CITY PARKS ALLIANCE

NATURE-BASED SOLUTIONS FOR MANAGING STORMWATER IN PARKS

Opportunities to Create a Win-Win for Urban Resilience

A policy brief for policymakers, organizational leaders, and advocates in the parks and stormwater sectors

EXECUTIVE SUMMARY

As storms become more intense and unpredictable, our infrastructure must adapt. Parks, forest reserves, greenways, and trails are among the largest green spaces in cities, and, being under public ownership, have immense potential for green infrastructure. By managing stormwater naturally, green stormwater infrastructure (GSI) helps reduce flooding and its financial impacts while protecting ecosystems and enhancing biodiversity. Green infrastructure in parks can improve public health by reducing water pollution and urban heat while increasing green spaces, all of which can lower healthcare costs related to respiratory and heat-related illnesses.[1] It also can enhance a city's climate resilience and create green jobs.[2]

Traditional "gray" infrastructure—gutters, sewers, and tunnels—moves water away from buildings but can contribute to flooding, pollution, and urban heat. In contrast, nature-based solutions like GSI use plants, soils, and permeable surfaces to manage and store stormwater naturally. However, our parks and public green spaces are currently underutilized for GSI due to several barriers: differing visions and priorities among public agency leaders, separate funding sources for parks and water projects, siloed planning and operations between parks and water agencies, policies and regulations that hinder interagency collaboration, skepticism toward nature-based solutions, limited skills for maintaining green infrastructure, and the complexity of engaging communities, particularly those historically disadvantaged, in infrastructure projects. Collaboration between parks and stormwater management agencies, who are not the likeliest of bedfellows, on funding, community engagement, planning, capital projects, and maintenance is the key for cities to unlock their parks' potential for GSI and create a win-win for urban resilience, as well as operational efficiencies and fiscal savings.

Prioritizing GSI in parks can also be an opportunity to advance racial and social equity. Historically, discriminatory policies have limited park and housing access for racial and ethnic minorities, immigrant groups, and low-income families, leaving these communities with less green space and greater exposure to flooding, extreme heat, and pollution. GSI projects in existing or new parks in these communities can address environmental justice needs and improve public health disparities. However, it is crucial to pair green infrastructure implementation efforts with community stabilization and economic development strategies to prevent displacement as property values rise, as well as to secure long-term funding for maintaining this critical infrastructure.

Working with the US Water Alliance and the Green Infrastructure Leadership Exchange, and with the support of the Robert Wood Johnson Foundation, City Parks Alliance invited a cohort of parks and water agency leaders from eight cities across the U.S. to inform how to increase collaboration between the parks and stormwater management sectors and address historic inequities.

Green Stormwater Infrastructure City of Atlanta parks (Credit: Atlanta Department of Watershed Management)

[1] U.S. Environmental Protection Agency. (2024). Environmental Benefits of Green Infrastructure. https://www.epa.gov/green-infrastructure/environmental-benefits-green-infrastructure

[2] U.S. Environmental Protection Agency. (2024). *Green Jobs in Your Community.* https://www.epa.gov/G3/green-jobs-your-community

SEVEN BIG PUBLIC BENEFITS AND OPPORTUNITIES FROM GSI IN PARKS

Guided by existing research and the experience of these practitioners in our cohort, this policy brief highlights the co-benefits of GSI projects in urban parklands to help inspire more GSI projects in parks in more cities. It identifies and addresses the systemic barriers to better collaboration between parks and stormwater management agencies and their partners, and shares recommendations and calls to action for public leaders and policy advocates to help overcome them. It also shares examples and resources to help cities tap into the public benefits and opportunities that GSI in parks can provide.

1 Investing in green stormwater infrastructure within parks creates healthier, more resilient communities.

Cities across the U.S. are facing increasingly intense and unpredictable storms, along with rising extreme heat.[3] Our public infrastructure must adapt to protect public safety and health. Traditional "gray" infrastructure—gutters, sewers, and tunnels—directs water away from buildings but can also contribute to flooding, pollution, and urban heat.[4] In contrast, nature-based solutions like GSI use plants, soils, and permeable surfaces to manage and store stormwater naturally.[5] Parks, already vital for physical activity, social connections, and mental health (highlighted notably during the COVID pandemic), can also mitigate flooding, pollution, and extreme heat by incorporating GSI. Additionally, GSI projects in existing or new parks in underinvested communities can help address environmental justice and improve safety and public health.

As some of the largest public green spaces in cities, parks and other public lands, such as trails, greenways, and forest reserves, offer immense potential for GSI solutions. However, they are often underused for GSI because of a lack of shared vision and priorities between public leaders and policymakers in the parks and stormwater management sectors. More

Storm to Shade, Tucson

[3] U.S. Environmental Protection Agency. (2024). Climate Change Indicators: Weather and Climate. https://www.epa.gov/climate-indicators/weather-climate

[4] U.S. Environmental Protection Agency. (2024). Environmental Benefits of Green Infrastructure. https://www.epa.gov/green-infrastructure/environmental-benefits-green-infrastructure

[5] Green Infrastructure Leadership Exchange. (2024). https://giexchange.org

structural and technical implementation challenges include separate funding sources for parks and water projects, agency silos, unsupportive policies and regulations, skepticism about nature-based solutions, limited green infrastructure maintenance skills, and the complexity of engaging stakeholders, especially those from historically disadvantaged communities, in infrastructure projects.

In the absence of a shared vision across agencies and a collaborative culture, GSI projects can be parochially viewed as competition for funding and space for other recreational amenities in parks. This challenge can be overcome when public leaders articulate a vision that shows GSI being aligned with parks goals. Examples of the co-benefits that follow from that shared vision, from enhanced stormwater management to the creation of new accessible green spaces to providing shade and irrigation solutions, are described in these examples from Houston and Tucson.

CASE STUDY

From Tragedy to Transformation: Houston's Bayou Greenways

Hurricane Harvey, which hit Texas and Louisiana in 2017 with up to 50 inches of rain, caused massive flooding across the Houston metropolitan area, resulting in more than 100 deaths and $125 billion in damage.[6] It remains the costliest natural disaster in Texas history, with much of the destruction stemming from unprecedented rainfall and flooding in Houston and southeast Texas. Harvey's wrath was devastating, but it was earlier, less damaging yet frequent storms that spurred a reassessment of Houston's flood management strategies.

In 2010, park advocates launched plans to expand trails and bikeways along the city's bayous, its slow-moving waterways. These efforts led to the Bayou Greenways project, a transformative initiative creating an interconnected park system along Houston's major waterways. The project will provide access to over 3,000 acres of greenspace and add more than 80 miles of hike-and-bike trails. Covering 150 miles of bayous, the Bayou Greenways system aims to connect 60 percent of Houstonians (around 1.5 million residents) to a greenway within 1.5 miles of their homes, once completed.

This $250 million public-private partnership involves the nonprofit Houston Parks Board and the Houston Parks and Recreation Department, in close collaboration with the Harris County Flood Control District, which manages the bayous for flood control. Community support, donors, and local foundations have played crucial roles in bringing the project to life. Advocates have found that using recent natural disasters as a focal point has helped engage community members and leaders in discussions about innovative infrastructure solutions. The full network is approximately 90 percent complete, providing safe and accessible recreational spaces and flood protection across the city.[7]

A benefits analysis estimated that the Bayou Greenways could generate upwards of $116 million in annual benefits for Houston, including $77 million in physical and mental health benefits (healthcare cost savings, recreational value, and urban cohesion), $22 million in environmental health benefits (improved air quality, increased bike use, ecosystem services, flood/runoff reductions, and enhanced water quality), and $17 million in economic health benefits (retiree retention and relocation, enhanced property tax base, and talent attraction through recreation opportunities).[8]

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[6] National Environmental Satellite, Data, and Information Service. (2024). Hurricane Harvey: A Look Back Seven Years Later. National Oceanic and Atmospheric Administration. https://www.nesdis.noaa.gov/news/hurricane-harvey-look-back-seven-years-later

[7] Houston Parks Board. (n.d.). *Bayou Greenways.* https://houstonparksboard.org/initiatives/bayou-greenways

[8] Crompton, J. L. (2012). Estimates of the Economic Benefits Accruing from an Expansion of Houston's Bayou Greenway Network. *Journal of Park and Recreation Administration,* 30(4).

Examples of Bayou Greenways projects include:

Willow Waterhole Greenspace Conservancy is a 291-acre urban park that combines flood protection with community space. Featuring lakes, prairies, marshes, and native wildlife, Willow Waterhole was developed over decades to address Houston's worsening floods. Its six interconnected lakes help reduce local flooding by storing up to 600 million gallons of stormwater—equivalent to six Houston Astrodomes—and gradually releasing it as waters recede. Beyond flood control, Willow Waterhole offers a scenic space for conservation, education, and recreation.

Harris County Flood Control District (HCFCD) is building stormwater detention basins on a former golf course to reduce flood damage during heavy storms. Jointly funded by the City of Houston, HCFCD, and a federal grant, the project's 12 detention basins will hold water equivalent to 1,200 Olympic-size pools, providing flood relief to over 4,400 structures. While HCFCD's primary goal is flood control, the Houston Parks Board was brought in to incorporate recreational elements. The resulting Inwood Recreation Project plan, shaped with community input, adds trails, recreational areas, and landscaping to the flood control project, creating multibenefit infrastructure.

Willow Waterhole Greenway
(credit: Willow Waterhole Greenspace Conservancy)

Bayou Greenways could deliver over $116 million annually in health, environmental, and economic benefits for Houston.

Inwood Recreation Project
(Credit: Houston Paks Board)

CASE STUDY

Green Infrastructure for a Cooler Tucson: The Impact of the Storm to Shade Initiative

Urban heat is a significant public health concern in Tucson, one of the fastest-warming cities in the U.S. In response, Mayor Regina Romero and the City Council declared a climate emergency in 2020, committing to achieve carbon neutrality by 2030. This declaration led to the development of Tucson's first Climate Action Plan, which serves as a roadmap for reducing greenhouse gas emissions, adapting to climate impacts, and enhancing community resilience.

A major initiative under the plan is Storm to Shade, Tucson Water's GSI program. This program installs and maintains GSI on public properties citywide, using stormwater as the primary irrigation resource for native trees and vegetation that provide shade, reduce flooding, cool the urban environment, and create habitat for native wildlife. Funding for Storm to Shade comes from a small fee included in City of Tucson Water Utility bills, based on water usage, and a park bond.

The program prioritizes investments in new GSI projects and maintenance by using the Tree Equity Score to identify areas with low tree canopy, high surface temperatures, and historically disinvested, vulnerable populations. Importantly, Storm to Shade seeks to layer investment in parks, which serve as crucial public resources that offer myriad benefits to communities, especially those with limited access to green space.

Examples of this work include:

Flowers and Bullets (F&B), a grassroots group from Barrio Centro, evolved from an art collective into a force for sustainability in Tucson, leading initiatives like gardening and rainwater harvesting. F&B members wanted to create multibenefit spaces, often found only in wealthier areas, in their own community. After transforming a closed school into Midtown Farm, a hub for community farming and education, F&B created the Barrio Centro Pocket Park, transforming an underutilized lot into a thriving Sonoran Desert landscape, nourished by rainwater and stormwater runoff. Funded by Tucson Clean and Beautiful, Mayor Regina Romero's Office, Storm to Shade, and Swire CocaCola, and maintained by Storm to Shade and F&B, the pocket park features stormwater basins, rain gardens, and 165 native desert plants.

After Tucson voters in 2018 passed Proposition 407 to fund parks and connections improvements, Storm to Shade partnered with the Tucson Parks and Recreation Department to incorporate GSI at CSM Martin R. "Gunny" Barreras Memorial Park. Storm to Shade worked with designers to replace nonfunctional turf with native trees, shrubs, and grasses irrigated by stormwater from nearby streets, parking lots, and walkways. Located next to Sunnyside High School, the park offers educational opportunities, such as a soil health investigation led by University of Arizona soil scientists. Now maintained by Storm to Shade and Tucson Parks and Recreation, GSI features include vegetated swales, a water-harvesting parking lot, and native landscaping. The 20-acre park also offers renovated sports fields, courts, and bathrooms as well as new and accessible fitness equipment, a splash pad, picnic areas, a walking path, and a playground.

CSM Martin R. "Gunny" Barreras Memorial Park Splash Pad (Credit: City of Tucson)

Public agency leaders must articulate a clear vision that aligns GSI with park goals, creating a foundation for changing unsupportive policies, regulations, and practices.

2 Implementing GSI in parks can promote environmental justice by benefiting historically underserved communities.

In many cities, the neighborhoods most vulnerable to flooding and extreme heat are often home to communities of color that have faced generations of disinvestment and marginalization.[9] These areas endure greater risks and suffer more severe financial, safety, and health impacts from major storms and inadequate infrastructure. This inequity stems from institutionalized discriminatory practices such as redlining, residential segregation, and the siting of polluting facilities, combined with the exclusion or tokenization of these communities in public planning processes.[10,11] As a result, community trust in public infrastructure projects can be low, making it challenging for cities to repair these harms and advance environmental justice.

Parks and stormwater management agencies have a unique opportunity to address these injustices by collaborating to implement GSI in parks. While all communities deserve access to parks and climate protection, tensions can arise when resources are distributed *equally* across geography rather than *equitably* based on need. But addressing long-overdue infrastructure needs can raise concerns about displacement and who will benefit from new investment. Parks and stormwater agencies have an opportunity to work with other public agencies, like housing, planning, economic development, public works, and transportation, and nonprofit partners to invest in green infrastructure as part of a broader strategy for equitable community development.

In flood-prone communities, parks are often repurposed for stormwater collection, limiting their recreational use. This challenge creates an opportunity for stormwater utilities and parks departments to collaborate in acquiring and developing properties that can serve both purposes—especially in underserved neighborhoods that lack green space. Indigenous communities and tribal governments, in particular, are often left out of these discussions, yet nature-based solutions like GSI offer a chance to reconnect people with nature and integrate Traditional Ecological Knowledge into planning.

To address the impacts of environmental racism, public infrastructure projects need to prioritize inclusivity, repair, and long-term equity. By focusing on priorities identified by the community, such as access to green space, this collaborative approach can ensure that investments not only meet infrastructure needs but also promote long-term equity and resilience, particularly in underserved neighborhoods.

Credit: Pittsburgh Parks Conservancy

[9] Berberian, A. G., Gonzalez, D. J., & Cushing, L. J. (2022). Racial Disparities in Climate Change-Related Health Effects in the United States. *Current Environmental Health Reports,* 9(3), 451-464.

[10] Salazar-Miranda, A., Conzelmann, C., Phan, T. et al. (2022). Long-Term Effects of Redlining on Climate Risk Exposure. *Nature Cities* 1, 436–444.

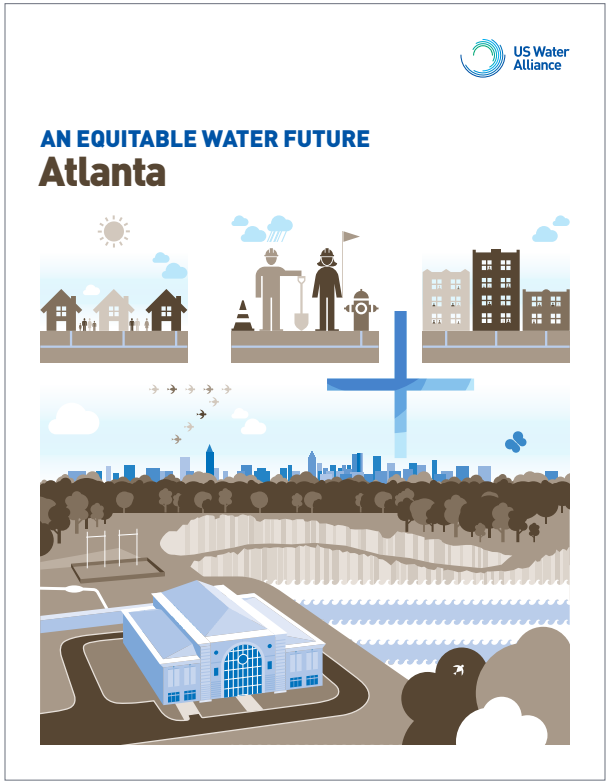
[11] Prevention Institute. (2021). Changing the Landscape: People, Parks, and Power. https://www.preventioninstitute.org/publications/changing-landscape-people-parks-and-power

CASE STUDY

Greening Without Displacement: Atlanta's Strategy for Parks, GSI, and Community Stability

Integrating GSI into Atlanta's city parks is a key strategy for expanding green infrastructure citywide and achieving multiple goals. The Department of Watershed Management and the Department of Parks and Recreation have formed a strong partnership to drive these efforts, guided by the city's commitment to authentic community engagement as outlined in its Water Equity Roadmap. This approach involves collaborating with advocates and stakeholders from the start to identify projects and address potential challenges.

To address concerns about "green gentrification," Atlanta has also taken steps to ensure that revitalization efforts benefit existing communities. In partnership with Invest Atlanta, Westside Future Fund, Atlanta Beltline, City of Refuge, Atlanta Housing, and charitable foundations, the City established the Westside Future Fund. This initiative aims to revitalize five historic Westside neighborhoods, transforming them while prioritizing community retention and support for legacy residents. Atlanta has implemented various anti-displacement measures to help legacy residents stay in their communities. These include an anti-displacement tax fund, property tax relief, rental and homeownership support, home repair assistance, financial literacy programs, workforce training, and affordable housing development. By combining GSI in parks with anti-displacement efforts, Atlanta is not only expanding green space but also stabilizing communities, ensuring that infrastructure improvements benefit existing residents while fostering environmental resilience and social equity.



Water Equity Roadmap (Credit: US Water Alliance)

Examples of this work include:

In 2002, a severe storm caused widespread flooding in Atlanta's historic Westside neighborhoods of Vine City and English Avenue, destroying homes and displacing residents. This disaster sparked a 20-year effort to restore the area and enhance community well-being. A community-led initiative identified green infrastructure opportunities to benefit these underserved neighborhoods. Through extensive partnerships and engagement, this vision was realized with the creation of Rodney Cook Sr. Park. Designed to manage up to a 100-year storm, the park proved its effectiveness during a major storm in 2023, with its 10-million-gallon flood storage capacity redirecting runoff away from the combined sewer system. The park features additional green infrastructure elements, including stormwater planters, rainwater cisterns, wetlands, and an aerating water feature, creating an urban oasis with nature and wildlife. Beyond flood control, the park offers recreational spaces, community gathering areas, and monuments honoring civil rights leaders. Guided by a community advisory board, it serves as a place of healing and connection for the neighborhood.

The Proctor Creek Stream and Floodplain Restoration project at Historic Hunter Hills will restore a section of the creek that was confined to a concrete channel in the 1960s, causing flooding, erosion, and pollution. The creek will be returned to a natural wetland, capable of holding five million gallons of stormwater, reducing local flooding, improving water quality, and creating wildlife habitat. The restoration will also add nearly 10 acres of green space to the Hunter Hills neighborhood, providing new trails, recreational areas, and better access to nature, boosting physical and mental well-being. It will also offer workforce development, environmental education, community science, and service-learning opportunities.

Public leaders, along with issue and community advocates, should champion GSI in parks as a tool to address the enduring impacts of environmental racism by prioritizing inclusivity, restoration, and long-term equity.

Rodney Cook Sr. Park (Credit: Atlanta Area Parks)

Proctor Creek Stream and Floodplain Restoration (Credit: Hunter Hills)

3 Effectively communicating the benefits of GSI in parks can build community trust and help educate and engage stakeholders, inspiring more support for nature-based solutions.

Because GSI is a technical topic, it can be difficult to communicate in ways that foster public understanding and support. To effectively engage the public, it is essential to present GSI concepts in relatable and easy-to-understand terms. Polling by the Water Hub shows that the term "nature-based solutions" resonates better with voters than "green infrastructure" or "natural infrastructure."[12] However, it is best to avoid relying solely on broad terms. Instead, use clear, specific language to describe the projects, like green alleys, rain gardens, or wetlands, and connect them to community priorities. Highlighting how these green spaces address local concerns makes the message more relatable and impactful, whether the focus is on flooding, drought, climate resilience, environmental justice, health, or economic costs.

It is also important to explain why GSI in parks is a win-win for climate, health, and other benefits like cost savings. While policymakers often need data, such as stormwater models to demonstrate runoff reduction, this information can be framed to show the broader value of GSI, including reduced flooding, operational efficiency, and financial savings. Parks are ideal spaces for educating the public about GSI. Many cities have found that installing educational signage around GSI projects to explain how it works and the benefits it offers is an excellent way to engage the public.

Public engagement in this work should be reimagined as a way to build community power, trust, and equity. Creative approaches, such as storytelling through art, can engage residents who might otherwise be unaware of these projects, fostering deeper community involvement and support, and showcasing local culture and history. Framing GSI as a community-driven solution that enhances both environmental health and well-being can make the message more compelling and resonate deeply with residents.

GSI in Tucson

[12] Water Hub. (2023). *Voter poll:* August 2023. https://waterhub.org/wp-content/uploads/2024/08/voter-poll-water-hub-aug-2023.pdf

CASE STUDY

Building Grassroots Power: The Atlanta Watershed Learning Network's Approach to Equitable Green Infrastructure

In 2016, the nonprofit Environmental Community Action launched the Green Infrastructure Advocacy Training, a pilot program focused on community outreach to promote green infrastructure and park development as solutions for stormwater issues. By training residents as green infrastructure and environmental justice advocates, the program strengthened community engagement and established parks as valuable community assets.

This initiative later evolved into the Atlanta Watershed Learning Network, which equips residents from historically disinvested communities of color affected by environmental injustices with the knowledge and skills to restore their watersheds and advocate for equitable development. The program's training modules cover topics such as watershed education, systemic racism, urban planning, community-driven solutions, and watershed management. Focused on communities of color impacted by historic disinvestment and environmental injustice, the Network ensures that residents have a voice in planning a more resilient future for their neighborhoods. Network participants and alumni are taking action to address flooding, reduce water pollution, educate themselves and others on environmental issues, and advocate for parks and green infrastructure projects.

Environmental Community Action (Credit: Environmental Community Action, Inc.)

Atlanta Watershed (Credit: Atlanta Watershed Learning Network Group)

CASE STUDY

Art, Education, and Engagement: Raleigh's GSI Strategy

The City of Raleigh and the nonprofit Partners for Environmental Justice have a long-standing partnership focused on community engagement, including initiatives like the Walnut Creek Watershed Learning Network. Modeled after Atlanta's program, this network educates residents on topics such as climate risks, watershed management, community science, environmental justice, advocacy, green infrastructure, extreme heat, and resilience, with stipends for participant involvement. Recently, The Conservation Fund established a similar initiative, the Raleigh Parks with Purpose Community Task Force, to enhance underserved neighborhoods with park amenities, green stormwater infrastructure, public art, and other social and environmental projects.

Raleigh also supports formal community involvement in green infrastructure through permanent, City Council-appointed boards, including the Parks, Recreation, and Greenway Advisory Board and the Stormwater Management Advisory Commission.

The city engages the community in green infrastructure through various creative efforts, such as:

- Leading tours and educational activities on GSI throughout Raleigh's parks.
- Installing artistic GSI displays, like the Alluvial Decoder and the Healing Continuum, in parks and greenways.
- Launching the GSI Visual Monitoring Program, where visitors photograph evolving GSI sites and provide feedback through brief surveys.
- Hosting project open houses and surveys for resident input on amenities, plant selection, and other design choices.
- Expanding GSI outreach in underserved areas through a rain garden teacher training and student apprenticeship program, introducing students to GSI design, planning, and installation while supporting Raleigh Stormwater's goals for education, community participation, and stormwater management.

Walnut Creek Watershed Learning Network (Credit: Raleigh)

GSI Visual Monitoring Program (Credit: Raleigh)

CASE STUDY

Quantifying Co-Benefits: The GSI Impact Hub

The Green Infrastructure Leadership Exchange GSI Impact Hub is an interactive platform with a suite of resources and tools to help quantify and communicate the multiple benefits (or co-benefits) of GSI and assist in siting and planning projects to achieve the greatest impact. One such tool is the GSI Impact Calculator, which provides a detailed analysis of potential GSI projects. Users can input local data to customize scenarios and assess benefits like flood reduction, heat mitigation, improved water quality, and job creation. This tool supports informed, strategic decision-making in the initial stages of infrastructure planning.

GSI Impact Hub
(Credit: Green Infrastructure Leadership Exchange)

Public leaders, along with issue and community advocates, should use the term "nature-based solutions" instead of technical jargon like GSI to make the message more relatable and impactful. Highlighting how infrastructure improvements align with community priorities—whether for climate resilience, public health, or cost savings—can build broader public support and buy-in.

4 Successfully integrating GSI in parks requires a collaborative, interdisciplinary approach that can transform how governmental agencies work together and serve their communities.

Parks and water agencies often have distinct cultures and goals when it comes to planning and implementing capital projects, especially in terms of community engagement and collaboration. Due to their distinct missions and operational silos, collaboration between these disciplines is not standard practice in many cities. Identifying opportunities for more systemic collaboration, for example on funding and development of capital projects and maintenance, is required to attain the mutual benefits green infrastructure can deliver.

Park leaders, focused on recreation and community activities, may not always recognize the full potential of parks in implementing GSI and related benefits such as economic development and fiscal cost savings. Water agencies, for their part, may not see parkland as an opportunity for stormwater management sites. Strong, clearly defined partnerships are essential to bridging these perspectives. Establishing a shared vision for GSI upfront and identifying common ground early on is critical to preventing potential conflicts. Roles and responsibilities should also be clearly defined, as there is often confusion about who is responsible for maintaining GSI in parklands. Developing a standardized process for coordination and planning between agencies will provide opportunities for park master planning to align with stormwater capital improvement planning and budgeting.

Addressing these challenges requires strong political will, along with changes in internal practices and procedures within departments, to shift the status quo in public sector capital projects, operations, and maintenance. Peer learning networks, such as our cohort and the Green Infrastructure Leadership Exchange, can play a crucial role in supporting this transition and fostering collaboration by learning from cities that are realizing the shared benefits of GSI.

Some of the City Parks Alliance Cohort

CASE STUDY

Boston Elevates Green Infrastructure with First-Ever Cabinet-Level Position

In 2022, Boston became the first major U.S. city to establish a dedicated cabinet position for green infrastructure, appointing Kate England to lead these efforts. Mayor Michelle Wu tasked England with advancing the City's Green New Deal goals, focusing on widespread implementation of green infrastructure. As an experienced engineer and planner, England leverages relationship-building and collaboration to drive systemic change across Boston. She leads the interdepartmental Green Infrastructure Working Group, bringing together various city departments to standardize green infrastructure design across city projects like sidewalk reconstruction, street repaving, development review, tree planting, and park renovations.

In addition to securing capital funding for green infrastructure projects, England works closely with key departments such as Boston Public Schools; the Housing Authority; Public Works, Parks and Recreation; and the Public Library to integrate green infrastructure into their plans and operations. While many cities have green infrastructure roles within water, sewer, or utility departments, Boston's decision to elevate this work to an executive level underscores the city's commitment to embedding nature-based solutions into its urban landscape. This leadership not only improves green spaces but also promotes innovation in flood control, air quality, public health, and job creation, positioning Boston as a model for cities pursuing green infrastructure through cross-sector collaboration.

Boston green infrastructure (Credit: City of Boston)

CASE STUDY

Districtwide GSI: Greening Milwaukee's Schoolyards for a Healthier Future

In 2015, the Milwaukee Metropolitan Sewerage District (MMSD) launched an ambitious initiative to invest in GSI in schoolyards, aligning with its broader goals of stormwater management and resilience. MMSD recognized that converting asphalt-paved schoolyards into green spaces not only reduces runoff and pollution but also promotes public health and climate resilience. Instead of targeting individual schools, MMSD focused on securing districtwide support.

A key to this success was partnering with Reflo, a local nonprofit that mobilized community engagement around the schoolyard transformations. Additional key partners include the City of Milwaukee, philanthropic funders, and academic institutions. MMSD established a three-way legal agreement with the City of Milwaukee, which owns the land, and Milwaukee Public Schools, which manages the properties. This agreement covers funding, long-term maintenance, and a conservation easement to ensure the continued care of the GSI, with Milwaukee Public Schools responsible for maintenance, supported by Reflo. Since 2019, the Green and Healthy Schools program has transformed 26 schoolyards, with 10 more projects in development, partnering with five schools each year.

Tools developed through the MMSD program include:

» MMSD's Green Infrastructure Guide for Schools.

» MMSD legal agreement covering funding and maintenance of GSI on school sites.

MMSD schoolyard initiative (Credit: MMSD)

CASE STUDY

Breaking Down Silos: Seattle's Innovative Liaison Model for Green Infrastructure

Since the early 2000s, Seattle Public Utilities (SPU) and Seattle Parks and Recreation (SPR) have shared a unique liaison position focused on coordinating GSI projects in parks. This position, structured under a multiyear memorandum of agreement, is evenly funded by both departments. While SPR manages the liaison's payroll and is reimbursed quarterly by SPU, the liaison serves both departments equally.

The jointly staffed liaison role exemplifies Seattle's "One City" approach, which prioritizes serving residents effectively, regardless of departmental boundaries or funding sources. Typically, government agencies operate within strict silos; however, this role fosters collaboration, promoting efficient use of public funds and easing coordination challenges between departments. As part of a broader cultural shift, Seattle is also beginning to view parks and open spaces as part of the public "right of way," similar to streets and sidewalks, a subtle yet transformative change in mindset and operations.

The liaison's role is not only about advancing the best use of public resources, but also about staying neutral between departments. While department staff may advocate strongly for specific project goals, the liaison's objectivity is essential for effective collaboration. This role is inherently relational, bridging the missions and priorities of both departments.

In concept, collaboration between parks and stormwater management is a win-win. In practice, however, issues of departmental property ownership, fiscal responsibility, and staff roles present real challenges. Moving beyond these silos requires both structural solutions, like the liaison position, and a commitment to creative, courageous leadership at all levels.

Public leaders need to clearly define roles and responsibilities and establish standardized processes for coordination and planning between agencies on capital projects and maintenance.

Seattle's Green Lake Park

5 The current gap in green infrastructure maintenance skills presents workforce development opportunities for disadvantaged communities.

Ongoing maintenance is crucial for public infrastructure, but GSI requires specialized care beyond traditional gray infrastructure. For example, nature-based solutions rely on resilient native plants that must be cultivated, not mowed, and maintaining porous pavement in parks or courtyards involves different methods than those used for standard asphalt or concrete.

Many park agencies will need workforce training to manage and maintain green infrastructure. This need represents an opportunity for workforce development, as GSI maintenance creates a pipeline of green jobs. But it raises several questions: Who will be responsible for managing GSI assets in parks? Who should fund it? What skills do park maintenance teams already possess? Are there local contractors with GSI expertise?

For all these reasons, it is essential to include maintenance staff throughout the entire planning, budgeting, design, construction, and evaluation process. Given GSI's specific maintenance needs, setting aside funds annually for retrofitting infrastructure is a wise investment. As cities across the country address these challenges, standards for GSI maintenance are evolving, along with innovative funding and partnership models.

The workforce for creating and maintaining GSI is still relatively small. Water agencies excel at maintaining pipes, and park departments focus on green spaces, but many agencies lack the in-house capacity for GSI design and maintenance, highlighting the need for skilled contractors, landscapers, and maintenance crews. Compounding the issue, limited external expertise and public procurement rules often create barriers to contracting private firms, as there can be a dearth of competition in the bidding process.

Credit: Pittsburgh Parks Conservancy

In disadvantaged communities, GSI in parks not only addresses environmental injustice but also creates significant workforce development opportunities. It can create living-wage green jobs, equipping people, including young people, with skills that drive economic growth, help them thrive, and help prevent displacement. Additionally, GSI offers opportunities to connect with immigrant rights and prison reform movements, creating stable economic pathways for undocumented workers and formerly incarcerated individuals.

Partnerships with local workforce development organizations and community-based nonprofits are the keys to exploring these opportunities. On a national level, the National Green Infrastructure Certification Program supports this workforce development by providing technical training for current GSI professionals and preparing new candidates to enter the green workforce and earn a sustainable living.

CASE STUDY

Advancing Equity through Green Jobs: The PowerCorps Philadelphia Model

For over a decade, PowerCorpsPHL has provided Philadelphia's youth with high-quality, paid career training programs, leading to sustainable careers in clean energy and community-focused fields. PowerCorpsPHL members work full-time on environmental projects led by the Philadelphia Water Department and Philadelphia Parks and Recreation, addressing critical challenges like GSI, pollution reduction, and land revitalization. This work benefits the city by creating cleaner, healthier public spaces while equipping members with essential green workforce skills.

Since 2013, PowerCorpsPHL has trained over 660 young Philadelphians, with two new cohorts each year. Participants from diverse backgrounds, including those with criminal records, foster care experience, and recent graduates, train in fields like GSI, urban forestry, and solar and electrical work. They also receive access to social services such as childcare and mental health support to build well-being and resilience.

Funded by AmeriCorps, city agencies, and private philanthropy, PowerCorpsPHL has completed over 10,000 work orders in its first 10 years, with 35 alumni securing full-time roles at the Philadelphia Water Department alone. The program not only strengthens the green job pipeline but also builds community support for nature-based solutions, improves public health, and fosters a network of volunteer stewards for green spaces across Philadelphia.

PowerCorpsPHL has completed over 10,000 work orders in its first 10 years, with 35 alumni securing full-time roles at the Philadelphia Water Department alone.

Credit: PowerCorpsPHL

CASE STUDY

Green Jobs and Green Spaces: Landforce's Solution for Pittsburgh

Landforce is an environmental restoration and workforce development organization that supports individuals reentering society through paid, meaningful work focused heavily on maintaining parks and green infrastructure across Pittsburgh. Since 2016, Landforce crews have completed over 57,000 hours of service on more than 100 projects, partnering with nearly 50 local organizations and making a significant impact on both Pittsburgh's parks and its workforce.

GSI maintenance is central to Landforce's work, some of which takes place within Pittsburgh's parks. Crews are trained to install, maintain, and restore rain gardens, bioswales, and stormwater systems that help manage flooding, improve water quality, and support urban ecosystems. These projects, along with trail construction, tree planting, habitat restoration, and erosion control, contribute to climate resilience and enhance the health of Pittsburgh's communities.

During their nine-month employment, Landforce crew members receive wages, intensive skills training, hands-on experience in restoration work, and career coaching. This approach has led to strong outcomes, with over 90 percent of participants securing stable jobs they retain for at least a year. By combining workforce training with environmental stewardship, Landforce helps individuals facing employment barriers build stable, sustainable careers in green infrastructure and beyond.

Public leaders, along with issue and community advocates, should recognize GSI in parks as a powerful opportunity for workforce development. Collaborating with partners to establish a skilled workforce pipeline is key to meeting ongoing maintenance needs.

Credit: Landforce

6 There are park funding opportunities for green infrastructure that park leaders can access by collaborating with partners.

Funding GSI in parks is challenging because stormwater infrastructure and parks traditionally rely on separate funding streams. But GSI can be an opportunity to create a new revenue source for park improvements. Political will to support these projects is often driven by regulatory pressures, such as regional Clean Water Act violations. And partnerships between park agencies and stormwater management agencies are emerging in some cities to jointly fund GSI in parks regardless of regulatory pressure, due to the need for enhanced climate resilience. However, because taking a green rather than gray approach is voluntary in most areas, agencies often need to piece together funding for various stages of a project.

Experienced practitioners recognize that there is no single funding source for GSI in parks. Important local revenue sources include the stormwater fees collected by stormwater management entities, and other development fees and exactions that may be charged by local governments on new real estate development. Public funds for stormwater, like Clean Water State Revolving Funds, set green infrastructure funding goals but are not always supportive of green infrastructure solutions, depending on the state's funding criteria. Federal legislation, including the Infrastructure Investment and Jobs Act of 2021 (also known as the Bipartisan Infrastructure Law) and the Inflation Reduction Act (IRA) of 2022, created new opportunities for accessing public funding for GSI in parks during the Biden administration. But continued funding, particularly for the IRA, could be subject to changing political priorities.

Alternative financing methods, such as environmental impact bonds, revenue-sharing agreements, and tax increment financing, offer additional funding options for various contexts. Private equity, such as from social impact investors, is also available but plays a complementary role rather than driving investment. Charitable foundations focused on public health and environmental issues may also offer some support for this work.

To ensure effective collaboration when sharing funding responsibilities, it is important for parks, stormwater management agencies, and their partners to establish clear expectations through memoranda of understanding. And practitioners note that more research is needed to demonstrate the financial, health, and environmental return on investment of GSI for policymakers.[13] As the field grows, there are more opportunities to evaluate and capture the impact of multibenefit projects.

Credit: Pittsburgh Parks Conservancy

[13] Green Infrastructure Leadership Exchange. (2023). *The state of public sector green stormwater infrastructure: Obstacles and opportunities*. https://giexchange.org/the-state-of-public-sector-gsi/

CASE STUDY

City Parks Alliance Equitable Funding Hub: Resources for Funding GSI in Parks

City Parks Alliance maintains a list of park funding sources through the Equitable Funding Hub, designed as a starting point for exploring funding strategies, complete with examples, case studies, and additional resources. The Climate Adaptation, Resilience, and Recovery section specifically includes funding options for GSI in parks.

CASE STUDY

Innovative Funding for Urban Resilience: Atlanta's First-of-Its-Kind Environmental Impact Bond

In 2019, Atlanta became the first U.S. city to use Environmental Impact Bond financing for green infrastructure projects. With a Rockefeller Foundation grant, the City partnered with an impact investment firm and a mission-oriented broker-dealer to issue the first publicly marketed Environmental Impact Bond, targeting socially and environmentally conscious investors. Atlanta's Department of Watershed Management secured $14 million to fund green infrastructure in the Proctor Creek Watershed, an area heavily affected by flooding, combined sewer overflows, environmental degradation, and unemployment. The financing supports six projects, selected through community planning and collaboration, aimed at reducing flooding, improving water quality, restoring wildlife habitats, creating recreational spaces, supporting public health, providing local jobs, and increasing resilience in Westside neighborhoods. Collectively, these projects are expected to reduce stormwater runoff by approximately 55 million gallons each year.[14]

Atlanta secured a $14 million Environmental Impact Bond to support six GSI projects, designed to reduce stormwater runoff by 55 million gallons annually.

Mayor Keisha Lance Bottoms (Credit: City of Atlanta Department of Watershed Management)

[14] City of Atlanta Department of Watershed Management. (n.d.). Environmental impact bond. https://www.atlantawatershed.org/environmental-impact-bond/

CASE STUDY

Combining Funding Streams for Success: Tucson's Storm to Shade Program

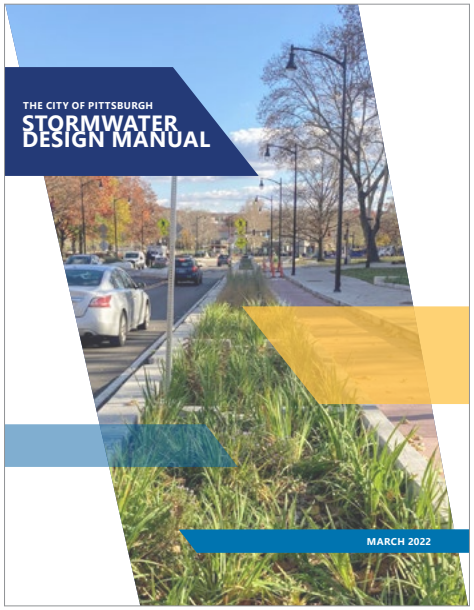
Tucson's Storm to Shade program succeeds in part because of its diversified funding structure, which blends a park bond with a GSI surcharge on water bills. Proposition 407, a $225 million bond approved by Tucson voters in 2018, funds park and connection improvements over 10 years (2019-2028). Park projects include upgrades to playgrounds, sports fields, pools, splash pads, recreation centers, and other amenities, while connection projects focus on greenways, pedestrian safety, and bicycle boulevards. Additionally, the city charges a small fee on every water utility bill within city limits. This fee is assessed based on customers' water consumption at a rate of 13 cents per 100 cubic feet used. The average residential customer pays about $1 per month, generating roughly $2 million annually. Of this, $300,000 is allocated to new GSI projects in each of the city's six wards, $300,000 is directed at the mayor's discretion, and $300,000 goes toward maintaining existing GSI.

CASE STUDY

Pittsburgh's Stormwater Trust Fund: Leveraging Development Fees for Green Infrastructure

Pittsburgh's Stormwater Design Manual provides technical guidance for meeting stormwater management requirements on development and redevelopment sites, ensuring new projects help mitigate flooding, basement backups, and pollution of the city's waterways. Updated in 2022, the manual allows developers unable to meet code requirements to pay a one-time fee of $600,000 per acre-inch of the required stormwater volume for each drainage area, with annual rate adjustments as needed. Fee-in-lieu payments are made to the city's Stormwater Trust Fund before construction begins. Funds are used to construct and maintain GSI on other sites (including parks) and meet the city's water quality regulations.

Public agency leaders should partner to maximize all available revenue streams for GSI in parks and adopt creative strategies to piece together funding from multiple sources for various project stages.



Stormwater Design Manual (Credit: City of Pittsburgh)

7 Successfully implementing GSI in parks can encourage the development of more supportive policies for nature-based solutions at all levels.

Key policy levers at the federal, state, and local levels can help integrate GSI into parks, but existing policies and agency procedures often create barriers. It is essential to assess how current policies either support or hinder GSI implementation and work to remove those obstacles. For example, challenges with contracting and procurement can delay projects, while inflexible ordinances may limit stormwater agencies' ability to adopt innovative solutions.

The civil engineering field, in its role to protect public safety, is seeking more information and resources about how to implement green infrastructure, since gray infrastructure is far more familiar and predictable. As a result, green infrastructure and nature-based solutions require ongoing efforts to increase awareness and understanding of their benefits and advantages over gray infrastructure. To support this process, municipalities should establish clear guidelines on why and where to implement GSI in parks, providing standardized project details instead of relying on developers to create them on an ad hoc basis. Equally important is the need, wherever possible, to measure and document benefits to all relevant public policy areas, including the collection of qualitative data that can be used to provide more immediate feedback.

Innovation within government can be difficult, especially when coordinating with quasi-governmental entities with different service areas and duties to serve. Starting with small-scale pilot projects allows practitioners to test approaches, learn what works, and refine strategies before scaling up. Success relies on building consensus along the way with other agencies, community groups, advocates, design professionals, and elected officials. Demonstrating success will ultimately help move the needle and embed GSI into standard practice for parks agencies, unlocking its many benefits.

Raleigh Rose Garden, NC (Credit: Raleigh)

CASE STUDY

Transforming Policy and Practice: Raleigh's Approach to Citywide GSI Implementation

The Raleigh City Council has shown a strong commitment to environmental quality by prioritizing GSI. Beyond integrating GSI into the City's Comprehensive and Strategic Plans, Raleigh has embedded these principles in City codes and agency practices. Recognizing that previous design standards unintentionally hindered GSI, a Code Review Work Group of City staff and community stakeholders met from 2014 to 2016 to identify and address nearly 25 such obstacles, resulting in targeted code updates. Recent changes have continued this progress, allowing GSI to be included in development amenity areas and buffers, providing designers greater flexibility in incorporating GSI practices. To further support this shift, Raleigh's GSI Policy now requires all capital improvement projects, including those in City parks, to evaluate the feasibility and benefits of incorporating GSI from the start.

Since implementing these changes, Raleigh has made significant strides, including integrating GSI into City projects; incentivizing its use in private developments; incorporating GSI into rezoning processes; and embedding GSI in long-term plans for parks, road upgrades, and neighborhood planning. The city has also updated the Unified Development Ordinance; customized planting palettes with a focus on maintenance; provided training to hundreds of project managers and maintenance staff; expanded the GSI maintenance program; and developed standard details, technical specifications, fact sheets, and outreach materials for GSI initiatives.

The City's Advancing Use of GSI Plan outlines specific steps Raleigh is taking to encourage GSI implementation citywide. This commitment has led Raleigh Stormwater to partner with the Parks, Recreation, and Cultural Resources Department on GSI projects at Walnut Creek Wetland Park, Glen Eden Pilot Park, Raleigh Rose Garden, Lions Park, Biltmore Hills Park, Wooten Meadow Park, and Dorothea Dix Park, and on various urban heat islands reduction projects. Funding from the stormwater utility has been allocated for additional high-priority projects, and the FY 2025 budget included a dedicated four-person GSI maintenance crew within the Parks department, fully funded by the Stormwater Utility Fee. This new team will reduce reliance on external contractors as Raleigh's GSI program continues to expand.

Wooten Meadow Park (Credit: Raleigh)

Raleigh Rose Garden (Credit: Raleigh)

CASE STUDY

Adapting to a Changing Climate: Pittsburgh's Updated Stormwater Policies and Infrastructure

Approximately 75 percent of Pittsburgh's sewer system is a combined sewer system, where wastewater and stormwater flow through the same pipes, while the remaining 25 percent is a municipal separate storm sewer system, with separate pipes for each. Both systems aim to safely channel water to treatment plants, but aging infrastructure, heavy rainfall, and human activities often strain these systems threatening public health and safety.

With increasingly intense rainfall events, stormwater management has become a top priority in Pittsburgh. Heavy rains can overwhelm the sewer system, leading to sewage overflows into rivers, street flooding, and basement backups. To tackle these challenges, Pittsburgh is implementing a distributed stormwater management approach with both green and gray infrastructure across the city, including in parks. This network captures and slows water flow using natural and engineered features such as vegetation, soils, open channels, and underground storage, creating more flood-resilient neighborhoods and improving water quality.

These priorities are now embedded in city policy. The 2022 update to the Stormwater Management Code incorporates climate change projections, and the city's Stormwater Design Manual includes updated standards for volume and rate control to address future climate impacts. Additionally, a stormwater fee based on property impervious surfaces ensures all property owners contribute fairly to stormwater projects, providing an equitable funding solution.

Public leaders and advocates must evaluate how current policies either support or hinder GSI implementation and work to eliminate barriers. Launching small-scale pilot projects provides an opportunity to test approaches, identify what works, and refine strategies before scaling up.

Construction of Maryland Avenue Stormwater Project in Shadyside (Credit: PGH2O)

CONCLUSION: A CALL TO ACTION FOR PUBLIC LEADERS AND ISSUE ADVOCATES

Cities are increasingly grappling with extreme weather events, from devastating floods to prolonged droughts, both of which strain infrastructure and communities. GSI uses the natural functions of ecosystems to protect cities, reduce costs, create jobs, and deliver a wide range of community benefits. Parks are an ideal location for GSI, helping cities adapt to climate challenges while enhancing public spaces. Across the U.S., there are successful examples of GSI in parks that can serve as adaptable models for other cities.

But we are missing the opportunity to capture these benefits by relying on traditional gray infrastructure alone, in part due to prohibitive policies and practices. How can policymakers and advocates work to change this status quo and expand the use of GSI in parks?

» Public agency leaders must articulate a clear vision that aligns GSI with park goals, creating a foundation for changing unsupportive policies, regulations, and practices.

» Public leaders, along with issue and community advocates, should champion GSI in parks as a tool to address the enduring impacts of environmental racism by prioritizing inclusivity, restoration, and long-term equity.

» Public leaders, along with issue and community advocates, should use the term "nature-based solutions" instead of technical jargon like GSI to make the message more relatable and impactful. Highlighting how infrastructure improvements align with community priorities, whether for climate resilience, public health, or cost savings, can build broader public support and buy-in.

» Public leaders need to clearly define roles and responsibilities and establish standardized processes for coordination and planning between agencies on capital projects and maintenance.

» Public leaders, along with issue and community advocates, should recognize GSI in parks as a powerful opportunity for workforce development. Collaborating with partners to establish a skilled workforce pipeline is key to meeting ongoing maintenance needs.

» Public agency leaders should partner to maximize all available revenue streams for GSI in parks and adopt creative strategies to piece together funding from multiple sources for various project stages.

» Public leaders and advocates must evaluate how current policies either support or hinder GSI implementation and work to eliminate barriers. Launching small-scale pilot projects provides an opportunity to test approaches, identify what works, and refine strategies before scaling up.

ABOUT THE PARKS AND GREEN STORMWATER INFRASTRUCTURE INITIATIVE

In 2023, City Parks Alliance launched an initiative to help parks and water professionals collaborate more effectively on green stormwater infrastructure within park systems. This collaboration aims to create new green spaces and recreational areas, boost climate resilience and biodiversity, improve public health and social equity, and offer fiscal benefits.

In collaboration with the US Water Alliance and the Green Infrastructure Leadership Exchange, and with support from the Robert Wood Johnson Foundation, we convened a cohort of parks and water agency leaders from eight cities. Our goal is to explore ways to enhance collaboration between these sectors and address historic inequities. The cohort shares experiences and strategies for overcoming barriers to developing GSI in urban parks, highlighting the many benefits it can bring.

The Parks and Green Stormwater Infrastructure Initiative cohort includes representatives from the parks and stormwater fields from Atlanta, Boston, Houston, Milwaukee, Pittsburgh, Raleigh, Seattle, and Tucson, including the:

- Atlanta Department of Parks and Recreation
- Atlanta Department of Watershed Management
- Boston Office of Green Infrastructure
- Boston Parks and Recreation Department
- Harris County (TX) Flood Control District
- Houston Department of Public Works
- Houston Parks Board
- Milwaukee Metropolitan Sewerage District
- Pittsburgh Department of City Planning
- Pittsburgh Water and Sewer Authority
- Raleigh Parks, Recreation, and Cultural Resources Department
- Raleigh Stormwater
- Seattle Parks and Recreation
- Seattle Public Utilities
- Tucson Parks and Recreation Department
- Tucson Water
- Willow Waterhole Greenspace Conservancy (Houston, TX)

Learn more and access tools and resources at https://cityparksalliance.org/stormwater.

City Parks Alliance is the only independent, nationwide membership organization focused exclusively on urban parks. It brings together a growing network of civic and community leaders, government agencies, parks and recreation authorities, funders, and others. The mission of the Alliance is to educate and empower a diverse community to harness the power of parks in creating equitable, resilient, and thriving cities.

The Green Infrastructure Leadership Exchange is a social innovation network and a community of practice that seeks to activate local governments and stormwater agencies in the U.S. and Canada to implement GSI equitably. It achieves this mission primarily through engaging cross-sector GSI practitioners in professionally facilitated peer learning experiences through which innovations to GSI implementation challenges are developed and communicated across the network.

The **US Water Alliance** is dedicated to advancing policies and programs to advance a sustainable water future for all. The Alliance brings together diverse interests to identify and advance common-ground, achievable solutions for our nation's most pressing water challenges. Its membership includes water providers, public officials, business leaders, environmental organizations, community leaders, policy organizations, and more.

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» Rachel Bennett, Director of Health Equity, MIG

» Nathan Polanski, Civil Engineer, MIG

» Itzel Peña, Former Project Associate, MIG

Cohort members:

» Shawsheen Baker, Capital Projects Superintendent, Raleigh Parks, Recreation and Cultural Resources Department

» Blue Baldwin, Storm to Shade Program Manager, Tucson Water

» Amanda Barnett, Senior Planning and Development Specialist, Liaison, Seattle Parks and Recreation

» John Brandt, Senior Capital Projects Manager, Houston Parks Board

» Bill Burhans, Board President, Willow Waterhole Greenspace Conservancy, Houston

» Todd Burley, Sustainability Advisor, Seattle Parks and Recreation

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