



Sustainable Solutions for Federal Landscapes



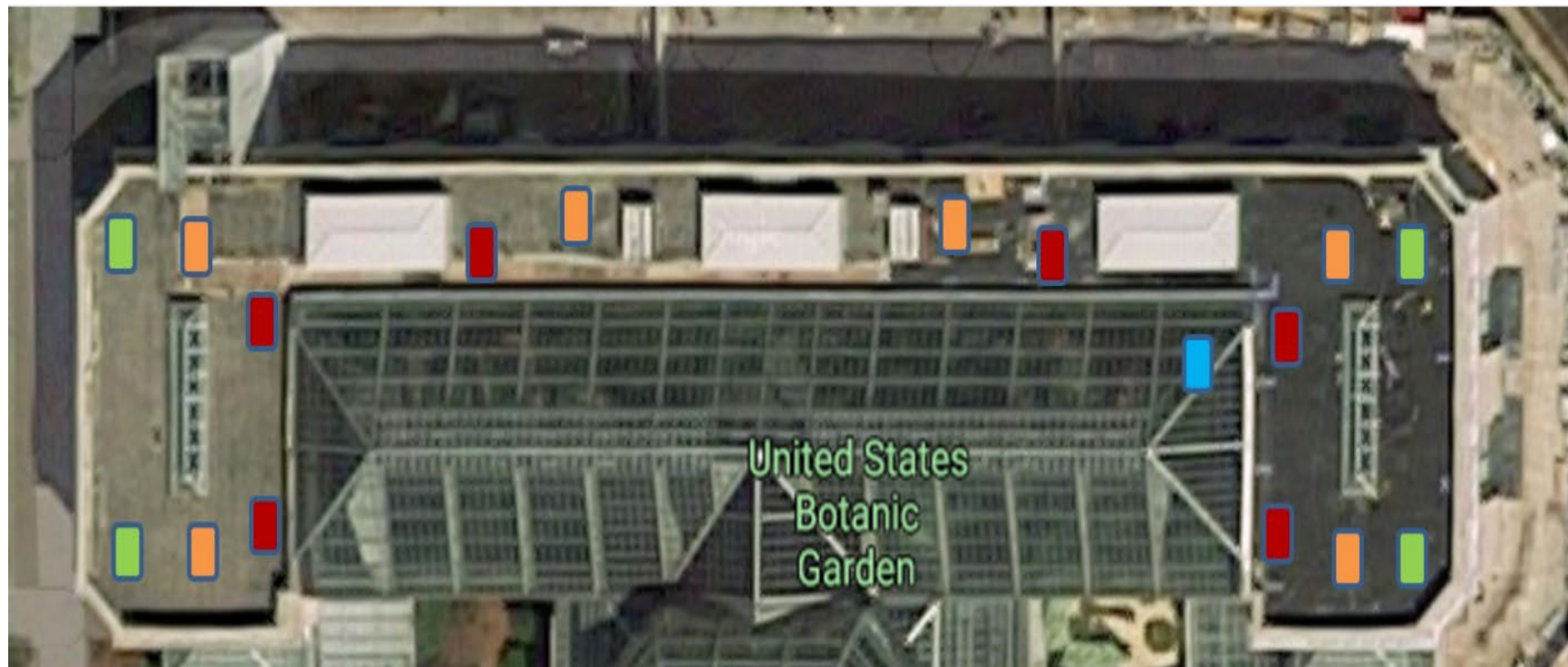
UNITED STATES
BOTANIC GARDEN

Green Roof and SITES

Ray Mims
United States Botanic Garden



900 MHz Basestation/Computer 900MHz Control Node 900MHz Monitoring Node 3G Monitoring Node





UNITED STATES
BOTANIC GARDEN

THE Sustainable
SITES
Initiative®



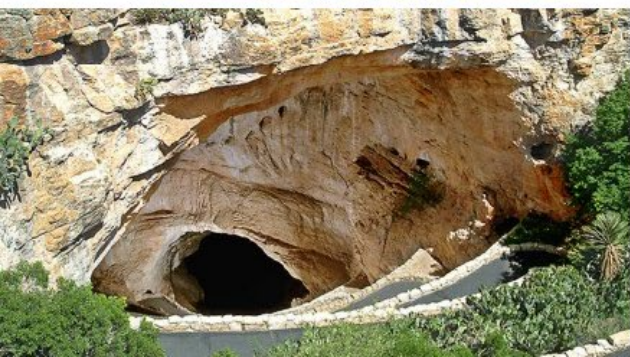
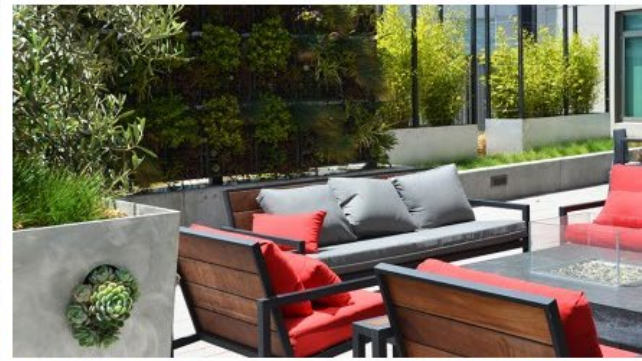


Land planning, design and development is essential to foster resilience, mitigate climate change, protect human health, and drive prosperity for all.



**We must move beyond the building
to be truly sustainable, resilient and healthy**





- » Transform the Market through Design, Development, & Maintenance practices
- » Create Regenerative Systems & Foster Resiliency
- » Ensure Future Resource Supply & Mitigate Climate Change
- » Enhance Human Well-Being & Strengthen Community

Every project holds the potential to conserve, restore and create the benefits provided by **healthy ecosystems.**



Green infrastructure
restores & replicates
ecological systems to
create human benefits.





Save money



Consume less energy



Use less water



User fewer resources



Improve human health &
productivity



SUITABILITY

- ▶ New construction or major renovations
- ▶ No maximum size
- ▶ Minimum of 2,000 square feet
- ▶ Anywhere in the world
- ▶ **Early engagement**



Areas of Focus



SITES v2

Rating System

For Sustainable Land Design and Development



Sustainable
SITES
Initiative™

SECTION 1: SITE CONTEXT

SECTION 2: PRE-DESIGN ASSESSMENT & PLANNING

SECTION 3: SITE DESIGN — WATER

SECTION 4: SITE DESIGN — SOIL + VEGETATION

SECTION 5: SITE DESIGN — MATERIALS

SECTION 6: SITE DESIGN — HUMAN HEALTH + WELLBEING

SECTION 7: CONSTRUCTION

SECTION 8: OPERATIONS + MAINTENANCE

SECTION 9: EDUCATION + PERFORMANCE MONITORING

SECTION 10: INNOVATION + EXEMPLARY PERFORMANCE

SITES v2 Scorecard Summary

YES ? NO

0	0	0	1: SITE CONTEXT	Possible Points:	13
Y			CONTEXT P1.1 Limit development on farmland		
Y			CONTEXT P1.2 Protect floodplain functions		
Y			CONTEXT P1.3 Conserve aquatic ecosystems		
Y			CONTEXT P1.4 Conserve habitats for threatened and endangered species		
			CONTEXT C1.5 Redevelop degraded sites	3 to 6	
			CONTEXT C1.6 Locate projects within existing developed areas	4	
			CONTEXT C1.7 Connect to multi-modal transit networks	2 to 3	

0	0	0	2: PRE-DESIGN ASSESSMENT + PLANNING	Possible Points:	3
Y			PRE-DESIGN P2.1 Use an integrative design process		
Y			PRE-DESIGN P2.2 Conduct a pre-design site assessment		
Y			PRE-DESIGN P2.3 Designate and communicate VSPZs		
			PRE-DESIGN C2.4 Engage users and stakeholders	3	

0	0	0	3: SITE DESIGN - WATER	Possible Points:	23
Y			WATER P3.1 Manage precipitation on site		
Y			WATER P3.2 Reduce water use for landscape irrigation		
			WATER C3.3 Manage precipitation beyond baseline	4 to 6	
			WATER C3.4 Reduce outdoor water use	4 to 6	
			WATER C3.5 Design functional stormwater features as amenities	4 to 5	
			WATER C3.6 Restore aquatic ecosystems	4 to 6	

0	0	0	4: SITE DESIGN - SOIL + VEGETATION	Possible Points:	40
Y			SOIL+VEG P4.1 Create and communicate a soil management plan		
Y			SOIL+VEG P4.2 Control and manage invasive plants		
Y			SOIL+VEG P4.3 Use appropriate plants		
			SOIL+VEG C4.4 Conserve healthy soils and appropriate vegetation	4 to 6	
			SOIL+VEG C4.5 Conserve special status vegetation	4	
			SOIL+VEG C4.6 Conserve and use native plants	3 to 6	
			SOIL+VEG C4.7 Conserve and restore native plant communities	4 to 6	
			SOIL+VEG C4.8 Optimize biomass	1 to 6	
			SOIL+VEG C4.9 Reduce urban heat island effects	4	
			SOIL+VEG C4.10 Use vegetation to minimize building energy use	1 to 4	
			SOIL+VEG C4.11 Reduce the risk of catastrophic wildfire	4	

0	0	0	5: SITE DESIGN - MATERIALS SELECTION	Possible Points:	41
Y			MATERIALS P5.1 Eliminate the use of wood from threatened tree species		
			MATERIALS C5.2 Maintain on-site structures and paving	2 to 4	
			MATERIALS C5.3 Design for adaptability and disassembly	3 to 4	
			MATERIALS C5.4 Use salvaged materials and plants	3 to 4	
			MATERIALS C5.5 Use recycled content materials	3 to 4	
			MATERIALS C5.6 Use regional materials	3 to 5	
			MATERIALS C5.7 Support responsible extraction of raw materials	1 to 5	
			MATERIALS C5.8 Support transparency and safer chemistry	1 to 5	
			MATERIALS C5.9 Support sustainability in materials manufacturing	5	
			MATERIALS C5.10 Support sustainability in plant production	1 to 5	

YES ? NO

0	0	0	6: SITE DESIGN - HUMAN HEALTH + WELL-BEING	Possible Points:	30
			HHWB C6.1 Protect and maintain cultural and historic places	2 to 3	
			HHWB C6.2 Provide optimum site accessibility, safety, and wayfinding	2	
			HHWB C6.3 Promote equitable site use	2	
			HHWB C6.4 Support mental restoration	2	
			HHWB C6.5 Support physical activity	2	
			HHWB C6.6 Support social connection	2	
			HHWB C6.7 Provide on-site food production	3 to 4	
			HHWB C6.8 Reduce light pollution	4	
			HHWB C6.9 Encourage fuel efficient and multi-modal transportation	4	
			HHWB C6.10 Minimize exposure to environmental tobacco smoke	1 to 2	
			HHWB C6.11 Support local economy	3	

0	0	0	7: CONSTRUCTION	Possible Points:	17
Y			CONSTRUCTION P7.1 Communicate and verify sustainable construction practices		
Y			CONSTRUCTION P7.2 Control and retain construction pollutants		
Y			CONSTRUCTION P7.3 Restore soils disturbed during construction		
			CONSTRUCTION C7.4 Restore soils disturbed by previous development	3 to 5	
			CONSTRUCTION C7.5 Divert construction and demolition materials from disposal	3 to 4	
			CONSTRUCTION C7.6 Divert reusable vegetation, rocks, and soil from disposal	3 to 4	
			CONSTRUCTION C7.7 Protect air quality during construction	2 to 4	

0	0	0	8: OPERATIONS + MAINTENANCE	Possible Points:	22
Y			O+M P8.1 Plan for sustainable site maintenance		
Y			O+M P8.2 Provide for storage and collection of recyclables		
			O+M C8.3 Recycle organic matter	3 to 5	
			O+M C8.4 Minimize pesticide and fertilizer use	4 to 5	
			O+M C8.5 Reduce outdoor energy consumption	2 to 4	
			O+M C8.6 Use renewable sources for landscape electricity needs	3 to 4	
			O+M C8.7 Protect air quality during landscape maintenance	2 to 4	

0	0	0	9: EDUCATION + PERFORMANCE MONITORING	Possible Points:	11
			EDUCATION C9.1 Promote sustainability awareness and education	3 to 4	
			EDUCATION C9.2 Develop and communicate a case study	3	
			EDUCATION C9.3 Plan to monitor and report site performance	4	

0	0	0	10: INNOVATION OR EXEMPLARY PERFORMANCE	Bonus Points:	9
			INNOVATION C10.1 Innovation or exemplary performance	3 to 9	

YES ? NO

0	0	0	TOTAL ESTIMATED POINTS	Total Possible Points:	200
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KEY	SITES Certification levels	Points
YES Project confident points are achievable	CERTIFIED	70
? Project striving to achieve points, not 100% confident	SILVER	85
NO Project is unable to achieve these credit points	GOLD	100
	PLATINUM	135

LEGEND:

- ① NW FOUNTAIN
- ② EDIBLE GARDEN
- ③ SIDE YARD GARDEN
- ④ MAGNOLIA BOG
- ⑤ TYPICAL GARDEN ROOM
- ⑥ SITE GATEWAY
- ⑦ PEDESTRIAN PATH (STONE & AGGREGATE)
- ⑧ FIELDSTONE SITE WALLS
- ⑨ STORMWATER RAIN GARDENS
- ⑩ LAWN
- ⑪ MIXED STORY PLANTING
- ⑫ BARTHOLDI FOUNTAIN
- ⑬ ADMINISTRATION BUILDING

SCHEMATIC SITE PLAN

US Botanic Garden, Bartholdi Park
Accessibility, Infrastructure & Sustainability Upgrades



Project Description:

The Accessibility, Infrastructure & Sustainability Upgrades project is a renovation of Bartholdi Park, with the objective to replace utilities and pathways, to align with the American Veterans' Disabled for Life Memorial, allowing direct access for wheelchairs into the park. The project corrects several ADA deficiencies and follows the Sustainable SITES Initiative v2 guidelines, with the intent to achieve an aesthetically beautiful garden that demonstrates ideas for the home owner.

Base Bid:

- Full restoration of the Northwest Fountain historic masonry, and replacement of surrounding pathways, with ADA compliant paving.
- Repurposing the existing fountain basin as a bioretention area, to capture storm water.
- Installation of an accessible edible garden between the Northwest Fountain and the Bartholdi Fountain, including new pathways and fieldstone retaining walls.

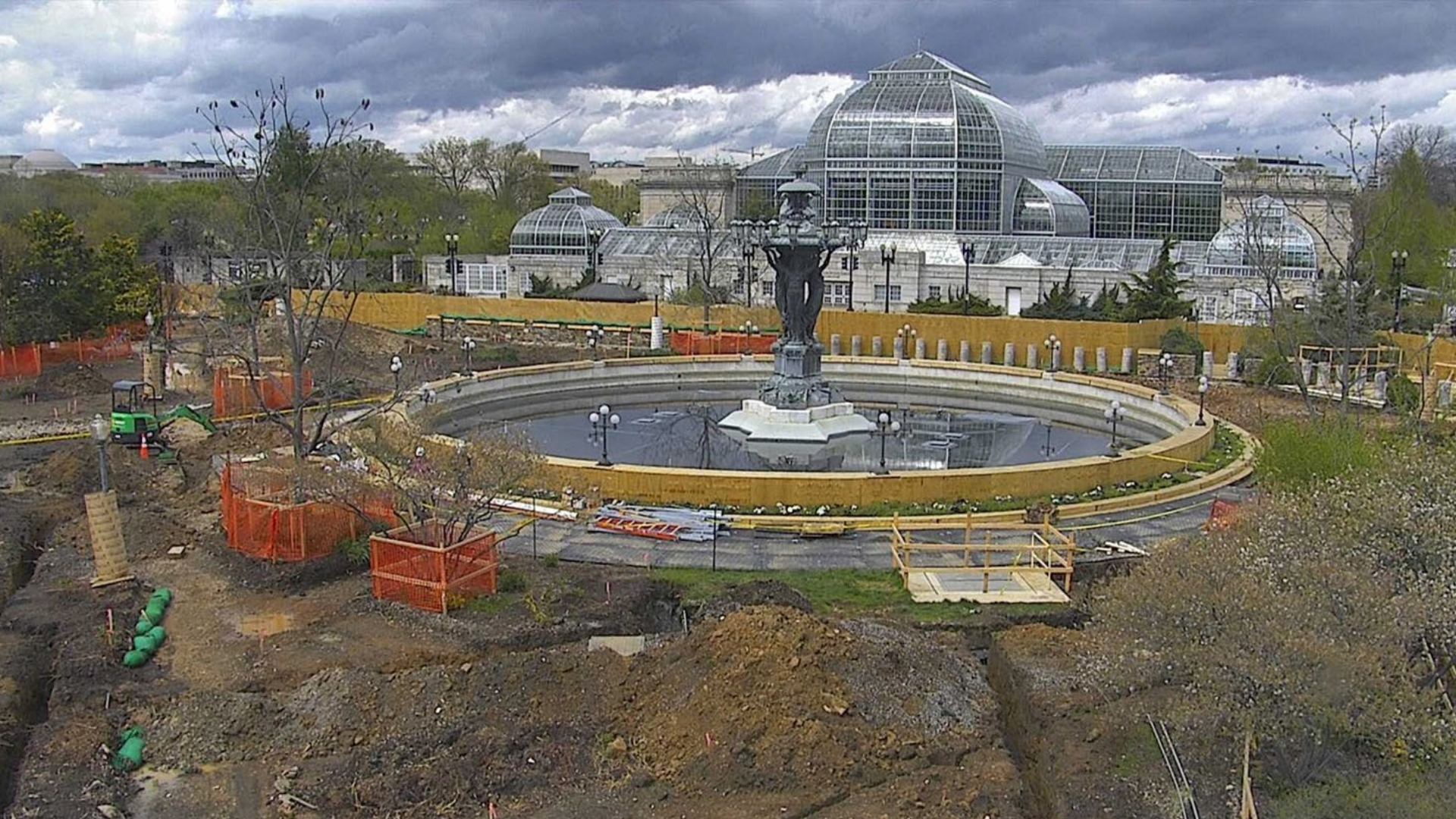
Option 1:

- Removal and replacement of existing aggregate walkways, providing ADA compliant sidewalks and ramps.
- Installation of Bioretention features and Raingardens, to maximize the capture and storage of storm water.
- Removal and replacement of the existing irrigation system with a system of hose connections, requiring gardeners to hand water, which will help achieve conservation goals.
- Accent lighting for the garden features and pathway lighting for safety.



SCALE: 1" = 20'-0"













www.sustainablesites.org

CONTACT US

sites@gbci.org

Advancing Policy to Incorporate SITES



**U.S. General Services
Administration Adopts SITES
for its Capital Construction
Program (April 2016)**



**SITES added to Rhode Island Green
Buildings Act
(December 2017)**

https://www.sustainability.gov/pdfs/sustainable_landscaping_practices.pdf

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Council on Environmental Quality

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INITIATIVES

[Climate Change Resilience](#)

[Federal Sustainability](#)

[Sustainability Plans](#)

[OMB Scorecards](#)

[GHG Accounting and Inventories](#)

[Sustainable Locations](#)

[Landscaping Guidance](#)

[Water Instructions](#)

[America's Great Outdoors](#)

[National Ocean Policy](#)

[Great Lakes Offshore Wind](#)

[Steps to Modernize and Reinvigorate NEPA](#)

Guidance for Federal Agencies on Sustainable Practices for Designed Landscapes and Supporting Pollinators on Federal Landscapes

President Obama's [Executive Order 13514](#) provides a unique opportunity for Federal agencies and facilities to improve sustainability across their operations. The Executive Order, in addition to its call for agencies to implement sustainable practices when constructing and operating high performance Federal buildings, establishes goals for the conservation of water resources on Federal facilities including potable, industrial, landscaping, and agricultural water. The Executive Order also calls for pollution prevention through a variety of landscape management practices.

To help achieve these policy goals, CEQ issued on October 31, 2011 [Guidance for Federal Agencies on Sustainable Practices for Designed Landscapes](#), which describes strategies to achieve sustainable Federal landscape practices. This guidance is to be used by Federal agencies for landscape practices when constructing new, or rehabilitating existing, owned or leased facilities, or when landscaping improvements are otherwise planned.

The Federal Government controls or owns more than 41 million acres of land and 429,000 building assets,



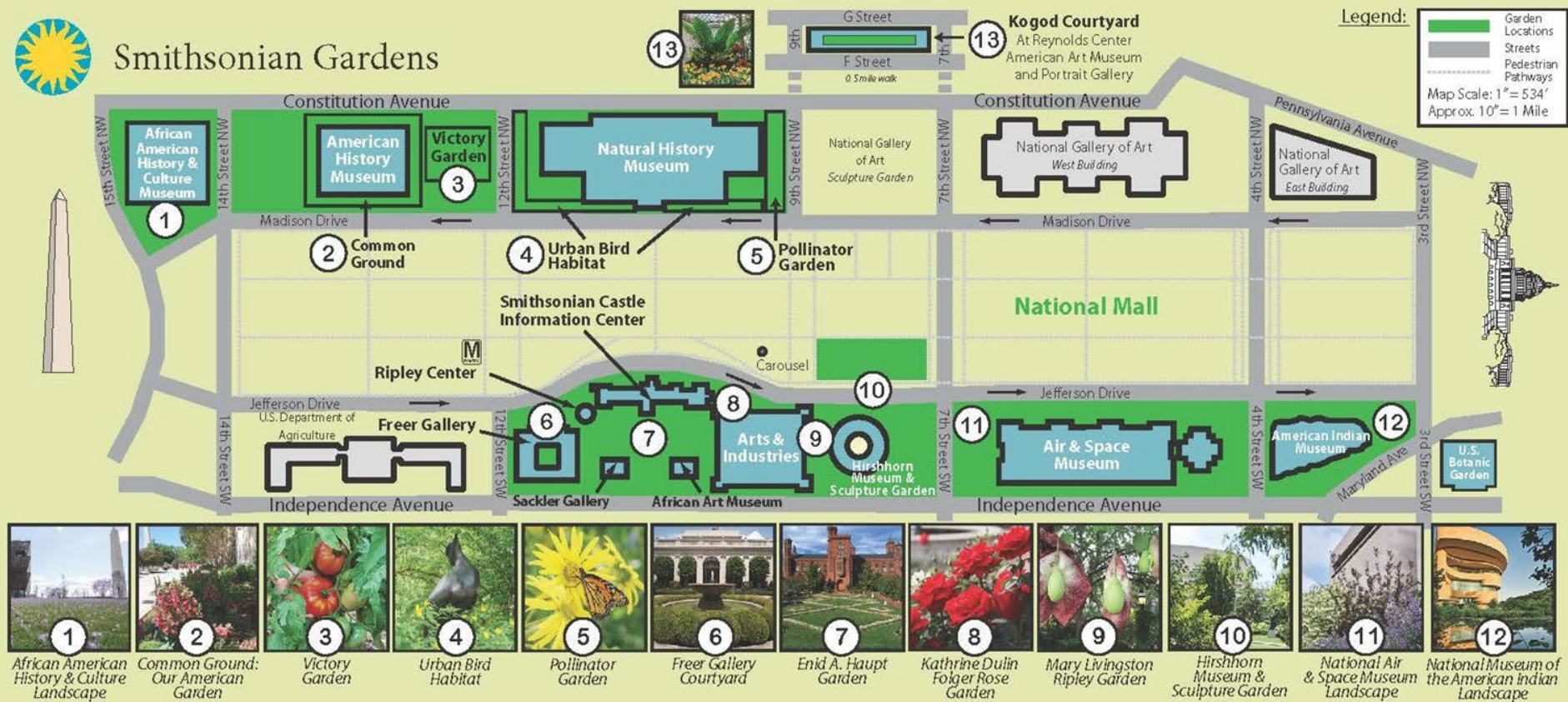
Smithsonian Gardens

**James
Gagliardi**

**Supervisory Horticulturist
Smithsonian Gardens**



Smithsonian Gardens



25 Million Annual Visitors



National Museum of African American History and Culture



Anacostia Community Museum



National Air & Space Museum Revitalization



Hirschhorn Sculpture Garden Redesign



Aesthetically Beautiful Displays



Engage People with Plants



Biophilic Design

connectivity to the natural environment





Create Sustainable Wildlife Habitat

MISSION

Smithsonian Gardens' mission is to:

ENGAGE.
INFORM.
INSPIRE.

As a vital and vibrant part of the Smithsonian experience, we **engage** people with plants and gardens, **inform** on the roles both play in our cultural and natural worlds, and **inspire** appreciation and stewardship.

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Supporting the Health of Honey Bees and Other Pollinators



October 2014

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Homes

Make Your Garden A Home

We plant gardens to grow flowers and food and surround ourselves with beauty. But did you know that your garden can also serve as a habitat for creatures great and small?



Photograph by James Duglass, Inishowme Garden.

Bringing Habitat Home

You can help host a wide variety of wildlife in your garden by supporting three basic needs:



Food



Water



Shelter



When

does pollination happen?

Successful pollination requires year-around efforts. Plants evolved with differing flowering times that **decrease competition among pollinators**. Continuous blooms in the growing season **provide pollinators with a constant food supply**.



Spring: Pollinators need early blooming plants to provide food after hibernation or northern migrations. Bulbs, spring ephemerals and spring blooming fruit trees are visited during this time.



Summer: Our gardens achieve their peak bloom when many pollinators reach peak populations. The long days of summer allow pollinators the maximum time to forage for nectar.



Fall: Late blooming plants provide many pollinators with needed fuel before hibernation or for the southern migrations of pollinators like monarchs and hummingbirds.



Winter: Even when there appears to be no activity, pollinators are in the garden. Leave decaying plants alone—they may be sheltering pollinating insects as they overwinter.

Do you know some
butterflies travel
thousands miles?

At the beginning of each spring, monarch butterflies migrate north from Mexico, following the growth of milkweed. They travel up to 30 miles a day, returning to Mexico in the fall.











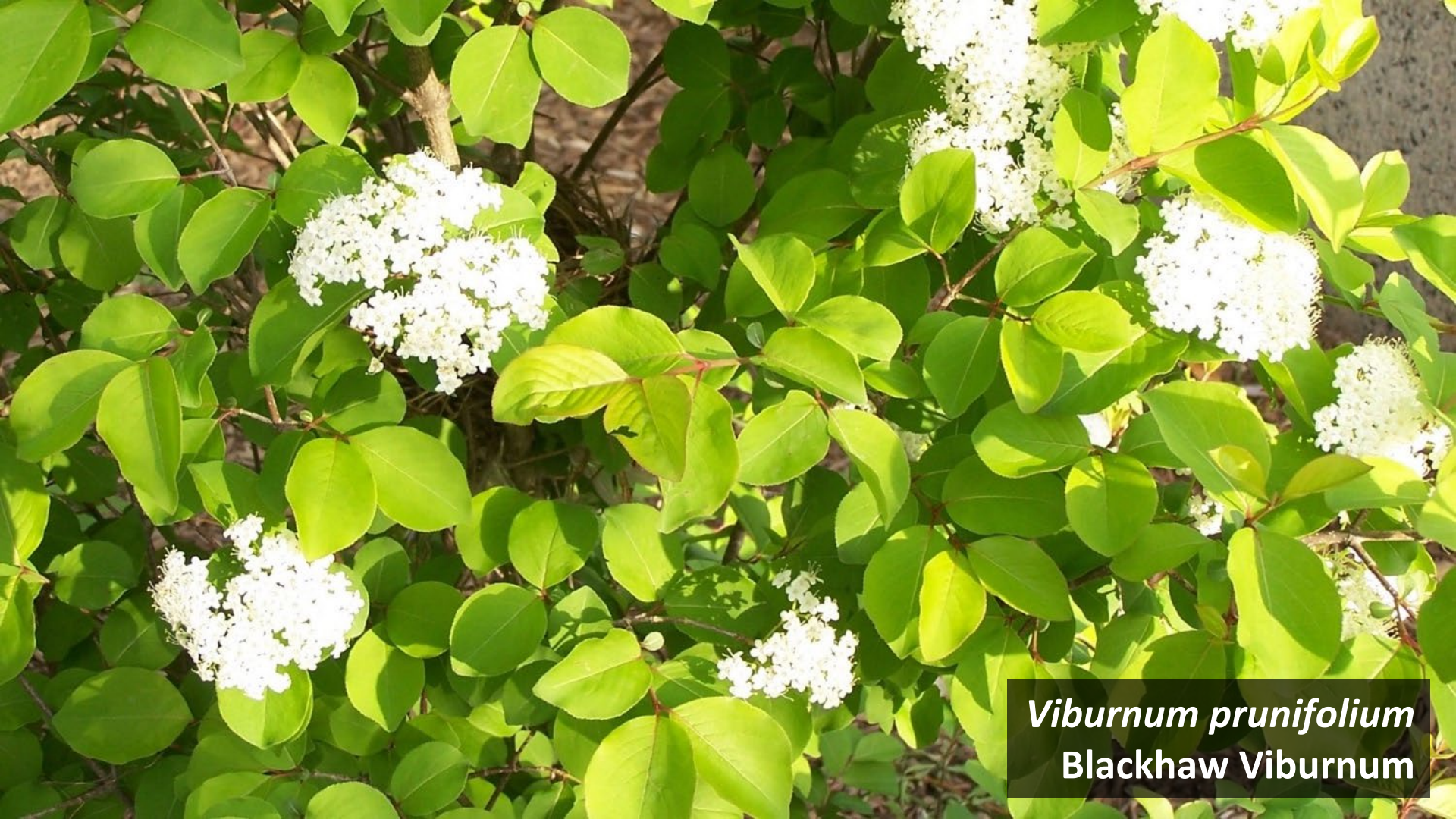
Cornus florida
'Jean's Appalachian Snow'
Flowering Dogwood





Lindera benzoin
Spice Bush



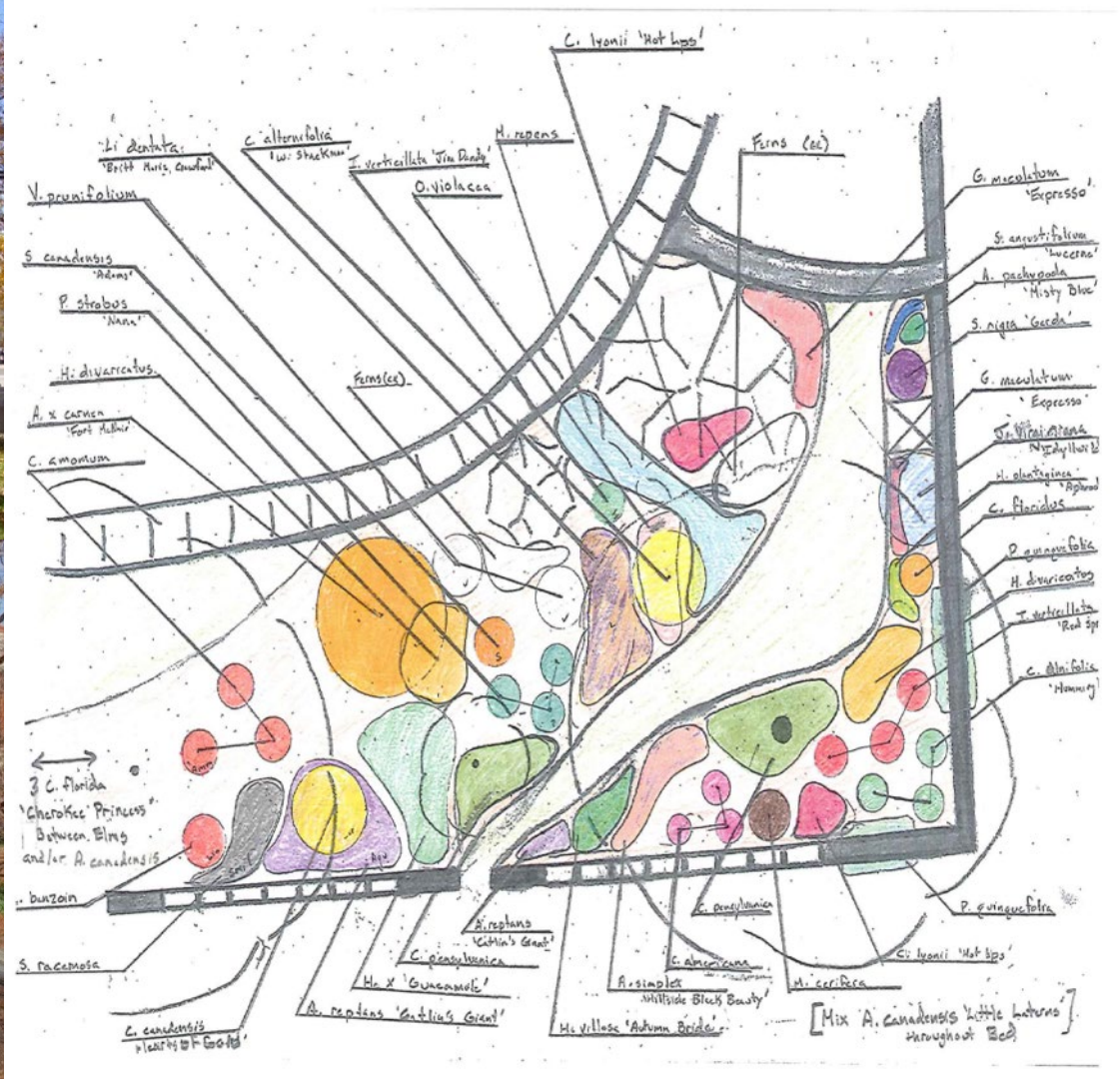


Viburnum prunifolium
Blackhaw Viburnum









The Smithsonian Urban Bird Habitat

PLANT AND ANIMAL DIVERSITY
is a sign of a healthy ecosystem.
This garden is an oasis for many
bird species; it provides for their
basic needs: food, water, shelter,
and a place to raise their young.

Over 300 bird species have been
identified in the District of Columbia.
Some live here all year round, some
stay seasonally, and others pass
through on annual migrations to
their summer and winter homes.



**The Smithsonian Urban
Bird Habitat** is a joint project
of Smithsonian Gardens and the
National Museum of Natural History.
Partial funding was provided by the
Smithsonian Women's Commission.





What Common Bird Species Live in DC Year-Round?



Brown-headed Cowbird
(*Molothrus ater*)

The 2-inch male is dross black with dark brown head. The dark brown female is dross brown. The dark brown head is the most of other birds in the area. Cowbirds follow their herds to see the insects stirred up by their passing. How Cowbirds and their mothers take the place of birds.



American Crow
(*Corvus brachyrhynchos*)

Large (17-18 inches) and entirely black. Crows are found in a wide range of habitats. They are common in urban areas, including backyards, parks, and forests.



House Sparrow
(*Passer domesticus*)

Large (10-12 inches) and entirely black. Crows are found in a wide range of habitats. They are common in urban areas, including backyards, parks, and forests.



Starling
(*Stercorarius*)

The Starling is a small bird with a black head and neck. It is found in a wide range of habitats. They are common in urban areas, including backyards, parks, and forests.



Goldfinch
(*Carduelis*)

The Goldfinch is a small bird with a black head and neck. It is found in a wide range of habitats. They are common in urban areas, including backyards, parks, and forests.



Goldfinch
(*Carduelis*)

The Goldfinch is a small bird with a black head and neck. It is found in a wide range of habitats. They are common in urban areas, including backyards, parks, and forests.







ONE WAY













NO STOPPING OR STANDING
PERMIT PARKING ONLY AREA 12



Echinacea purpurea 'Ruby Giant'
Purple Coneflower







U.S. General Services Administration

GSA Sustainable Solutions for Federal Landscapes

presented by
Maureen Alonso

MARY SWITZER
330 C STREET SW

























EARTH DAY PARK 9TH AND INDEPENDENCE SW





















INTERIOR MAIN GREEN ROOF

1800 E STREET NW











ST ELIZABETHS MUNRO BUILDING LANDSCAPE































































SITE COMMISSIONING

PROVING LANDSCAPE PERFORMANCE AT A NATIONAL SCALE

LAUREN MANDEL PLA, ASLA - ASSOCIATE & RESEARCHER, ANDROPOGON

**14.5° COOLER
THAN TRADITIONAL
ROOF**
Ellis & Reilly (2015)

**15-35% LOWER
MAINTENANCE COSTS**
Ellis & Reilly (2005)

DIFFERENCE IN
TEMPERATURE
ON ROOF

0°

TIME OF DAY
Ellis & Reilly (2015)

GREEN ROOF TALL GRASS
TRADITIONAL ROOF

andropogon

GSA



**IT LOOKS GREAT,
BUT IS IT WORKING?**



PEOPLE



increased
productivity



occupant
satisfaction



safety +
security



education



PLANET



stormwater
management



stewardship



wildlife habitat
provision



carbon
sequestration



energy
conservation



PROFIT



fewer construction
errors



remediation
before turn-over



efficient site
management

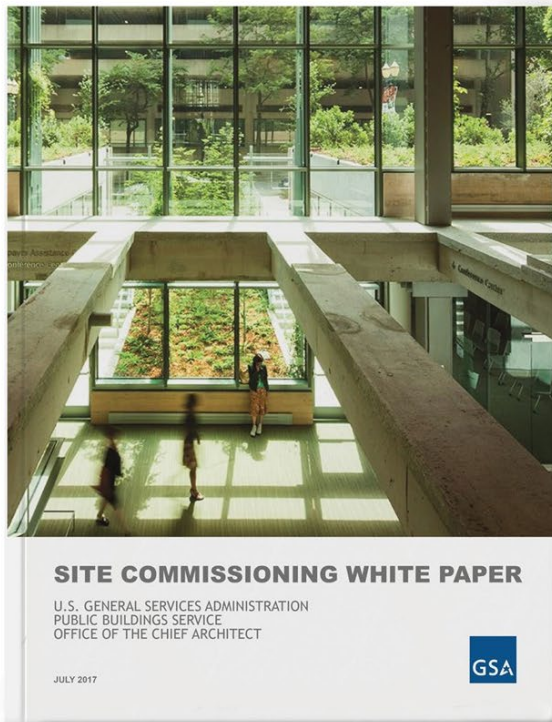


employee retention
+ productivity



SCx WHITE PAPER (2017)





SITE com·mis·sion·ing

/ke ' miSHən , iNG/ 

EVERYTHING
OUTSIDE THE
BUILDING SKIN

PROCESS IN WHICH PERFORMANCE
STANDARDS ARE ESTABLISHED
& THEN FIELD-VERIFIED OVER TIME

PUBLICLY ACCESSIBLE:

https://www.gsa.gov/cdnstatic/2017-10-12_SiteCommissioning_Spread.pdf



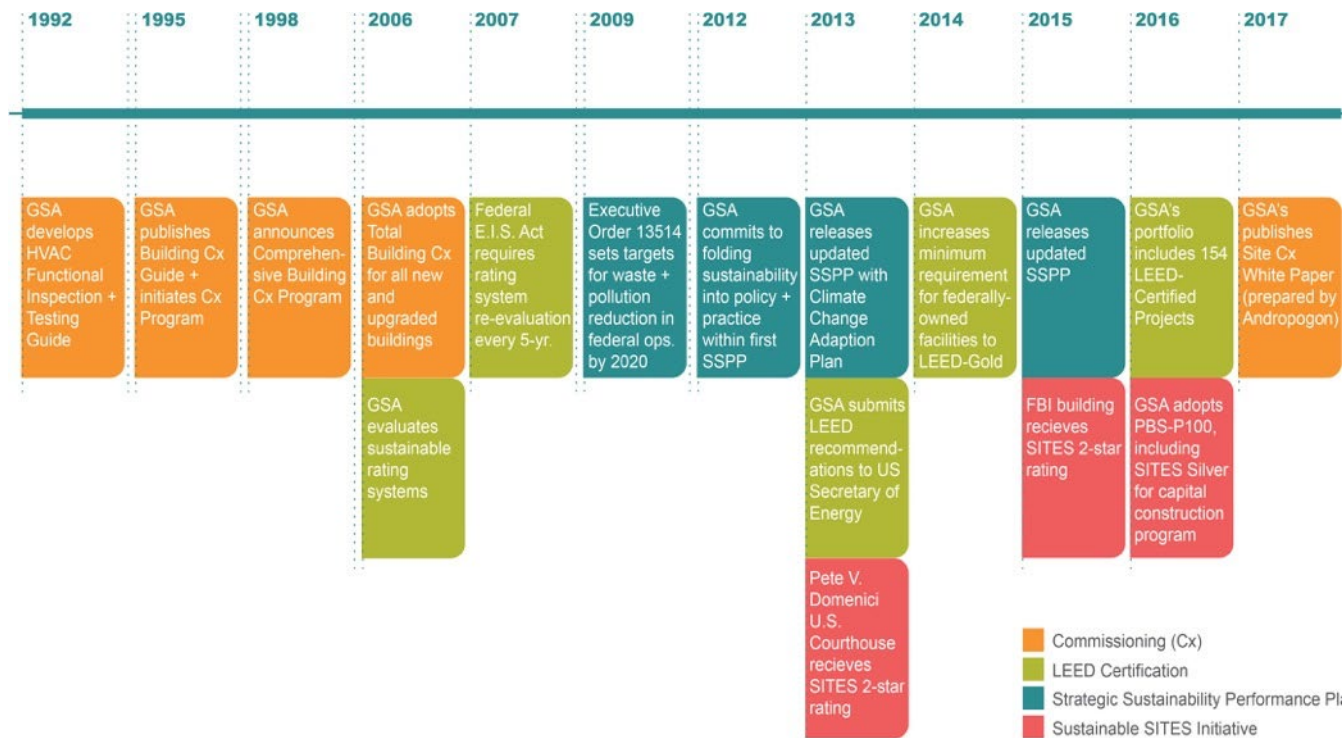
BORN OF NECESSITY

“ [Commissioning’s greatest benefit is] the ability to **verify performance**, inform future practice, and help owners/operators to make real-time adjustments. It also serves the field as a whole as a **tool of market transformation.** ”

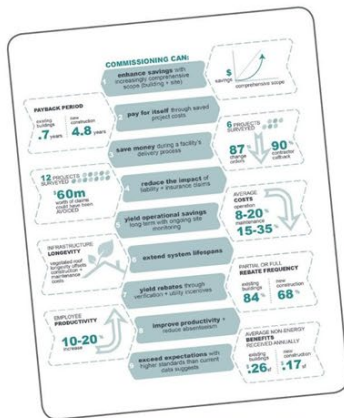
*Maribeth Delorenzo, Deputy Director,
Urban Sustainability Administration, Department
of Energy + Environment*



PARADIGM SHIFT



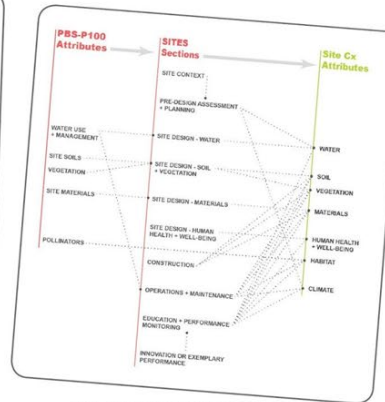
GSA'S PERFORMANCE-VERIFICATION LEADERSHIP



LITERATURE REVIEW



CASE STUDIES



INDUSTRY ANALYSIS

more
 ? ? ?
 than answers



PRELIMINARY INVESTIGATION

7 WORKING GROUPS



WATER

- 30% governmental organization
- 8% non-governmental organization
- 23% academic institution
- 39% professional company



SOIL

- 9% governmental organization
- 18% non-governmental organization
- 9% academic institution
- 64% professional company



VEGETATION

- 29% governmental organization
- 14% non-governmental organization
- 7% academic institution
- 50% professional company



MATERIALS

- 36% governmental organization
- 14% non-governmental organization
- 7% academic institution
- 43% professional company



HABITAT

- 15% governmental organization
- 31% non-governmental organization
- 23% academic institution
- 31% professional company



HUMAN HEALTH + WELL BEING

- 33% governmental organization
- 33% non-governmental organization
- 17% academic institution
- 17% professional company



CLIMATE

- 55% governmental organization
- 18% non-governmental organization
- 9% academic institution
- 18% professional company



EXPERT INPUT

89 INDUSTRY
THOUGHT
LEADERS

283 ONLINE
SURVEY
QUESTIONS

8 GROUP
INTERVIEWS

COMMISSIONING CAN:

1. Enhance savings with increasingly comprehensive scope (building + site).
Mills (2011)

2. Pay for itself through saved project costs. *Mills, et al. (2004), Mills (2011)*

3. Save money during a facility's delivery process. *Mills, et al. (2004)*

4. Reduce the impact of liability + insurance claims. *Mills, et al. (2004)*

5. Yield operational savings long-term with ongoing site monitoring. *Ellis & Reilly (2005)*

6. Extend system lifespans. *GSA (2011)*

7. Yield rebates through verification + utility incentives. *Mills (2011)*

8. Improve productivity + reduce absenteeism. *Lotturp, et al. (2015)*

9. Exceed expectations with higher standards than current data suggests.
SBW & Skumatz (2003)



FINANCIAL BENEFITS



**152,517 LBS OF
CARBON SEQUESTERED
ANNUALLY.** *Ellis & Reilly (2015)*

**10-20% INCREASE IN
EMPLOYEE PRODUCTIVITY**
Lotturp, et al. (2015)

**88% EMPLOYEE
SATISFACTION**
Ellis & Reilly (2015)



INTERCONNECTED BENEFITS



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Image credit: Andropogon Associates



CASE STUDY 5

PROJECT: THE CLARK ART INSTITUTE
LOCATION: WILLIAMSTOWN, MA
PERFORMANCE GOAL: LEED 2.2 Gold-certification
CX AGENT: ARAMARK ENGINEERING & ASSET SOLUTIONS
DESIGNER: TADEO ANDO ARCHITECTS / GENSERL / REED HILDERBRAND

The Clark Art Institute deployed one of the first, formal site commissioning processes in the U.S. during a comprehensive campus renewal. Core to the 140-acre pastoral campus, is the Clark Center—a visitor exhibition and conference center with an underground physical plant building, parking, rain gardens, and meadow—which received LEED 2.2 Gold-certification in 2016. As part of a coinciding campus-wide stormwater management strategy, the Clark Center's water systems are fully integrated with the surrounding site through a network of water collection and re-use systems. A one-acre, tiered reflecting pool that flanks the Clark Center is central to this strategy. Foundation water and roof runoff feed the reflecting pool, which in turn supplies the site's irrigation, gray water use for building plumbing, and cooling tower systems.¹

LEED 2.2 Enhanced Commissioning requires verification of building system performance, but since the building and site systems were fully integrated,

¹ The Clark (2016)

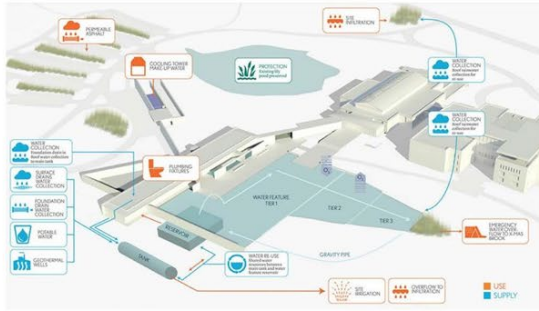


Image credit: courtesy of Gensler



site commissioning became necessary. Initially, the project's landscape architect, Reed Hilderbrand, aimed to self-perform the site commissioning, but through trial and error realized the advantage to engaging a certified, third party commissioning agent. The project's acting building commissioning agent, Aramark, was therefore retained for site commissioning during construction. As the company's foray into site commissioning, the agent authored testing protocols and procedures for each relevant system: stormwater management, gray water and irrigation, water feature pumping, water feature treatment, and automatic controls.² After substantial completion, the owner retained the agent for retro-commissioning services to trouble-shoot a repeatedly clogging reflecting pool purifier.

Performance Outcomes: 1) Fully-functioning stormwater, gray water, irrigation, and water feature systems.

² Kramer (2013)

CASE STUDY 6

PROJECT: SHOEMAKER GREEN
LOCATION: PHILADELPHIA, PA
PERFORMANCE GOAL: SUSTAINABLE SITES INITIATIVE PILOT PROJECT
CX AGENT: SELF-EVALUATED (ANDROPOGON ASSOCIATES / UNIVERSITY OF PENNSYLVANIA)
DESIGNER: ANDROPOGON ASSOCIATES

Shoemaker Green has supported one of the most comprehensive site monitoring programs of any constructed landscape to date. This 2.75-acre, publicly accessible, greenspace at the University of Pennsylvania contains a bioretention rain garden, large green with sub-grade stormwater storage, planting beds, tree trenches, permeable pavement, and a stormwater capture and re-use system that supplies a site irrigation system. Due to inconsistent urban fill composition and infiltration rates, this greyfield redevelopment is fully lined, thereby functioning hydrologically like a non-infiltrating green roof. Shoemaker Green's design is optimized to manage stormwater from the site and surrounding rooftops; provide viable native plant and animal habitats; demonstrate sustainable land management strategies; and support large crowd of people.

To meet the university's research goals and SITE-certification performance monitoring requirements, university and design team personnel initiated a robust, five-year monitoring program. The design



and academic researchers conducted monitoring site visits multiple times per year to collect certain data, while relying upon continuous monitoring equipment and software for other data types. Monitoring and evaluation has targeted water (quality, quantity, plant transpiration rates); soil (compaction, infiltration, biology, moisture, pH, organic matter); plants (vigor, species suitability); and human use (occupancy, behavior).¹

While a formal commissioning process was not utilized, the comprehensive monitoring program exhibited more regularity and detail than would likely be typical of a standardized site commissioning program.

Performance Outcomes: 1) 3x more rainwater managed than regulatory models predicted, due to soil storage capacity and plant transpiration; 2) Irrigation programming error detected and resolved.

¹ McCoy & Mandel (2017)



Image credit: Andropogon Associates













CASE STUDY ASSESSMENT

CORE ATTRIBUTES

SUPPORTING ATTRIBUTES

SITE COMMISSIONING
ASSESSMENT METRICS
CHART

DATA TYPES		PERFORMANCE LEVEL			PHASE ENGAGEMENT					MONITORING FREQUENCY*				
General Examples		★ Tier 1	★★ Tier 2	★★★ Tier 3	Planning / Pre-Design	Design	Construction	Substantial Completion	Post- Construction	Only during construction	Only at end of warranty	Annually	Quarterly	Continuously
	Water													
	Water Use	X	X	X	X	X			X					X
	Flow Rate		X	X					X					X
	Water Quality			X					X				X	
	Soil													
	Storage Capacity	X	X	X		X			X	X				
	Chemical Properties	X	X	X		X			X			X		
	Physical Properties		X	X		X	X		X			X		
	Biological Properties			X		X			X		X			
	Soil organic matter, macronutrients and micronutrients, microbial biomass (C, N), pathogens													
	Vegetation													
	Plant Coverage	X	X	X		X	X	X	X			X		
	Health + Vigor	X	X	X			X		X				X	
	Maintenance Effort	X	X	X	X	X						X		
	Species Richness		X	X		X	X		X			X		
	Transpiration			X					X				X	
	Materials													
	Constructability	X	X	X		X	X	X		X				
	Durability	X	X	X		X			X			X		
	Porous Pavement Permeability		X	X				X	X					
	Cost-Benefit			X		X				X		X		
	First cost, maintenance cost, replacement cost and frequency													
	Habitat													
	Habitat Value		X	X	X	X			X			X		
	Pollinator Biodiversity		X	X					X			X		
	Non-pollinator Biodiversity			X					X			X		
	Human Health + Well-Being													
	Accessibility		X	X		X			X			X		
	Access to Amenities		X	X	X	X			X			X		
	Safety		X	X					X			X		
	Satisfaction		X	X					X			X		
	Human Behavior			X		X			X			X		
	Educational Value			X		X			X			X		
	Local Economic Impact			X	X	X	X		X			X		
	Climate													
	Weather		X	X					X					X
	Energy Use		X	X	X	X	X		X				X	
	Heat Island Effect		X	X	X	X			X			X		
	Carbon Sequestration			X		X	X		X			X		
	Carbon footprint, carbon storage, carbon credits													

* = Frequencies recommended by Working Groups to gain basic performance data that balances cost, accuracy + usefulness

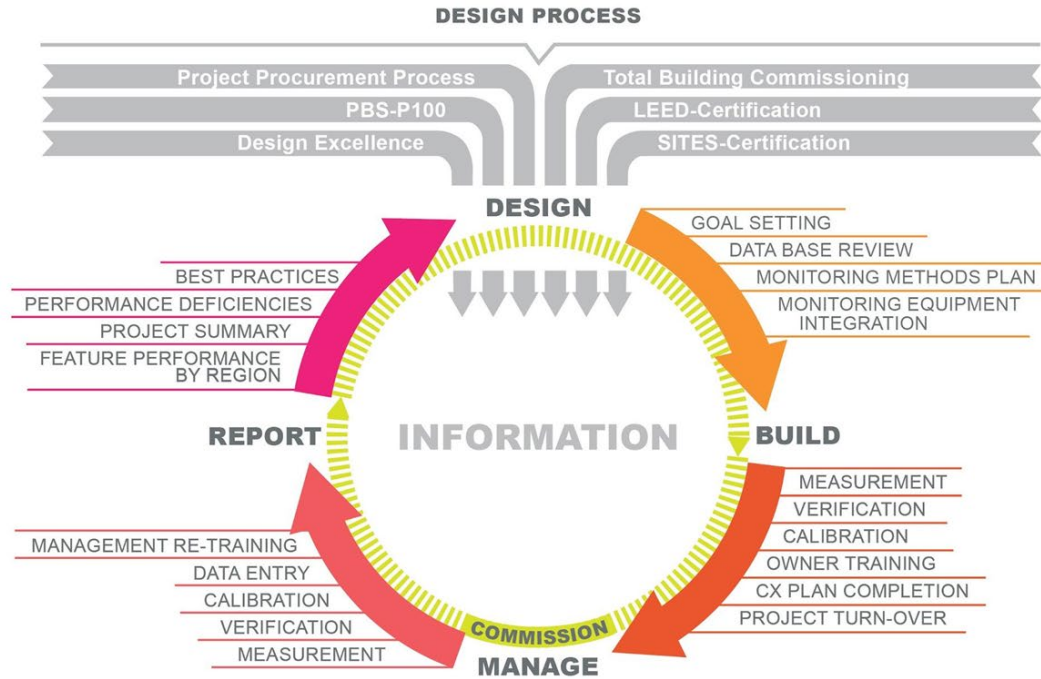
43

44

* = Frequencies recommended by Working Groups to gain basic performance data that balances cost, accuracy + usefulness



ACTIONABLE FRAMEWORK



ADAPTIVE FEEDBACK LOOP

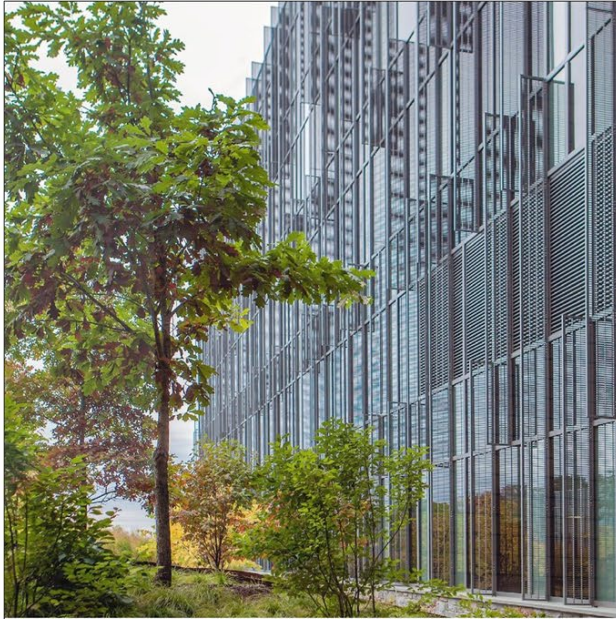
1. **Front-end investment**
2. **Adopt an inclusive project development process**
3. **Leverage ecosystem services**
4. **Launch a 3-year pilot program**
5. **Split site maintenance into two phases:** “early-stage management” (years 0-2 post-construction) & “long-term management”
6. **Anticipate performance trajectories**
7. **Create an agency-wide information feedback loop**
8. **Confirm true costs & benefits**
9. **Embrace a long-term outlook**



KEY RECOMMENDATIONS

A photograph of the Greenville Courthouse, a modern building with a glass and metal facade. The building is partially obscured by a large tree with green and yellowing leaves in the foreground. The text "GREENVILLE COURTHOUSE (2019)" is overlaid in white on the left side of the image.

GREENVILLE COURTHOUSE (2019)



SITCOMMISSIONINGMICRO-REPORT: OPPORTUNITIESFORTHEGREENVILLECOURTHOUSE

U.S. GENERAL SERVICES ADMINISTRATION
PUBLIC BUILDINGS SERVICE
OFFICE OF THE CHIEF ARCHITECT

MAY 2019



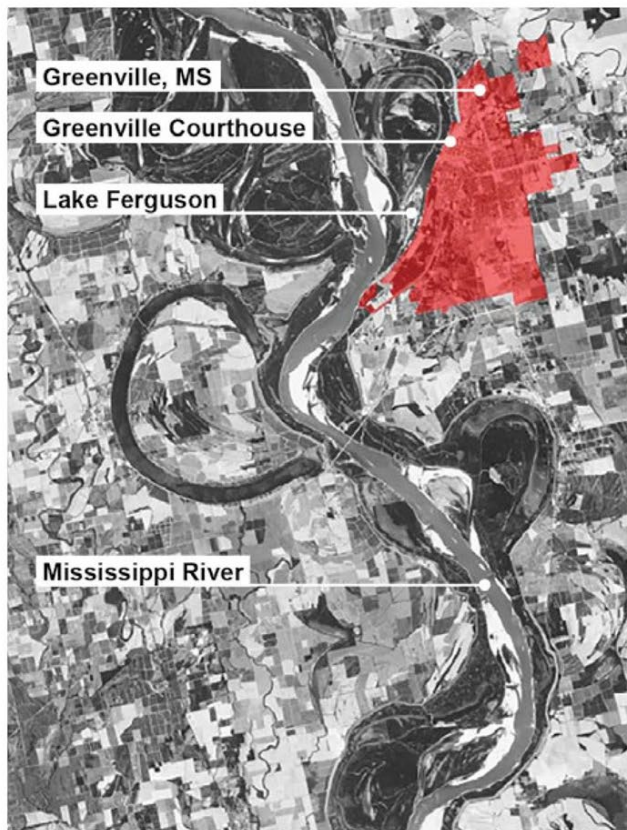
30 SITE-PERFORMANCE GOALS APPLICABLE
TO ALL GSA FACILITIES

3 SITE-PERFORMANCE GOALS SPECIFIC TO
THE GREENVILLE COURTHOUSE

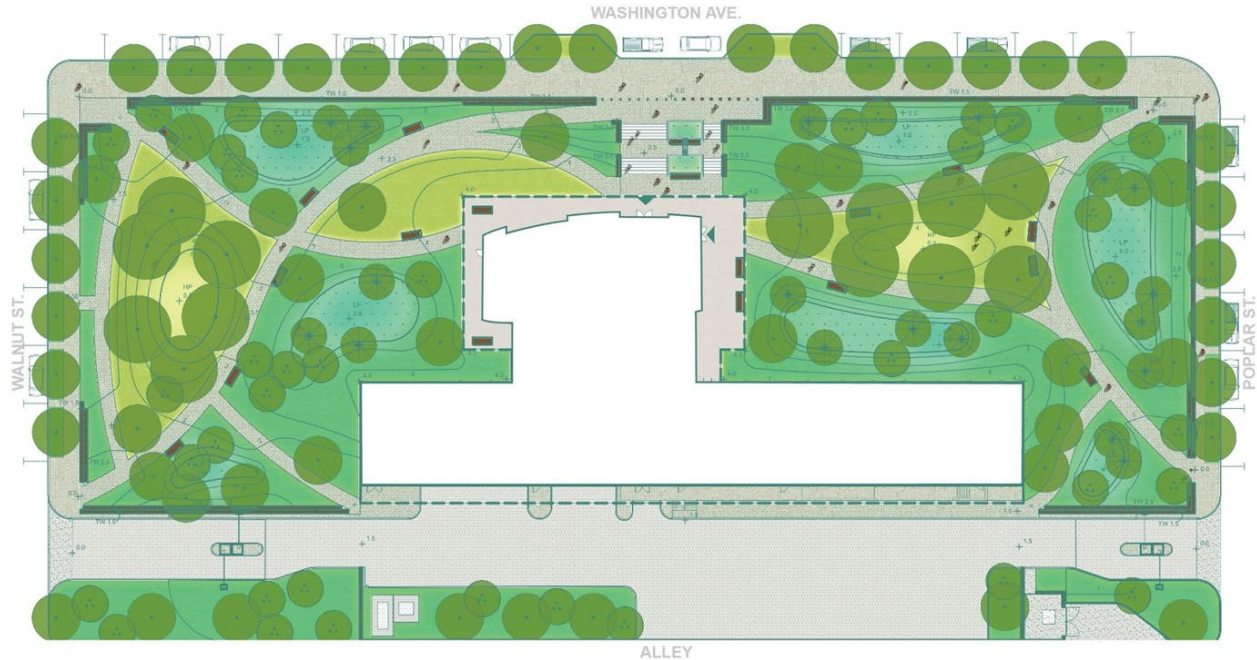
2 MEASURABLE, SITE PERFORMANCE
GOALS SUITABLE FOR VERIFICATION
THROUGH SCx



BRIDGING THEORY & PRACTICE



SITE SIGNIFICANCE



 Lawn with soil-based rainwater storage & irrigation

 Planting bed with irrigation

 Rain garden with irrigation

 Porous unit pavement

 Porous conc. pavement

 Wall or seat wall

 Tree



CONCEPTUAL PLAN

PRIMARY DRIVERS								
	Goal	Driver	Requirement		Guidance or Incentive			
			Federal legislation	Federal regs. & executive orders	GSA agency-wide standard	Independent certification	Financial risk mitigation	Environmental risk mitigation
1	Maintain pre-development site hydrology by managing 95th percentile storm on-site, or by managing total volume of rainfall based on a site-specific hydrologic analysis.	Energy Independence and Security Act (EISA), 2007, Section 438	X				X	X
2	Reduce fossil fuel use by 100% in federal buildings by 2030.	Energy Independence and Security Act (EISA), 2007, Section 433	X				X	X
3	Design federal buildings to be \geq 30% more efficient than ASHRAE 90.1-required design, if life cycle is cost effective.	Energy Policy Act (EPAct), 2005	X				X	
4	Take appropriate actions to promote clean air and clean water for the American people.	EO 13783 Promoting Energy Independence and Economic Growth		X				X
5	Achieve and maintain annual reductions in building energy use; implement efficiency measures that reduce costs; and annually assess and report on building performance relative to sustainability metrics.	EO 13834 Efficient Federal Operations		X			X	X
6	Track and report on energy management activities, performance improvements, cost reductions, green-house gas emissions, energy and water savings, and other appropriate performance measures.							



30 GOALS FOR ALL GSA FACILITIES










1 ENERGY PERFORMANCE: **DESIGN TO MEET 2030 CHALLENGE pEUI TARGETS**

2 BUILDING- & LANDSCAPE-FOCUSED ENVIRONMENTAL PERFORMANCE: **DESIGN FOR LEED V4 GOLD**

3 LANDSCAPE-FOCUSED ENVIRONMENTAL PERFORMANCE: **DESIGN FOR SITES V2 SILVER**



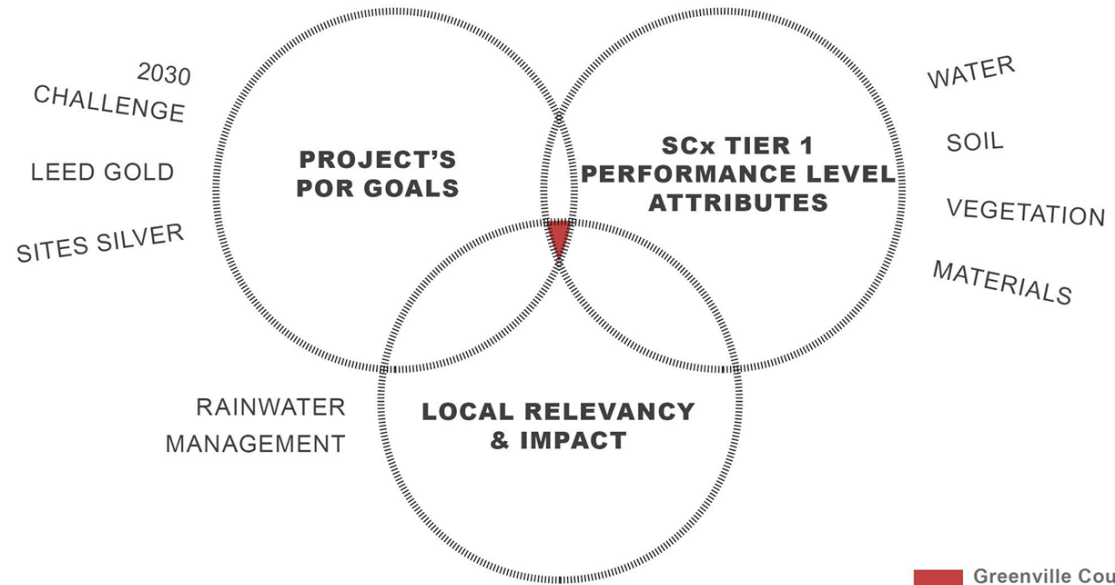
3 PROJECT-SPECIFIC GOALS


	SITE COMMISSIONING ASSESSMENT METRICS CHART	DATA TYPES	PERFORMANCE LEVEL			PHASE ENGAGEMENT						MONITORING FREQUENCY*			
			★	★★	★★★	Planning / Pre-Design	Design	Construction	Substantial Completion	Post- Construction	Only during construction	Only at end of warranty	Annually	Quarterly	Continuously
			Tier 1	Tier 2	Tier 3										
CORE ATTRIBUTES		Water													
		Water Use	X	X	X	X	X			X					X
		Flow Rate		X	X					X					X
		Water Quality			X					X				X	
		Soil													
		Storage Capacity	X	X	X		X			X	X				
		Chemical Properties	X	X	X		X			X			X		
		Physical Properties		X	X			X		X			X		
		Biological Properties			X		X			X		X			
SUPPORTING ATTRIBUTES		Vegetation													
		Plant Coverage	X	X	X		X	X	X	X			X		
		Health + Vigor	X	X	X				X	X					X
		Maintenance Effort	X	X	X	X	X					X			
		Species Richness		X	X		X	X		X		X			
		Transpiration			X					X				X	
		Materials													
		Constructability	X	X	X		X	X	X		X				
		Durability	X	X	X		X			X			X		
		Porous Pavement Permeability		X	X		X		X	X		X			
		Habitat													
		Habitat Value		X	X	X	X			X		X			
		Pollinator Biodiversity		X	X					X		X			
		Non-pollinator Biodiversity			X					X		X			
		Human Health + Well-Being													
		Accessibility		X	X		X			X			X		
		Access to Amenities		X	X	X	X			X			X		
		Safety		X	X					X			X		
		Satisfaction		X	X					X			X		
		Human Behavior			X		X			X			X		
		Climate													
		Weather		X	X					X					X
		Energy Use		X	X		X	X	X					X	
		Heat Island Effect		X	X		X	X		X			X		
		Carbon Sequestration			X		X	X		X			X		

* = Frequencies recommended by Working Groups to gain basic performance data that balances cost, accuracy + usefulness



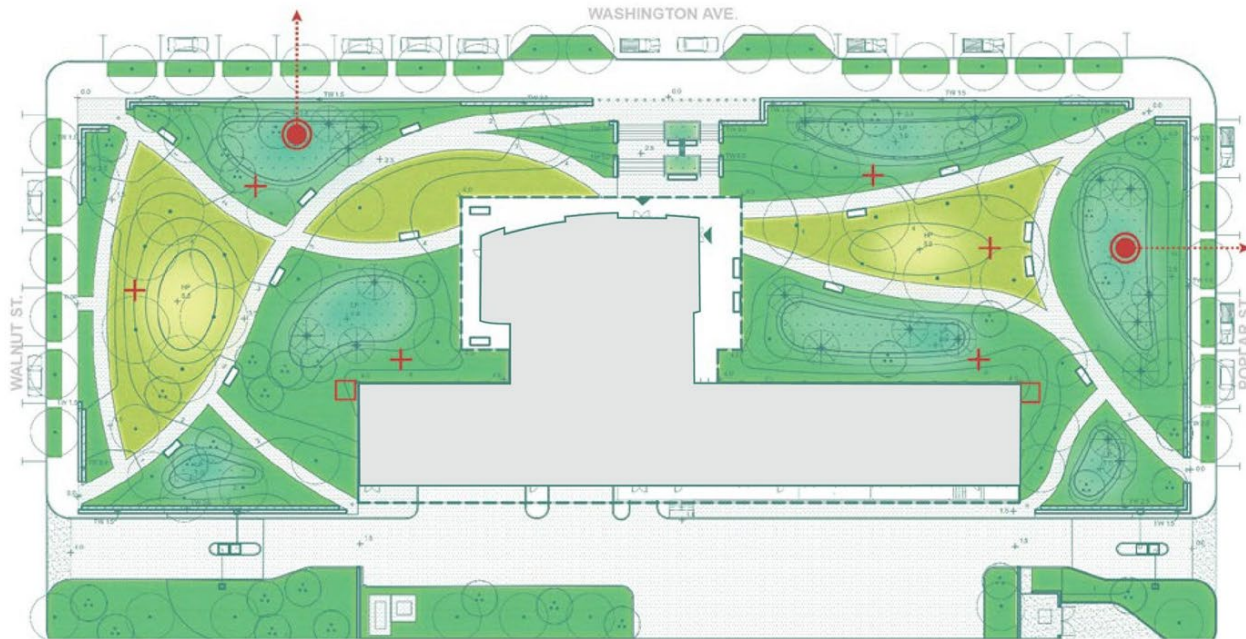
POTENTIAL PILOT PROJECT










 Greenville Courthouse performance goals selected for verification through SCx



2 PROJECT-SPECIFIC GOALS FOR SCx



- | | | |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|  Weather station with rain gauge |  Irrigation flow meter |  Insertion flow meter |
|  Soil moisture sensor |  Outlet control (e.g. weir) with sump & submersible transducer |  Sewer lateral |
| | |  N.T.S. |



GOAL #1 - Manage all rainwater on-site for the 95th percentile storm (2.07-inches)



GOAL #2 - Verify that on-site trees meet growth assumptions, over time, as defined in the vegetative shading portion of the project's energy model

1. **Defining goals will become simpler** over time.
2. **Early SCx goals should focus on water and energy**, & then additional goals may be curated for each project, as needed.
3. Building systems that address rainwater and energy-use reduction (e.g. cistern) may be **downsized to accommodate predictable, site system contribution**.
4. Confirming which entity will be responsible for data collection & analysis, & **budgeting accordingly** is critical.
5. Beneficial to host data online & **store data in a centralized location** for the team to access.
6. **Emphasize the importance of project turn-over**.



LESSONS LEARNED

POTENTIAL IMPACT



- 
1. **Gain assurance** that site is functioning as intended
 2. Save money through **reduced change orders & contractor callback**
 3. Improve the **effectiveness of project turnover**
 4. **Prevent problems** before they start

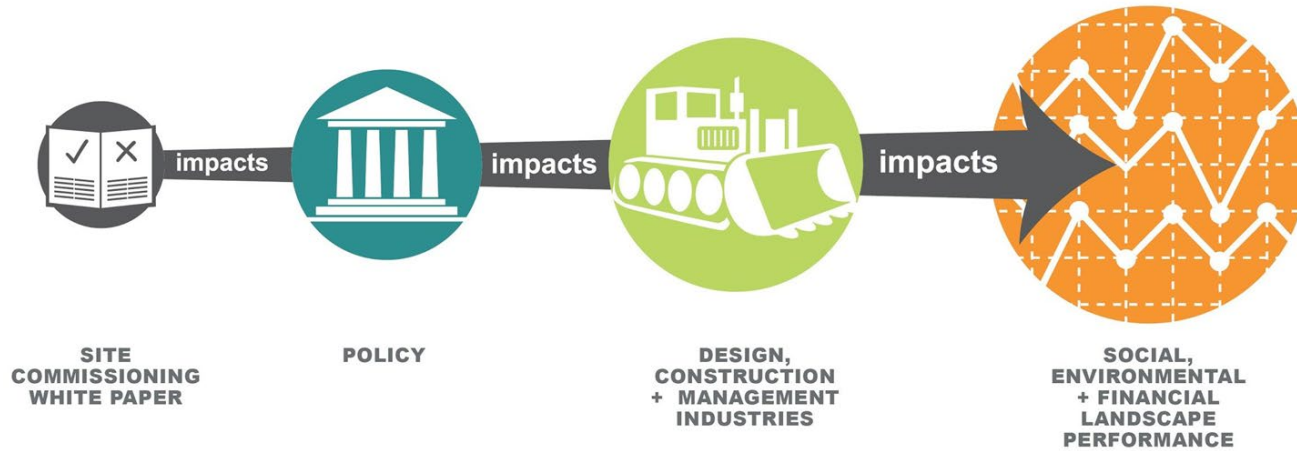


PROJECT-SPECIFIC BENEFITS

- 
1. Confirm **triple-bottom-line performance**
 2. **Protect investment** in land development for the long-term
 3. Build agency-wide arsenal of **proven development & management practices**
 4. **Improve land development efficiency & effectiveness**



AGENCY-WIDE BENEFITS



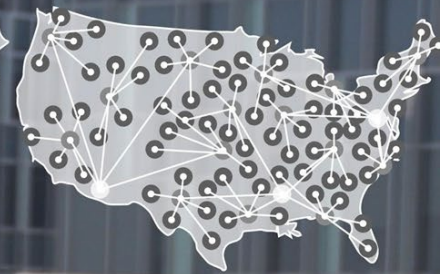
ELEVATING LANDSCAPES



FEDERAL PILOT PROJECTS



FEDERAL ROLL OUT



PRIVATE SECTOR ADOPTION



NATIONAL IMPACT

QUESTIONS

