entire growing season. Given a long season, they can reach ten feet long or more. This gives them a long fruiting season, as it is the new growth that produces flowers and fruit. By contrast, *determinate* varieties reach a certain height and stop growing. Some are markedly dwarf, while others are taller. This results in a short, heavy fruiting season for the plant, since it sets its entire season of flowers and fruit at roughly the same time. *Determinate* varieties are more convenient for container gardens where small stature is important. In either case, the plants need to be staked or put in cages to keep them upright,

LEFT: A variety of tomatoes after harvest
Image provided by: Marguerite Wells

RIGHT: Collard greens growing on a rooftop
Image provided by: Marguerite Wells

keep the fruit accessible for harvest, and make them less disease-prone.

There are hundreds of tomato varieties, both old heirlooms and new hybrids. Fruit qualities, disease resistance, and growth habit are the primary distinctions between them. One common tomato "disease" is called blossom-end rot. The bottom of the tomato fruit forms a flat black area, making the fruit inedible. Technically this is caused by calcium deficiency, but really it's due to irregular watering, which causes the calcium problem. Keeping your tomato plants hydrated on a regular basis will prevent this problem.

COLLARD GREENS

The second vegetable to explore here is the humble collard green. Collards are popular in the southeastern US, but there's no horticultural reason for that. They grow as well in the north as down south. When I was a young white kid selling veggies at a farm stand in a predominantly black neighborhood, I kept getting requests for collards, which I had never eaten, much less grown. I added the crop the next season, and I've grown them for myself ever since. A new urban farm in Syracuse, New York is planning only one crop this coming season—collards.

A member of the plant family *Brassicaceae*, its relatives are all well-known veggies: cabbage, broccoli, bok choy, turnips, and the like. Those crops are generally known for doing well in cold climates, and collards are no different. Collards and kale are some of the last greens of the fall, standing out in the blowing snow, perfectly edible. There are wide swings in rooftop and wall temperatures, and collards are very tolerant of extreme temperatures. High heat, high humidity, and deep cold are all no problem for them, even in quick succession. Very nutritious they are the quintessential dark leafy greens we are always supposed to eat more of.

Collards can be planted as seeds directly in the soil, or started indoors as transplants in the spring along with other starts, then planted out in milder weather. There are only a handful of varieties of collards, which differ only in subtle ways in terms of leaf type and likelihood of bolting. When started in the spring, they can be harvested for the entire season and into the winter; or spring and fall crops can be planted. Very few pests or diseases bother collards. Flea beetles can be a problem in spring on small plants, but a light fabric row cover for a few weeks prevents that. Fertile soil will produce the best yields, as collards and their kin are heavy feeders. They are moderately drought tolerant and very heat and cold tolerant. For providing a prodigious amount of nutritious food for very little effort, collards deserve wider recognition than they currently receive.

Marguerite Wells is the owner of Motherplants.

CITIESALIVE 2013

EXPLORING THE CONNECTIONS BETWEEN LIVING ARCHITECTURE AND URBAN RESILIENCE

BY: REBECCA BLACK

Save the date! Green Roofs for Healthy Cities will be hosting the 11th Annual *CitiesAlive*: *Green Roof & Wall Conference* in San Francisco October 23 to 26, 2013. The timely theme for this year's event is 'Securing Urban Resiliency with Living Architecture: Food - Water – Energy.' At *CitiesAlive* 2013, we will explore the many links between the roofs and walls of our cities and the critical social, environmental and economic necessities of urban life that lead to urban resilience. And we'll be doing it in one of the most innovative and exciting cities in North America.

SAN FRANCISCO, CALIFORNIA: AN EXPANDING GREEN INFRASTRUCTURE MARKET

From launching the 60's counterculture and electing the first openly gay mayor, to spawning the likes of Apple, Ebay and Netflix, to leading the continent in alternative power technology implementation, the state of California and the San Francisco Bay Area have consistently demonstrated the ability to lead, and create thought and action leaders who have built a legacy of social, economic and ecological innovation.

Several 'green infrastructure' mandates are driving the green roof and façade business development market in the San Francisco and Bay area. The city's 2010 Stormwater Management Ordinance mandate the development and maintenance of stormwater management controls for developments over 5,000 square feet. Stormwater Design Guidelines published on the San Francisco Public Utility Commission website explicitly feature vegetated roofs, and advise on the use of native plant species in stormwater swales, vegetated roofs, constructed wetlands, and other stormwater best management practices. Developers are poised to take note as building resumes across the region.

The San Francisco Urban Agriculture Ordinance, announced by Mayor Ed Lee in early 2012, made commercial garden and small farm sites legal city-wide and allows properly permitted and code-abiding gardeners and farmers to sell any produce they grow directly to the public on site. New urban agriculture projects have sprung up across San Francisco and legislation is underway to create a city Urban Agriculture Program. Across the bay, Oakland boasts a vital urban farming movement. Rooftop and vertical gardens in a region where land is scarce and highly valued are viable options, providing a strong business development market for GRHC members.

An emphasis on urban forestry and biodiversity, a growing 'urban parklettes' program, dedicated funding for green infrastructure development … add these local initiatives to California's greenest building code in the USA and there's never been a better time to bring the *CitiesAlive*: *Green Roof & Wall Conference* to one of America's most exciting and diverse cities.

CATCH THE INNOVATIVE WEST COAST CULTURE AT *CITIESALIVE*

This year's *CitiesAlive* is a unique opportunity for the green roof and wall industry to gain insight into the leading culture and philosophy of innovation in the San Francisco Bay Area. Delegates will be exposed to the Bay Area entrepreneurial mindset and discover new and enlightened ways of approaching their enterprise, as well as professional and industry development. It will be a rare opportunity for the green roof and wall industry to interact with San Francisco Bay Area visionaries, activists, designers,

green business leaders, community leaders and software engineers, providing relevant personal and professional development opportunities for attendees.

Delegates will network on the iconic green rooftop of the California Academy of Sciences in San Francisco. Walking and cycling tours will visit acclaimed West Coast green wall and roof projects; and bus tours will head into Sonoma Valley, birthplace of the California wine country, to visit out of town green roofs and walls and taste world-class California wines.

The 2013 *CitiesAlive* conference will bring the industry a fresh perspective on achieving sustained growth and corporate development in 2013 and beyond. We look forward to hosting you in October 2013.

Rebecca Black is the director of business development at Green Roofs for Healthy Cities.

FIND OUT MORE

Visit www.citiesalive.org or contact Rebecca Black, 416-971-4494 x 226 or rblack@greenroofs.org.

San Francisco Stormwater Design Guidelines: http://www.sfwater.org/modules/showdocument.aspx?documentid=2778

CITIESALIVE
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NEW FOR *CITIESALIVE* 2013

To improve the *CitiesAlive* experience and meet the personal and professional goals of GRHC members and *CitiesAlive* delegates, here are some new initiatives in the works:

New faces in rooftop technologies: Adopting a multi-disciplinary approach, *CitiesAlive* 2013 will draw together a range of professionals from across the spectrum of living architecture plus other integrated technologies including rooftop solar, on-site water management and city-based agriculture.

Local participation: To bring out the local design and planning community, we've created new *à la carte* registration packages at individual price points, and added *West Coast* programming to highlight the best and brightest in local projects, policy and research.

New sponsorship packages: Tailored to local businesses and small / medium enterprises in the living architecture space, new packages deliver branding value, include comp passes and support for local students and developing professionals.

Top notch venue: All *CitiesAlive* 2013 programming takes place at the world-class Marriott Marquis hotel conveniently located in the center of San Francisco. A preferential hotel rate at the Marquis has been secured for *CitiesAlive* delegates.

A LIVING, LEARNING WALL

MINNESOTA CHILD CARE CENTRE HOME TO FIRST LIVING WALL PROJECT

BY: CHRISTOPHER LYON

The Seward Child Care Center, located on a quiet city street, not far from the bank of the Mississippi River as it passes through Minneapolis, has been ahead of its time since it was founded in 1973. Parents started the preschool on the high-minded principals of teaching children democracy, anti-bias skills and environmental awareness. They were challenged to put these ideals into action recently when their building required maintenance. It needed a fresh roof, new flooring, plumbing and water heating. The cooperative's plan was to follow LEED guidelines, so the renovation would turn the building into an environmental showpiece.

The undertaking was a challenge for a small, volunteer-led group with little funding. Hillary Oppmann, a parent with two children at the school, was the campaign chair and led both the fundraising as well as much of the coordination of the work. She had been involved with stormwater mitigation projects in the past, and believed that they could obtain a grant from the Mississippi Watershed Management Organization (MWMO) to address the roof issue. As part of receiving a planning grant, they connected with Stacy Anderson of Earth Wizards, a local design-build contractor specializing in stormwater mitigation. The design encapsulates various stormwater practices such as permeable pavements, turfstone, and what was expected to be a green roof but, because of budget concerns, quickly migrated to a living wall.

As the design evolved, the rainwater retention system became an important feature, although one of the most problematic. The goal was to make the path of the water from the roof to the living wall "visible" to the children. The

ABOVE: The children and living wall of the Seward Child Care Center
Image provided by: Hillary Oppmann

water collected from the roof is channeled through a kinetic waterwheel/carousel sculpture designed and fabricated by a local artist to a large stainless steel "water table" where the children can play. From there it drains into to a 500 gallon storage cistern. Despite consulting with irrigation suppliers to design an appropriate system, Earth Wizards went through four different pumps trying to find the right one for the project.

The design team consisted of a landscape contractor, a horticulturalist, a native plant specialist, as well as a diverse construction team. One member had worked on several interior living wall projects, but between an exterior mounted system, a harvested rainwater element, and winter conditions, the project required an extensive amount of research, educated guesses and a willingness to attempt the unknown.

The team started the design with a living wall system using a 4" soil profile, but after a brief conversation with Peter MacDonagh at Kestrel Design, he suggested that if the plants were to survive the winter, they'd need a system with a deeper soil profile. At that point the team selected the Tournesol Siteworks VGM system with an 8" soil profile. MWMO grants typically allow only native plants to be used for projects, but in this case they were willing to accept a mix of 55% native/45% non-native ornamentals to ensure greater plant survival on the wall. They planned out the wall using 17 different varieties of plants in the 64 square foot living wall. As the main construction work was done through the fall of 2011, Earth Wizards discovered that the cinder block wall slated to hold the structure wouldn't hold the weight of the plants and soil. Despite the complications, the center wanted to continue—the MWMO working grant had been issued and they wanted to see it through. Although the modules had already been planted (and were being maintained at the contractor's premises), erection had to be put off to the next spring, after the wall had been reinforced.

As spring arrived, the school was able to have the work completed to shore up the wall with a Helifix system recommended by the structural engineer. The rails were hung, the boxes were retrieved, and the plants refreshed as needed. After hanging the modules, the irrigation was set to run twice a day. The plants have thrived since installation, and the living wall has become a real statement for the greening of the school. "The project has made a real impact," commented Oppmann. "Not only has it dramatically greened the face of the center where parents and the public encounter it—it provides an opportunity to teach the children about water and conservation. Children totally get what a living wall is and does. They love that there are plants on their building. We are raising the next generation to expect that buildings will be green and sustainable. I have heard from parents that kids say 'We should have a green wall at our house.' Having elements like the living wall, the water feature, and solar panels at their child care center empower them to create a future where those things are the norm."

Creating the first exterior living wall project in Minnesota was a challenge that no one anticipated at the outset. Contractor Anderson commented that "between learning about living walls, dealing with site challenges, and managing the budget, the project was considerably more difficult than we anticipated." Because "everyday"-type maintenance is the responsibility of the volunteer parents, a key to the overall project design was to make the wall as low-maintenance as possible. Earth Wizards consults to monitor the performance of the plants and the irrigation system, replacing what isn't working as required. As winter arrives, the plants go dormant in the boxes, and the irrigation is shut down and winterized. This past winter is the first that the plants have overwintered on the wall with the southern exposure. They started off the winter with a bang, but the real test will be to see what recovers in the spring. The team has high hopes for the first living wall project in Minnesota!

TEAM

OWNER/DEVELOPER:
Seward Child Care Center

DESIGN/BUILD CONTRACTOR:
Earth Wizards

IRRIGATION AND PLANTS:
Pangaea Design

NATIVE PLANTS:
Ecological Strategies

ARCHITECT:
House Green Inc.

ENGINEER:
Canyons Structural

ARTISTS:
Puppet Farm Arts and Mosaico Group

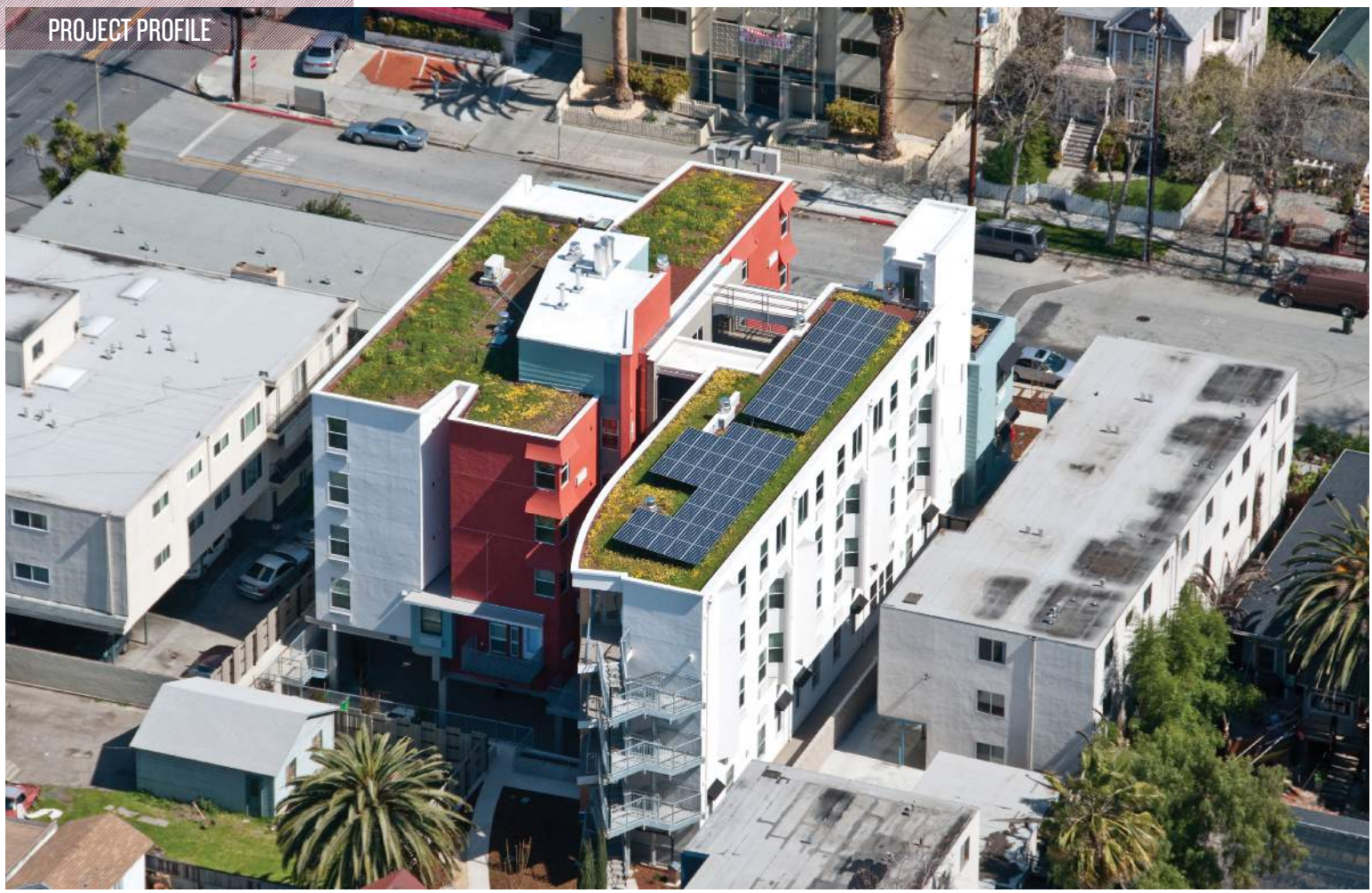
LIVING WALL SYSTEM:
Tournesol Siteworks

SOIL MEDIA:
Midwest Trading

Christopher Lyon lives in Northern California and is the president of Tournesol Siteworks. He has served on the judging panel for the GRHC Awards of Excellence program for the past two years.

FIND OUT MORE

See more photos, the site plan and plant layout from this project at http://livingarchitecturemonitor.com/index.php/extras-extended-articles/extras-extended-articles



HOUSE CALL

SAN JOSE, CALIFORNIA'S FIRST GREEN ROOF IS SETTING THE STANDARD HIGH WITH COMMUNITY HOUSING DEVELOPMENT

BY: MARYANNE WELTON

Replacing an aging residential hotel near downtown San Jose, Casa Feliz Studios was developed in 2009 with 60 new apartments by First Community Housing (FCH). The energy-efficient apartments serve extremely low-income residents—35% with developmental disabilities—and are located in a run-down neighborhood of Victorian houses interspersed with deteriorating 1960's apartment buildings. At less than half an acre, the tight infill site required a creative and efficient design.

The building's crowning glory is San Jose's first green roof, which was engineered to maximize stormwater retention, holding 60 to 80% of rainwater on the roof. Preliminary meetings with the City Public Works Department realized a requirement to replace and upgrade the existing storm sewer to a 100-year flood capacity at an estimated cost of over $300,000. The owner and architect, Rob Wellington Quigley, FAIA, researched using a green roof as a way to mitigate the stormwater requirement. Paul Kephart of Rana Creek provided FCH with design assistance using this "revised" technology.

Preliminary analysis showed that the installation of a green roof could reduce the stormwater runoff to such an extent that only a new 10-year event pipe would be required. This could be accomplished at the same cost or less than the 100-year storm sewer "upgrade". A series of meetings with various city departments was necessary to convince city officials that the green roof could indeed reduce the building's stormwater runoff.

The high cost of upgrading the insufficient storm drain system made the decision to add green roofs economically feasible, but the green roofs add much more to the building than simple stormwater retention. They provide habitat for wildlife, increased roof insulation and cooling, longer roof life due to the blocking of ultraviolet rays, and reduced ambient heat reflected from the roof (which increases the efficiency of the photovoltaic system). The non-irrigated

ABOVE: Case Feliz green roof
Image provided by: Steve Probl

OPPOSITE: Casa Feliz green roof design
Image provided by: Rob Wellington Quigley, FAIA

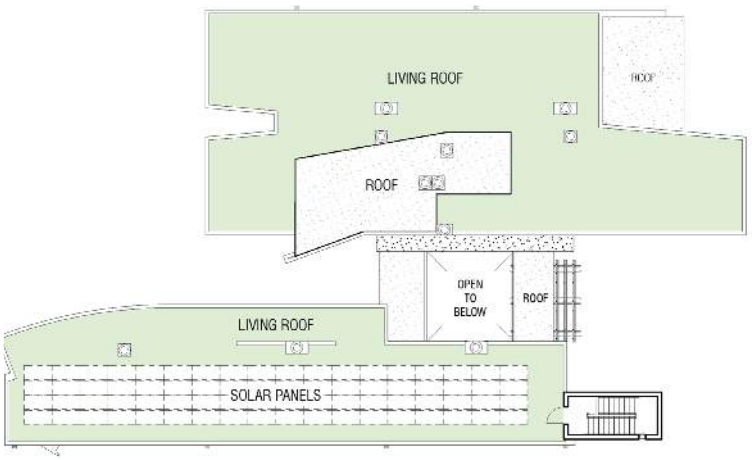
plantings bloom during the mild winter and spring rain, and die down during the long, warm summers.

The use of organically grown plants and a pesticide-free growing medium protects the quality of any water that percolates into the site or drains into the public storm drain system. The plants are a mixture of annual and perennial sedums, grasses and wildflower species that provide a healthy habitat for birds, insects and butterflies. The plant materials were chosen to thrive in hot, polluted air and shallow soil mixtures. They are typically found in California's native serpentine grasslands, which feature shallow, nutrient-poor soils.

There are five different green roof areas, totaling 5,375 square feet. One is partially covered with photovoltaic panels. The rooftop wildlife habitat is not intended for tenant recreation or public viewing, but three small garden roofs at each upper floor are visible from apartments, hallways and decks, which will display vibrant colors and textures throughout the seasons for the daily enjoyment of building occupants.

Each roof includes a waterproof membrane covered with 3 to 6" of specialized soil mixtures. The upper roofs were planted with scattered seeds. Rana Creek was involved in developing a biodegradable modular planting system made from coconut shells that was used for the project called BioTray. For the lower roofs, the plants were grown at Rana Creek's nursery and transported to the site in 4" deep BioTray baskets, which provide both erosion control and thermal resistance.

The green roofs at Casa Feliz provide a continuous layer of R-30 insulation over the building spaces below, eliminating the thermal breaks that result in energy losses in standard wood-frame roof assemblies. The mass of the living roof combined with the water retention capacity minimizes "thermal shock" to the building from varying high and low roof temperatures, thereby moderating temperature fluctuations inside the building and reducing the need for heating and cooling. The roof provides free evaporative cooling on hot days and high insulation value on cold days, keeping the roof at a relatively stable temperature.



While there are additional costs for installing a living roof, particularly for increased structural load, Jeff Oberdorfer, the executive director at First Community Housing, estimates that it added about half of a percent to the overall construction cost, which was offset by eliminating the required storm drain upgrade.

To track the performance of the living roof, FCH installed an Agilewaves resource monitoring system. A weather station measures rainfall at the site, and water flow gauges at the roof drain measure runoff, enabling the developer to calculate the actual water retention capacity of the living roof and demonstrate the reduced burden on the City's storm drain system. This performance data will be used to educate the building industry and policy makers about the benefits of green roofs with the goal of encouraging wider spread adoption.

As San Jose's first development with a living roof, the project acts as a prototype and educational resource for other municipalities, developers and communities. Casa Feliz "has been a model for incorporating water conservation features in affordable housing," says Oberdorfer. The project team hopes that the success of Casa Feliz's living roof experience will plant a seed to inspire others to plant their own rooftop gardens.

Maryanne Welton has been a project manager with Rob Wellington Quigley, FAIA, for thirty-four years, leading design teams on a variety of affordable housing and civic buildings.

TEAM

OWNER/DEVELOPER:
First Community Housing

ARCHITECT:
Rob Quigley Architects, FAIA

GENERAL CONTRACTOR:
Branagh Construction

LEED CONSULTANT:
Simon & Associates

GREEN ROOF CONSULTANT:
Rana Creek

CIVIL ENGINEER:
Carroll Engineering

ROOFING:
Tremco

MODULAR GREEN ROOF SYSTEM:
BioTray

GREEN ROOF MONITORING:
Agilewaves

PLANTS

BIOTRAYS:
Sedum 'album murale'
Sedum rubrotinctum 'Jelly Bean'
Sedum 'acre aureum'
Sedum 'Borshi Sport'
Sedum spathufolium
Dudleya ceaspitosa (or) pulverulente

TOP LEVEL ROOFS (HAND SCATTERED SEED)
Lasthenia californica
Eschscholzia californica
Lupinus nanus
Gilia capatata
Clarkia amoena
Trifolium wildenovii
Castilleja exserta
Plantago erecta
Layia platyglossa

SPREADING THE GREEN ROOF BUG

GREEN ROOF DESIGNATED A CERTIFIED WILDLIFE HABITAT BY THE NATIONAL WILDLIFE FEDERATION

BY: TERRI HUGHES-LAZZELL

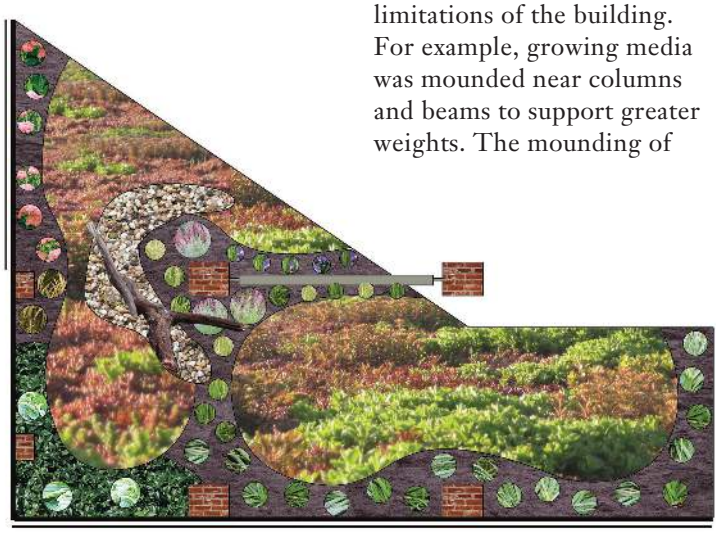
Designing green roofs took on a new shape for Advanced Green Architecture (AGA) in 2011 when the company worked with the Christian Reformed Church in North America (CRCNA) based in Grand Rapids, Michigan, on a project that became the first green roof to be a Certified Wildlife Habitat by the National Wildlife Federation.

The CRCNA wanted to increase biodiversity and wildlife habitat space in the community. To help reach its goals, AGA suggested implementing a green roof design on the CRCNA's rooftop, which would increase plant diversity, create wildlife habitat and improve aesthetics.

The green roof was designed to mimic habitat characteristics found in the surrounding landscape. The designers also wanted to create higher diversity in plant species, which has the potential to produce higher diversity in bird and insect species. "A wide range of plant species, including some native genus, were used to create varying levels of landscape structure and ecology," said Erik Cronk, AGA co-founder. "Native plants are important for all wildlife, especially for providing food and shelter. For these, as well as biodiversity considerations, it is important to use native vegetation when the green roof environment allows."

The National Wildlife Federation's Certified Wildlife Habitat requires a property to provide the four basic elements that all wildlife need: food, water, cover and places in which to raise young. Certified Wildlife Habitats also must conserve natural resources by reducing or eliminating the need for fertilizers and pesticides, which ultimately protects the air, soil and water throughout communities. The Certified Wildlife Habitat program began in 1973, and has since certified almost 150,000 habitats nationwide.

While meeting the certification requirements from the National Wildlife Federation, the roof designed by AGA also met the church's desires to be good stewards of the earth. "The CRCNA has a keen interest in creation care and we have tried to demonstrate our commitment through the management of our facility," said John H. Bolt, director of finance and administration for CRCNA. The organization had made other improvements to the building's heating and cooling system, and then decided that creating a green roof would be another step toward its goal. "We have had numerous compliments about the roof," Bolt said. "The roof lies outside of the windows in one of our primary conference rooms and gets close inspection by employees and visitors on a regular basis. This past spring and summer we found the roof also was a great attraction for a number of bird varieties."



The design elements used in this project were selected in order to support urban biodiversity—the variety and richness of living organisms and habitat diversity found in urban areas and suburban neighborhoods. Many times, cities and other urban areas can and do have rich biodiversity, something the city of Grand Rapids is interested in with its green initiative. Grand Rapids Mayor George K. Heartwell notes that the CRCNA green roof "has taken green roofs to a whole new level … [in the] city with more LEED certified buildings per capita than any other city in America."

The design incorporated bare soils to create a patch effect for wildlife to forage for food. The design also incorporated multiple types of green roof media, gravel swaths and logs with snags to provide nesting and perching structures.

Joining AGA in the project was GMB Architecture and Engineering, who provided the structural analysis for the retrofit green roof project, which was designed to incorporate the structural limitations of the building. For example, growing media was mounded near columns and beams to support greater weights. The mounding of

TOP: AGA working on the CRCNA green roof
Image provided by: Advanced Green Architecture

BOTTOM: CRCNA green roof
Image provided by: Advanced Green Architecture

OPPOSITE: CRCNA green roof design
Image provided by: Advanced Green Architecture

soil also mimics the natural environment and creates microclimates for soil dwelling organisms and insects. It also allows for a wider range of plants to be used.

AGA is committed to the success of this unique green roof project. They are planning to implement a research plan in 2013 to monitor the amount of birds using the roof; and collect samples of the invertebrate/insect species found in growing media and plants. Furthermore, the team does quarterly inspections to check plant health and do minimal hand weeding. Thus far, no plants have died and weeds have not been a problem. In the spring, AGA will cut back the native/ornamental grasses and clean up any debris from the other perennials. Overall, maintenance is minimal, but AGA keeps an eye on things just to make sure the green roof is thriving.

In urban settings, green roofs, like this one, may be one of the only sources of biodiversity and wildlife habitat. So, it's important to incorporate a high diversity of plant species and plant structure, which in turn, will yield a higher diversity of wildlife and insect species. The more plants (especially natives) and habitat structures—such as logs and rocks—found on a roof, the more attractive it becomes to other forms of wildlife.

Terri Hughes-Lazzell is the communications manager at Advanced Green Architecture.

TEAM

CLIENT:
Christian Reformed Church

ARCHITECT:
GMB Architecture and Engineering

GREEN ROOF DESIGNER:
Advanced Green Architecture

INSTALLER:
Weathershield Roofing Systems

GROWING MEDIUM:
Renewed Earth

WATERPROOFING:
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EDGING:
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SEATTLE, WA - APRIL 11-14

CHICAGO, IL - APRIL 25-28

AT LANDSCAPE ONTARIO (HALF-DAY COURSES)

GREEN WALLS 101: SYSTEMS OVERVIEW AND DESIGN – MARCH 12

ADVANCED GREEN ROOF MAINTENANCE – MARCH 19

AT THE GREY TO GREEN CONFERENCE (HALF-DAY COURSES) ON MAY 22 (WWW.GREYTOGREENCONFERENCE.ORG)

INTRODUCTION TO URBAN AGRICULTURE - MAY 22

GREEN WALLS 101: SYSTEMS OVERVIEW AND DESIGN - MAY 22

GREEN INFRASTRUCTURE: POLICIES, PERFORMANCE AND PROJECTS - MAY 22

FOR MORE INFORMATION, AND TO REGISTER, SEE WWW.GREENROOFS.ORG/EDUCATION

GRHC BOARD MEMBER UPDATES

Green Roofs for Healthy Cities would like to thank Dan Slone for his commitment to GRHC for the last nine years as he retires from the board of directors. With Dan's departure, GRHC welcomes Tricia Dunlap of McGuire Woods LLP to the board. Tricia focuses her practice across a wide range of sustainability issues.

GRHC BUYERS GUIDE

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9 Olive Square, Somerville, MA 02143
www.recovergreenroofs.com

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www.stancills.com/skygarden

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THE LUCKY 7

SEVEN INSTALLATION ISSUES FROM THE GREEN ROOF CONTRACTOR PERSPECTIVE

BY: ANDY CREATH

Installation issues occur in all areas of construction. Green roofs are not special in that regard, but there are a few issues green roof contractors should keep in mind—and some tips for planning ahead to ensure success. Here are just a few of the many issues that can occur, and need to be thought about before beginning the installation.

1. CONTRACTOR COMMUNICATION

Let's face it, at times the general contractor's (GC) understanding of green roof components are minimal. Constant communication is necessary to ensure that the GC recognizes that all materials have been installed correctly and will perform accordingly. Lack of communication can result in delays and numerous site tours.

2. LEAK TEST

Please get one done. Nothing tempers the excitement of a beautiful green roof more than a leak that could have been discovered prior to the installation.

3. GREEN ROOF MAINTENANCE PRIOR TO, DURING, AND AFTER INSTALL

You need a green roof maintenance plan—from day one. Imagine this scenario: A 100 degree day with plants sitting in a sun-baked parking lot waiting to be brought up to the roof. Then a problem occurs on the roof, delaying installation for three days and leaving those plants without water. Construction delays occur quite frequently, putting plants at risk; it is therefore crucial to prepare and plan for such circumstances. If the plants survive this first phase, and are safely installed on the roof, the next phase of maintenance begins. There needs to be a green roof maintenance plan in place during this crucial time period—before the building is complete and the owner's maintenance crew begins the care.

4. CLEAR PLANS

On a job site things are not always constructed according to architectural plans. This is especially common with roofing plans. A skylight may have moved or water and electricity may not have made it out to the roof where you need to work. Architectural and landscape plans are the green roof contractor's guide to the intent of the designer. If the plans aren't clear or complete, the final product may not be what the owner expects, and costly change orders may occur.

5. COORDINATION WITH OTHER TRADES

Whether you are on a commercial or residential green roof installation, the rooftop can be a really busy place. Learning to "play well with others" makes for a smooth installation. Without coordination, you often have to wait for other trades to finish their work or move their materials.

6. WATER ACCESS

No water equals dead plants, unless cacti are utilized in the majority of the planting plan. Ensure that water is available from a hose bib, metered fire hydrant or other water source. This limits time spent dragging a hose or filling five-gallon buckets in the bathroom sink.

7. GREEN ROOF ACCESS

Because of the park-like feel of many green roofs, the newly constructed green roof can become a break area for workers on site. To manage traffic, lay protection down or tape off areas to ensure plantings are not damaged by foot traffic or other trades' work. This needs to occur both during and after the construction of the green roof.

Andy Creath is the owner of Green Roofs of Colorado and a GRHC course instructor who teaches Advanced Green Roof Maintenance.

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