



WORKSHOP 7 PROCEEDINGS // MAY 17TH, 2023

THE NATURE-BASED EXCHANGE

Design Standards for Natural and Nature-Based Solutions, Part 2

The Nature
Conservancy 

SURCULUS 



 School of
ARCHITECTURE
Resilient Urban Design

 Biohabitats
SOUTHEAST ATLANTIC BIOREGION

 Robinson
Design
Engineers

Acknowledgments

Planning Team: This workshop series would not have been possible without the time, effort, and expertise of the planning team. Their countless hours of work led to the formation of a robust workshop series that increased knowledge, spurred discussion, and produced tangible outcomes for South Carolina.

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The Nature Conservancy

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Chief Resilience Officer
City of Charleston

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B.D. Wortham-Galvin, Ph.D.
Director and Associate Professor
Master of Resilience Urban Design,
Clemson University

Contributors: The successful execution of each workshop was due to our amazing contributors, including our speakers, panelists, and facilitators as well as those who worked behind the scenes to help us with planning and logistics, funding, and agenda-shaping.

Clemson Design Center
Host venue

**The Honda Foundation and Clemson
University's Masters of Resilient Urban
Design Program**
Financial support

Amy Nguyen
*Nature-Based Exchange
compendium design*

**ACE Basin NERR/SCDNR Coastal
Training Program, South Carolina
Chapter of the American Society of
Landscape Architects**
Continuing education credits

Robinson Design Engineers
Nature-Based Exchange compendium

*Goldbug Living Shoreline, located on Goldbug Island, SC, is a 225 foot long oyster castle reef build by The Nature Conservancy in 2016. Since its construction, the project has successfully attenuated wave energy at the site, as evidenced by sediment accretion and the growth of vegetation and oysters.
(Photo by The Nature Conservancy)*

Workshop Series Timeline

There is often a gap between conceptualizing ideas for natural and nature-based solutions (NNBS) and developing practical and solution-oriented plans using them. To close this gap, The Nature Conservancy, Clemson’s Resilient Urban Design Program, and the City of Charleston conducted a series of practical and outcome-based workshops that brought together a variety of local partners to discuss and develop NNBS. The goal was to synthesize existing knowledge and information on NNBS, align it with opportunities and barriers within the state of South Carolina, and create practical and equitable steps for implementation.

There are a total of seven workshops in the series. The first workshop served as a springboard for the rest of the series, offering an introduction to NNBS and gathering input from participants. The information gathered during that workshop informed the focal topics for the remaining workshops. Workshops 2 through 7 focused on one specific topic each to ensure a targeted conversation with produced outcomes.



WORKSHOP 1
Introduction to Natural and Nature-based Solutions
May 18th, 2022



WORKSHOP 2
Common Messaging on Natural and Nature-based Solutions
July 27th, 2022



WORKSHOP 3
Planning for Natural and Nature-based Solutions
September 14th, 2022



WORKSHOP 4
Funding NNBS: Navigating Grants, Risk Assessment, and Costs Benefit Analysis
November 16th, 2022



WORKSHOP 5
Equity in Natural and Nature-Based Solutions
January 18th, 2023



WORKSHOP 6 & 7
Design Standards for Natural and Nature-Based Solutions, Part 1 & 2
March 22nd, 2023
May 17th, 2023

Workshop 7: Design Standards for NNBS (Part 2)

The seventh Nature-Based Exchange workshop continued the conversation on design standards that began in the sixth workshop. Like the previous workshop, this exchange included insights from both academia and practitioners, with the first three presentations focused on answering one of the following questions:

1. **What are we teaching?**
2. **What are we doing?**
3. **How are we doing it?**

By addressing these key questions, the speakers demonstrated that:

Graduate-level programs focused on the design and incorporation of nature-based solutions are helping change the way the next generation of professionals approach their work.

Designers are aware of the challenges preventing the widespread use of nature-based solutions and are actively educating contractors, suppliers, property owners, and others on the value these methods can bring to the landscape.

While each nature-based project will face constraints throughout the design and development process, it is possible to build a successful project if the design team remains flexible, adaptable, and committed to meeting project goals.

To wrap up the workshop (and the workshop series), we had the honor of welcoming Dr. Todd Bridges who took us back in time, reminding us of the dual importance and existence of nature-based solutions. These solutions were around long before humankind altered the landscape and by continuing to study and work with nature, we can build resilient and sustainable communities where all life can thrive.

AGENDA ITEMS (9:00 am - 12:00 pm)

Designing with Water: community-centered and nature-based designs for resilient water management in Charleston

B.D. Wortham-Galvin, PhD, Master of Resilient Urban Design Program, Clemson University

Planting Design for Ecological Services

Erin Stevens, RLA, LEED AP, Surculus

Barberry Woods – Turning Nature-based Concepts into Reality

Marc Horstman, PE, PH, D.WRE, WK Dickson

Featured Speaker Engineering With Nature for a More Resilient and Sustainable Future

Todd Bridges, PhD, College of Engineering, University of Georgia

Group Discussion and First Year Wrap Up

Designing with water: community-centered and nature-based designs for resilient water management in Charleston

Clemson University's Master of Resilient Urban Design Program (MRUD) is a graduate program based in Charleston, SC that was created to teach students how to design, consider, and plan for nature-based solutions and resilience using a community-centered and research-based approach. The program prepares students for productive and impactful careers by fostering conversations with professionals and community members, ensuring that students are playing an active role in what is happening in the city.

To enhance their learning, students are assigned projects that address real-world problems; for instance, one cohort was tasked with conducting a parallel study to consider how to deal with water on the Charleston peninsula. Students are expected to begin their projects with research – such as analyzing case studies – and continue that research alongside stakeholder engagement throughout the design process. Research must be conducted in a physical, ecological, and cultural context, with all three elements treated as equal in terms of importance and relevance.



Photo courtesy: The Nature Conservancy

Unlike many architectural schools, the MRUD program encourages students to include nature-based systems and policy reform in their designs while also incorporating spaces for education, outreach, and support. Examples of student work clearly demonstrate that students implement what they are taught into their designs – such as compensating for impacts at multiple scales and incorporating social, cultural, and ecological considerations alongside landscape strategies. Students are given the freedom to propose ideas that may be outside of what is currently realistic, which can be valuable for future planning. Ultimately, the program strives for student work to help inform and encourage community conversation while preparing students with the knowledge, experience, and networks needed for them to succeed.



Dr. B.D. Wortham-Galvin

Director of Master of Resilient Urban Design Program, Clemson University, School of Architecture and Professor

Dr. B.D. Wortham-Galvin is Director of the Master of Resilient Urban Design Program and Associate Professor in the School of Architecture, Clemson University. Her research focuses on those people and places left out of traditional design and development decisions, as well as alternative design praxis. She works with communities on issues of equity and resilience in managing change in rural, suburban, and urban places; the Daily Journal of Commerce named her one of Oregon's Women of Vision in 2015 and the Environmental Design Research Association the 2018 Paper of the Year based on this work. She holds degrees in American Civilization, Anthropology, Historic Preservation, Architecture, and History and Theory of Art, Architecture & Environmental Studies from Brown University, University of Pennsylvania, University of Maryland, and MIT.

(Top) Excerpt from B.D. Wortham-Galvin's presentation, photos courtesy Dutch Dialogues Charleston

(Bottom) Excerpt from presentation, graphics created by MRUD students

LANDSCAPE STRATEGIES

LIVING BREAKWATERS
Living breakwaters reduce the velocity of storm surge and can help reduce peak flood levels as well as creating marine habitat.

BUILDINGS AS BUFFERS
Buildings at the water's edge protect the urban fabric behind them by being placed strategically and built to withstand storm surge.

FLOODABLE PLAZAS
Hardscaped floodable plazas are best utilized where soil conditions or low elevations restrict water infiltration.

LAND SWAP
Land is moved to create strategic low and high ground prior to new development.

DREDGE SPOILS
Dredge spoils are reused in areas where sea level rise has killed off the marsh to promote regrowth with appropriate elevations.

RAIN GARDENS
Rain gardens can range in size from whole blocks to small plots but are best utilized where there is optimal water infiltration.

PLANTED CHANNELS
An alternative to traditional street tree pits, channels have greater capacity for stormwater with additional filtering capabilities.

ELEVATED BUILDINGS
Buildings may be built in areas susceptible to sea level rise if they are elevated to 12' NAVD88 and have the ability to be elevated higher in the future.

WET FLOODPROOFING
Buildings that are wet floodproofed are designed to safely flood with minimal damage.

GREEN ROOFS
Both green roofs and green walls help to slow and filter rainwater as well as reducing temperatures and increasing biodiversity.

BIORETENTION CURB EXTENSIONS
Bioretention curb extensions are best utilized on streets where large curb extensions are appropriate and street trees are preferred along the sidewalk.

STORMWATER MEDIANS
Stormwater medians can vary in size, but 10' is optimal for converting to a turn lane at intersections and are best utilized on streets with longer blocks.

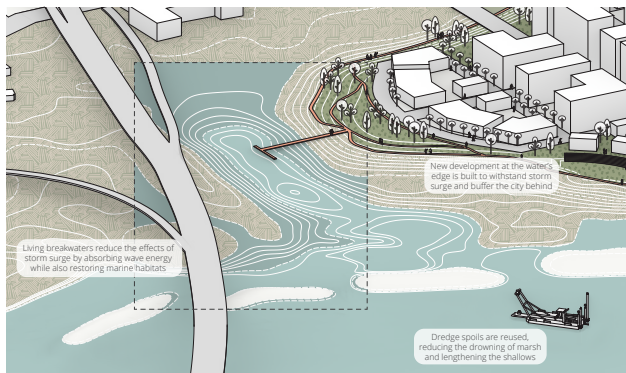
ECOLOGICAL CONSIDERATIONS

THE APPROACH

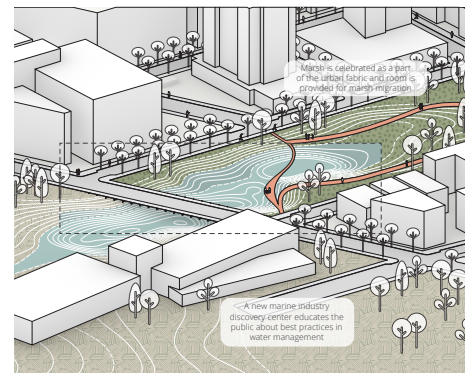
In this project, natural systems are layered with projected development to create a long-term water management for the focus area. Three main approaches to water are being proposed: store, filter and slow. Each of these approaches are implemented through multiple design strategies at a variety of scales.

THE IMPORTANCE

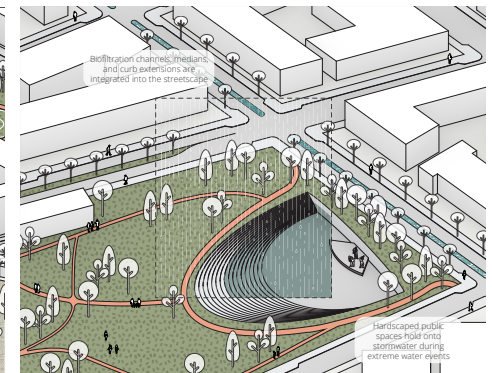
- While all of the proposed design strategies play a significant role in water management, there are also numerous additional benefits of these strategies. In general, nature-based solutions such as the ones being implemented also:
 - Restore damaged ecosystems and create new habitat for at-risk species
 - Provide recreation opportunities such as hiking, paddling, and bird-watching
 - Capture carbon dioxide from the atmosphere, helping to slow global warming
 - Filters out dangerous pollutants from both soil and water
 - Reduce the urban heat island effect which results in lower energy costs, air pollution levels, and heat-related illness



SLOW
Both velocity and peak flood levels are reduced by using natural and artificial forms to buffer incoming water.



FILTER
While fostering the marsh ecosystem is the most widespread strategy, smaller scale interventions such as biofiltration systems in the streetscape should be incorporated into design. Community education about proper use of our water systems is also critical.



STORE
Water is prevented from entering the stormwater system through detention, retention, and infiltration. To determine which strategy to employ, special consideration should be given to soil type and water table height.

Excerpts from the *Designing with Water Report* designed and created for the City of Charleston. Provided by B.D. Wortham-Galvin, MRUD Program, Clemson University. Graphics courtesy of Courtney Wolff.

Planting Design for Ecological Services

Surculus is a landscape architecture firm that brings art and science together to create dynamic, engaging, and functional landscapes that not only promote ecosystem health, resilience, and balance but also connect people with natural systems and with each other. Following nature-based design principles can transform small and large-scale projects from bland, sterile landscapes into thriving communities where plants and animals can find food, protection, and reproductive success.

One of the key barriers to successful nature-based design and implementation is that plant specificity is not given the proper respect and understanding it deserves. Plants are incredibly specialized and act as efficient and productive little machines that create ecological value and perform vital services that extend far beyond aesthetic appeal. As a result, designers consider many factors before specifying a particular plant, such as soil, elevation, salinity, flood susceptibility, light, erosion, and habitat value. (For instance, some plants thrive in low-nutrient, sandy soils as opposed to rich, black organic soil; understanding what soil exists and what soil is wanted for the future can hugely impact plant choice.) The right native plant can benefit other species by providing food or protection, playing a pivotal role in reproduction or migration cycles, offering habitat or biomass to the landscape, or controlling disease. Unfortunately, substitutions often happen and have the potential to result in far-reaching implications. These impacts can range from a landscape experiencing fewer ecological benefits to a species experiencing harm to their reproduction, migration, and overall health (as seen in the case of monarch butterflies and non-native milkweed).

Designers at Surculus are trying to overcome this barrier by communicating the role plants play in the larger ecosystem. One way they do this is by expanding the design pallet they share with clients to showcase the proposed native plants alongside the plant and animal communities that benefit from their presence. Another way they do this is through interactive educational signage in public areas that are accessible to children and adults. Plants are vital to the long-term success of nature-based projects and through proper plant selection and expanding education, their many benefits can be better understood and appreciated.

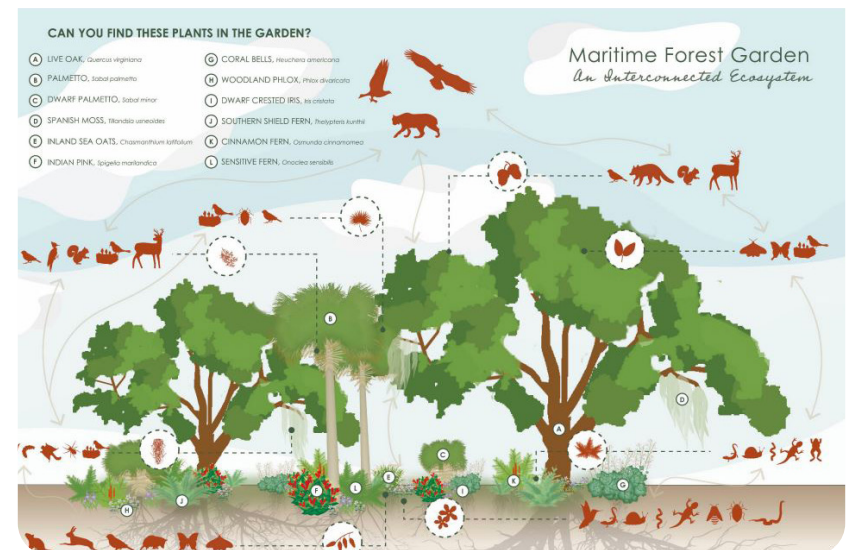


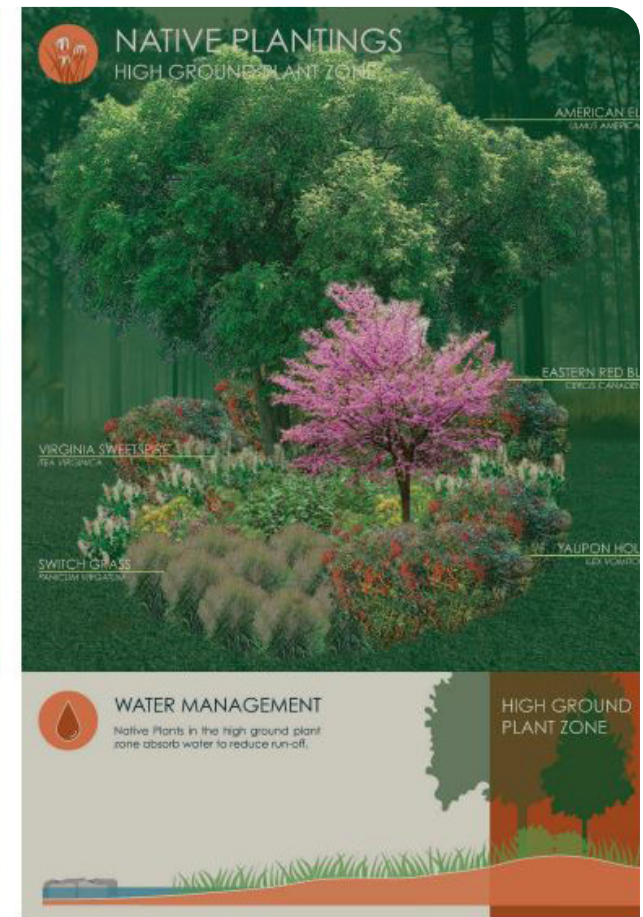
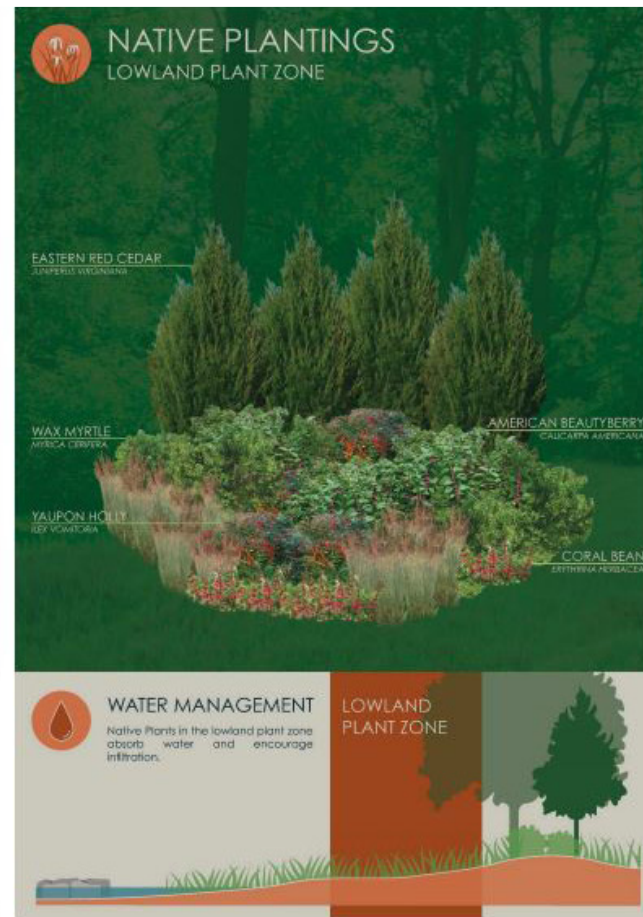
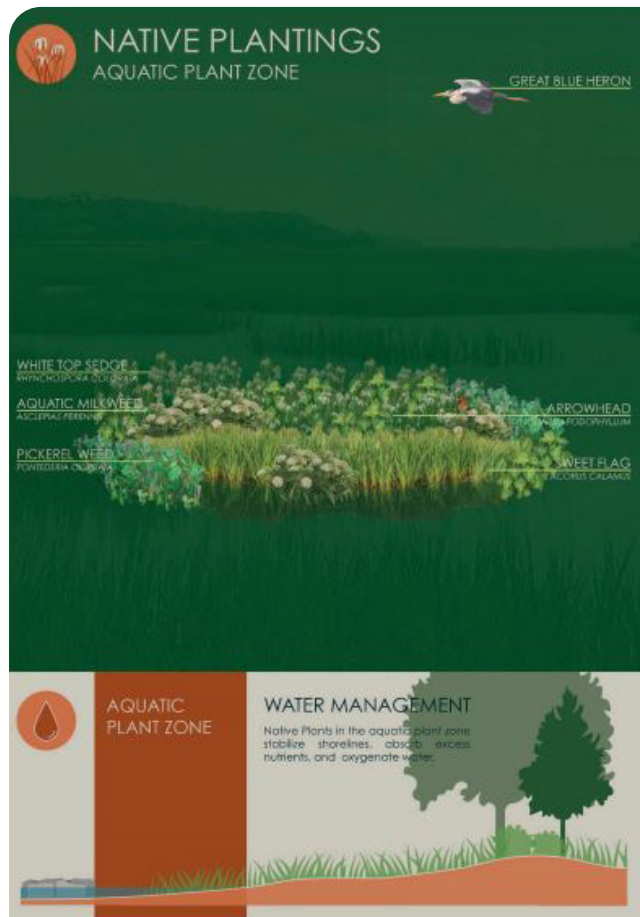
Erin Stevens

President, RLA, LEED AP, Adjunct Professor

A native of the South Carolina barrier islands, Erin Stevens acquired a Bachelors Degree in English and American Literature and Language from Harvard University and a first-hand understanding of the power of varying environmental factors in shaping the human experience. To further explore this phenomenon, she moved to Manhattan to pursue urban studies at Columbia University. After a series of internships she completed her Masters in Landscape Architecture at the University of Georgia.

In her professional career, Erin has worked on a variety of planning and design projects including a federally-funded transit study for the Charleston region, the redevelopment of an environmentally sensitive low-impact residential neighborhood within a highly contaminated watershed, and development guidelines and public space design for multiple mixed-use and infill developments in the Charleston region. In 2016, Erin founded Surculus, a Charleston-based landscape architecture and urban design firm focused on increasing resilience and effectively integrating ecologically sensitive systems into urbanized and other human-affected contexts. In addition to her practice, she currently teaches a design studio within Clemson University's Master of Resilient Urban Design Program.





Signage like this one at Bridge Pointe Ecological Park can help people understand how a nature-based solution and the site it sits on are part of the larger ecosystem. This signage in particular shows the types and locations of native plants that are incorporated into the landscape design and explains their benefits.

Barberry Woods – Turning Nature-based Concepts into Reality

Barberry Woods is a neighborhood on Johns Island, SC that has experienced repeated flooding. During flood events, the **single entrance neighborhood** is nearly impassable, preventing property owners, guests, and emergency vehicles from entering or leaving. To address the flooding problem, WK Dickson partnered with Biohabitats, Inc. and the City of Charleston to design a nature-based solution that would **slow, store, and ultimately convey the water** away from the neighborhood and across the landscape. Yet even the most well-thought concepts change over a project’s development due to **seen and unforeseen constraints**.

Marc Horstman, PE, PH, D.WRF

Water Resource Engineer,
Senior Project Manager



Marc is a senior project manager in WK Dickson’s Watershed Services group, emphasizing municipal stormwater infrastructure, including planning and design, hydraulic and hydrologic modeling, innovative and sustainable site design, and stormwater SCM design. In addition to his proficiency in modeling, Marc’s expertise includes managing various projects that involve planning and designing innovative water quality and ecological engineering components for Capital Improvement Projects (CIPs), Low Impact Development (LID), and infrastructure upgrades. Marc has both an undergraduate and Master of Science degree in Biological Engineering from North Carolina State University. He is a registered Professional Engineer in North Carolina, Georgia, Tennessee and South Carolina; a certified Professional Hydrologist; and a Diplomat, Water Resources Engineer.



Yet, as with all constraints, lessons were learned and areas for improvement were unveiled. For instance, the stormwater design criteria taught the team to view the

Step in the Project Development Curve	Constraints
Stormwater Design Criteria	Using the City of Charleston’s Stormwater Design Standards Manual (January 2020), the design had to account for increased rainfall and sea level rise in the project area while ensuring excess water did not flow downstream.
Funding	South Carolina Office of Resilience (SCOR) American Rescue Plan Act (ARPA) funding requires that project funds must be utilized by the end of 2026. This means that the project must be fully designed and constructed before the end of 2026, placing the project on a fairly tight deadline.
Property Acquisition	The project site was determined to be heirs’ property, complicating property acquisition. In the end, some parcels were purchased while others were placed under easements, affecting the project’s design.
Permitting	The checklists devised by the permitting agencies do not always account for nature-based solutions, making the permitting process tricky and sometimes illogical (like paying a wetland mitigation fee to help wetlands). Working through this process can require time and coordination.
Engineering Ecological Design	Since the project aimed to infiltrate water into an area with a high water table, advanced sub-surface and groundwater modeling was needed to determine any impacts the project could have on adjacent properties and wetlands.

flow of water (and subsequent flooding) at the project site in a holistic manner (i.e., as part of the whole system), rather than through a site-specific lens. Additionally, permitting constraints highlighted the need for permitting agencies to be educated and for their checklists to be expanded to address and include nature-based projects.

This project shows that the design of nature-based projects may change significantly from the initial concept to the final design. But it also shows that despite the twists and turns, it is possible to design a project that meets the project goal as well as the restrictions and requirements placed upon it.



An aerial image of the Barberry Woods neighborhood on Johns Island, SC. WK Dickson's design rerouted water through the central tree-covered area to reduce flooding in the neighborhood. (Photo by WK Dickson)



Dr. Todd Bridges

Professor of Practice in Resilient and Sustainable Systems

Dr. Todd Bridges is a Professor of Practice in resilient and sustainable systems in the College of Engineering at the University of Georgia. Prior to joining UGA in 2023, Todd had a 30-year career in research with the U.S. Army Corps of Engineers and for 17 years served as the Senior Research

Scientist (ST) for Environmental Science for the U.S. Army and the Corps of Engineers, where his leadership in innovation focused on the development of sustainable infrastructure. Todd founded the Corps' Engineering with Nature® Program (www.engineeringwithnature.org) in 2010, which includes a broad range of research, field-scale applications, multi-sector collaborations, and communication efforts to advance the delivery of nature-based solutions. Among his many publications, Todd led a 5-year collaboration across the public and private sectors to develop and publish International Guidelines on Natural and Nature-Based Features for Flood Risk Management. Todd and the EWN Program were contributors to the White House report Opportunities to Accelerate Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, & Prosperity. Among other awards, Dr. Bridges received a Distinguished Presidential Rank Award from President Biden in 2021 for exceptional leadership, accomplishments, and service.



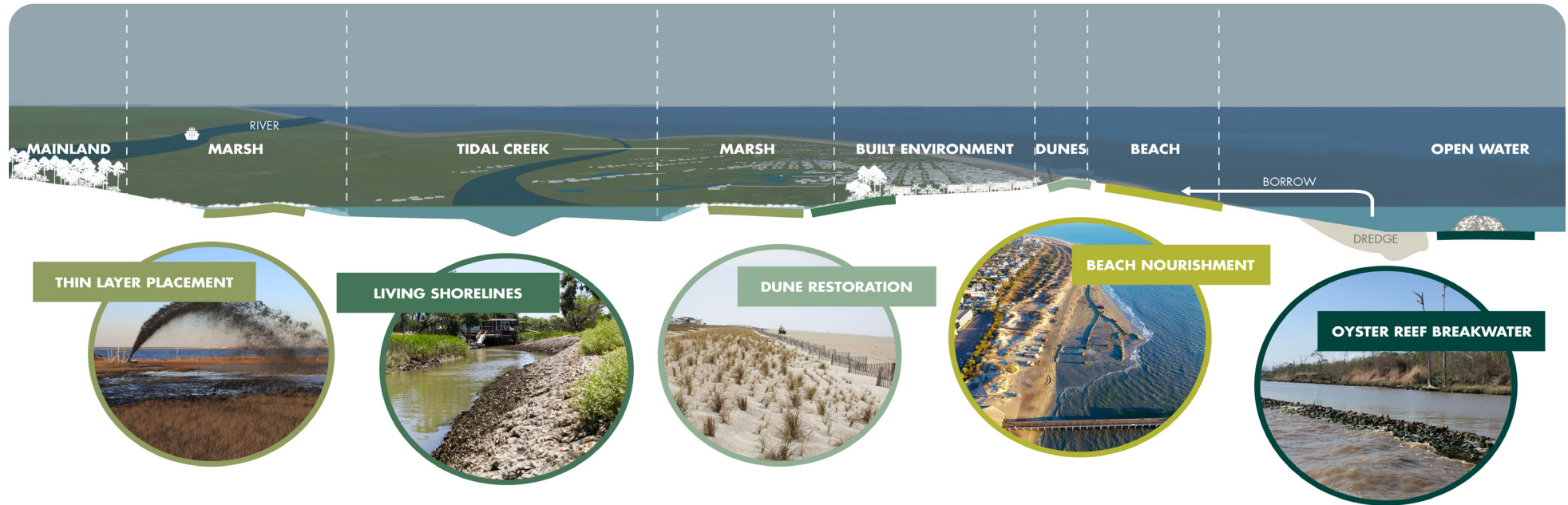
Engineering With Nature for a More Resilient and Sustainable Future

We live in a world that faces multiple hazards and is dominated by human made infrastructure. We have pursued development in some problematic places, including wetlands and lake beds, transforming nature's landscape into something that would have been unrecognizable in centuries past. Humanity has long been confident in its ability to conquer and control nature, but we are increasingly being reminded that Mother Nature is persistent and can overcome human engineering. There is a continuum between 'wild, free-flowing nature' and nature 'tamed, conquered' through engineering and it should be our goal to find productive harmony between nature and human systems. It is in this sweet spot that we find nature-based solutions.

Nature-based solutions have been around for millennia – from the methods of indigenous people around the globe to the modern-era work of HT Odum and Ian McHarg and their colleagues – and these solutions are relevant to a diversity of problems and applications. The U.S. government is helping to propel this work forward through policy direction and the recent investment of billions of dollars into nature-based solutions. A key player on the scene is the U.S. Army Corps of Engineers, whose commitment to seriously consider nature-based solutions for future projects could result in significant progress across the country. Their work through the Engineering With Nature program, which has conducted research and pilot projects, supported teams across the country, encouraged collaboration, and hosted 75 workshops since its development in 2010, has repeatedly proven its value.

Communities are made up of people, built assets, and nature; a community cannot thrive without a balance among these three components. To build a resilient and sustainable future, we must blend conventional engineering with nature-based engineering; find a balance between human systems and nature; and focus on the diverse benefits we can create through integration. By doing so we might just find that we can work with Mother Nature.





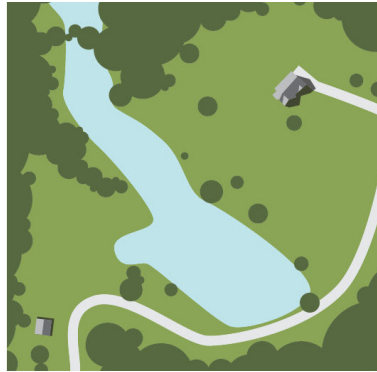
As we design and build nature-based solutions, there are a few things we should keep in mind:

- Nature-based solutions should be built at a scale that fits the purpose of the project.
- Nature-based solutions can and should be backed up by science and that evidence is increasing daily.
- We must be deliberate and intentional about creating space and partnerships for innovating.
- Guidance is important and helpful, but it does not solve every problem; we must bring our own imagination, creativity, and vision to successfully integrate nature-based solutions into infrastructure systems and communities.
- We must be willing to spark conversations, thinking and new ideas; this means we must talk to each other and listen to one another.

(Above) Nature-based solutions can be used across the state of South Carolina from the inland to the coast. Within the coastal zone, nature-based solutions of various types can be found at different locations and scales based on the surrounding natural ecosystem and the issue being addressed.. Graphic above was developed by Rhett Jackson and Kelsey Broich, Network for Engineering with Nature, University of Georgia. Thin layer placement image by Tim Welp, USACE. Living shoreline and dune restoration images by UGA Marine Extension and Georgia Sea Grant. Beach nourishment image by Alan Robertson, City of Tybee. Oyster Reef Breakwater, Bon Secour National Wildlife Refuge in Alabama photo used with permission and provided to the University of Georgia by USACE, Engineering with Nature.



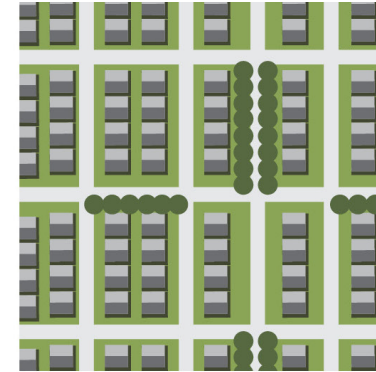
UNDEVELOPED
Natural Groundcover



RURAL
Low Density Residential



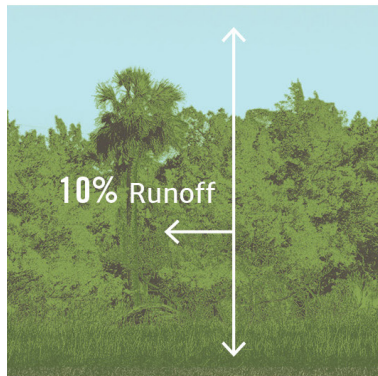
SUBURBAN
Medium Density Residential



URBAN
High Density Residential/
Commercial

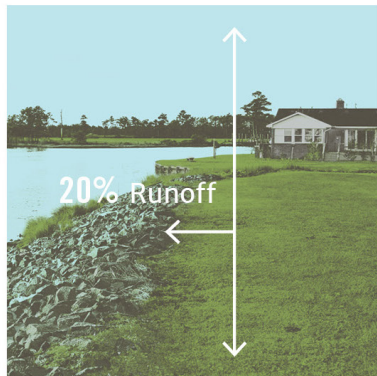
GREEN TO GREY →

40% Evapotranspiration



50% Infiltration
0% Impervious Surface

38% Evapotranspiration



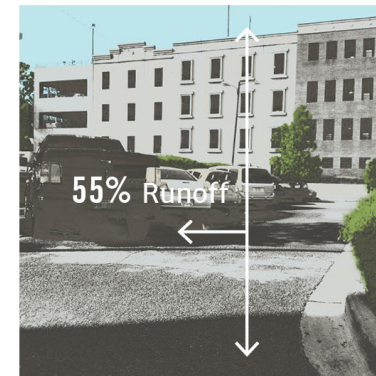
42% Infiltration
10-20% Impervious Surface

35% Evapotranspiration



35% Infiltration
30-50% Impervious Surface

30% Evapotranspiration



15% Infiltration
75-100% Impervious Surface

Built assets and nature are two key pillars of a thriving community. While grey infrastructure such as housing, shops, office buildings, and roads are vital elements to a community, they can also cause high percentages of runoff which can be harmful to people and nature. A balance between green and grey is needed across scales to keep the third critical pillar – people – happy, healthy, and safe for generations to come.

(Above) Graphic credit to University of Georgia and Georgia Sea Grant

Workshop Takeaways

- Clemson University's Master of Resilient Urban Design Program (MRUD) is one example of a graduate program created to teach students how to design, consider, and plan for nature-based solutions and resilience using a community-centered approach.
- Students are being taught to consider bold new approaches to address resilience through active participation in existing issues. Ideally, student work will spark conversations and encourage action outside of the classroom.
- Plants are not being given the proper respect they deserve. Plants are highly specialized, play huge roles in maintaining and expanding biodiversity, and highly influence the success of nature-based solutions. Yet their perceived value often stops at their potential for beautification.
- While common on project sites, plant substitution can result in fewer ecosystem benefits and, in some instances, harm the surrounding flora and fauna communities.
- Educating people – including other designers, contractors, suppliers, property owners, municipalities, maintenance workers, and the public – on the value and role of plants in the ecosystem, as well as the importance of using native plants, is critical.
- Project design can change throughout the development phase due to constraints such as stormwater design criteria, funding restrictions and requirements, property acquisition, permitting, and ecological engineering design. Designers must be flexible and adaptable throughout the process to produce a successful nature-based project.
- For large nature-based projects it is vital that designers use a holistic approach that considers the whole system (rather than only the project area).
- Thanks to engineering and construction, we have transformed our world from wild nature to conquered, controlled, and tamed nature. Yet nature is more powerful than we'd like to think, and nature will return despite our best intentions.
- Nature-based solutions aim to conserve, restore, and engineer nature for the benefit of people and nature. These methods have been used for millennia and have been reinforced in modern times.
- The scale at which nature-based solutions should be deployed depends on the problem that is being addressed. The design of these solutions should be fit for a specific purpose.
- We need to use evidence-based science, not fairytale-based ideas, to design and implement nature-based solutions. We don't have to build a nature-based solution to study it; we can study nature for the answers we seek.
- Communities are comprised of people, nature, and built assets; all three elements must be present for a thriving community to exist. Future resilience and sustainability efforts must keep all three elements in mind as projects are sought to blend and balance nature with engineering design while benefiting people and nature.



NBS Design Summary

Nature-based solutions are being taught, designed, and installed across the state of South Carolina and beyond. When designing these projects, some suggestions to keep in mind include:

Design Phase

- Engage with community members
- Collaborate with other professionals
- Maintain communication with the project team
- Consider bold new approaches and ways of thinking
- Take a holistic approach
- Conduct research on social factors (such as cultural and economic impacts) as well as ecological factors
- Ensure the scale of the project is fit for the purpose

Construction Phase

- Educate people associated with the project as well as those impacted by its construction
- Enforce all design specifications (including plant choice)
- Create signage describing the benefits of the project
- Be flexible and adaptable

The advancement of nature-based solutions relies on all of us, not just designers and educators. As Todd Bridges shared, we should:

- Create space and partnerships for innovating
- Evaluate comprehensive nature benefits
- Design with 'nature-first thinking'
- Support education and progress
- Spark conversation, thinking, and new ideas

Native Plant Moment

Native plants are often misunderstood and underappreciated in the landscape. As described by Erin Stevens, here are two native South Carolina plants that add value to the ecosystem and the property owner.



Yucca

The yucca plant is a wildlife magnet. Not only does the yucca plant serve as the exclusive host for the reproduction of multiple species, but it also provides food for birds and small mammals and supports a variety of pollinating species. Its spikey spines provide animals with protection from predators, making it ideal bird nesting habitat. It thrives in places with nutrient poor soil, offering habitat and biomass where many other plants would fail.



Milkweed

There are about 80 species of milkweed native to North America with at least 17 species native to South Carolina. The diversity of species offers a variety of color options and native species are vital to monarch butterflies, whose caterpillars feed exclusively on their leaves. Unfortunately, there is a tropical species of milkweed that is harmful to monarch butterflies. This species has a longer bloom season which can interfere with butterfly migration and reproduction patterns. By choosing native milkweed species, property owners can beautify their outdoor space while also contributing to the health and longevity of monarch butterfly populations.

(top) Photo yucca plant was taken by "terren in Virginia".

(bottom) Photo of a milkweed plant taken by the U.S. Department of Agriculture

Thank you to our attendees...

Thank you to everyone who attended the workshop. These individuals contributed their thoughts, energy, and enthusiasm to the exchange and are responsible for the ideas and content produced in this compendium.

David Bell	Jacobs	Anna Kaczmarek	CSS/NOAA OCM
Jared Bramblett	HDR, Inc.	Anna Kimelblatt	Weston & Sampson
Todd Bridges	College of Engineering, University of Georgia	Steve Kirk	City of Charleston
Joy Brown	The Nature Conservancy - South Carolina Chapter	Kaylan Koszela	City of Charleston
Ron Bucci	City of Charleston	Jason Kronsberg	City of Charleston
Sarai Carter	Biohabitats, Inc.	Keisha Long	S.C. DHEC
Tarleton Cave	City of Charleston Stormwater Department	Caroline Lord	Clemson-MRUD Program
Bo Ellis	S.C. DHEC- Coastal Stormwater	Bridget Lussier	NOAA
William Eubanks	GA NW	Susan Lyons Groundswell	Charleston 3x3 Advisory Committee
Cyndy Ewing	Citizen Scientist Sullivan's Island	Anna McClendon	Robinson Design Engineers
Liz Fly	The Nature Conservancy	Colleen McDonald	S.C. DHEC OCRM CZC
Zachary Fogleman	S.C. Sea Grant Consortium	Kristin Miguez	Berkeley-Charleston-Dorchester Council of Governments
Amanda Guthrie	S.C. Sea Grant Consortium	Bonnie Miley	Town of Summerville
Nick Hannah	Clemson-MRUD Program	Kim Morganello	Weston & Sampson
Rachel Hawes	Coastal Conservation League	Dale Morris	City of Charleston
Kasey Henneman	Black & Veatch	Amy Nguyen	Robinson Design Engineers
Marc Horstman	WK Dickson	Joseph O'Callaghan	SGA NW Design
		Fred Palm	Edisto Island Community Association

Nicole Pehl	The Nature Conservancy	Erin Stevens	Surculus
Kayla Pehl	Weston & Sampson	Richard Symuleski	Dochester County Planning Commission/ Coosaw Creek Owners Association
Joshua Robinson	Robinson Design Engineers	Lilly Taylor	Clemson University: Urban Forestry
Mason Rosenthal	The Boeing Company	Benjamin Thepaut	S.C. DHEC OCRM
Ian Rossiter	NOAA Restoration Center	Oksana Veselkova	Clemson University
Nolan Schillerstrom	Audubon South Carolina	Nolan Williams	Robinson Design Engineers
Keil Schmid	Geoscience Consultants, LLC	B.D. Wortham-Galvin	Clemson University
Jessi Shuler	Town of Summerville	Holly Yaryan Hall	Robinson Design Engineers
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Jenna Stephens	City of Folly Beach		



