

Arthington Mall Plaza: Green Infrastructure, Outdoor Oasis and SITES™

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Sustainable Features



Rain Gardens

The most effective way to retain stormwater onsite is by incorporating green infrastructure components such as native plant rain gardens. This area features over 11,000 square feet of rain gardens.



Pollinator Habitats

There is nearly 14,500 sq ft of native plantings that attract urban pollinators like the Monarch butterfly. The comprehensive Operations and Maintenance Plan and training for grounds staff is important for long-term health of the areas. Green infrastructure is only effective at reducing stormwater runoff when it is properly maintained.

Mature Trees

There are 24 mature, healthy honey-locust trees highly valued not only in the Arthington Mall Plaza itself, but the near west side community in general, prized for their aesthetic benefits, for the cooling shade they provide, and for their contributions to controlling water runoff, stabilizing the soil, and sequestering atmospheric carbon.



Permeable Pavers

The renovation of Arthington Mall installed 10,350 sq ft of permeable pavement while also reduced the square footage of impervious paving onsite by 19,000 sq ft which is predicted to increase the retention of 653,060 gallons of runoff water annually, or 188,709 per rain event.



Arthington Mall Plaza



This project is a joint effort between the University of Illinois at Chicago, the National Fish and Wildlife Foundation, and the Metropolitan Water Reclamation District of Greater Chicago to promote the use of green infrastructure as an effective means of stormwater management. The site provides a welcoming, hospitable space that retains stormwater onsite and is part of the larger campus green space system of pedestrian streets and promenades.

Sustainable Goals

Detains stormwater by incorporating green infrastructure components such as permeable paving, native plants, and rain gardens with monitoring stations (rain gauges) to evaluate their efficacy.



Implements a long-term, comprehensive Operations and Maintenance plan to ensure longevity of green infrastructure.

Creates areas for flexible use by students, faculty, and staff with new walkways, seating options, artwork, landscaping and energy efficient exterior lighting.



Reduces the square footage of impervious paving on-site and implements sustainable site design and utility standards;

SITES Recognition

Earning SITES certification publishes the project's sustainable commitment as the SITES principles align with the goals of the project of:

- Creating regenerative systems and foster resilience.
- Ensuring future resource supply and mitigate climate change.
- Transforming the market through Design, Development and Maintenance Practices.
- Enhancing Human Well-Being and Strengthen Community.

Site Context



Western view of deteriorated pavers, 2010



Western view of a rain garden, 2021



"Tussle" by Ted Sitting Crow Garner

Arthington Mall Plaza is a 37,000 square-foot biodiversity haven located in the middle University's Health Sciences Colleges. Previously, the space served as a residential city block that included three-flat apartment buildings, alleyways, and utilities. Since then, the space has been transformed into a pedestrian-only green space that personifies the goals of the UIC Climate Commitments. The property on which Arthington Mall sits was part of Native American sacred land, and nature plays a part in the healing tradition. In a nod to the site's Native American roots, Arthington Mall is anchored by the sculpture, "Tussle" by Ted Sitting Crow Garner.

Overcoming Construction Challenges

The site's history posed numerous challenges during design and construction including the presence of contaminated soils and characteristics thereof that were difficult to fully characterize prior to excavation, conflicts with old and abandoned buried utilities that were sometimes not accurately represented on record documents, and the logistics of coordinating a project of this size in the heart of an active campus community.



The main takeaway would be to conduct a more thorough site design and investigation prior to the start of construction. Looking ahead into the future of the renovation of similar spaces, more vigorous soil contamination testing should be done at smaller intervals.

Arthington Mall Plaza

A Case Study in Green Infrastructure Implementation

Background

The University of Illinois at Chicago

Located in the heart of one of the world's great cities, the University of Illinois at Chicago (UIC) is a vital part of the educational, technological and cultural fabric of the region. UIC transforms lives, inspires discovery, and serves individuals, communities and businesses. As stated in its mission: "UIC embraces its mission of teaching, research, service and economic development through hundreds of academic programs, community service initiatives, and research endeavors". UIC is Chicago's only public research university with over 33,000 students, 16 colleges, and a hospital and health sciences system. UIC is among the top five most diverse campuses in the nation and a national leader among urban, public higher education institutions in providing access to underrepresented students.

Stormwater Management in the City of Chicago

Today, storm water flows directly into the combined storm water-sewer system that is part of the Metropolitan Wastewater Reclamation District (MWRD) where it is treated and released into the Sanitary Canal that flows to tributaries of the Mississippi River and down the river to the Gulf of Mexico. It is best to divert storm water out of the combined sewer-storm water system and back towards Lake Michigan. In addition, reducing storm water run-off protects the sewer system during intense rain events that cause overflow. If the system cannot contain all the run-off in this urban environment, the MWRD must divert the storm water directly into tributaries that feed the Chicago River and into flow into Lake Michigan. UIC is built on infill from previous land uses. UIC has undertaken many steps to improve storm water management on the campus including permeable pavers and the use of native plants around campus. Several buildings have green roofs and a cistern that capture rainwater from the roof of the UIC Forum for irrigation.

Arthington Mall Plaza

UIC's Arthington Mall Plaza is located on the West Side of campus directly outside of Student Center West. This plaza, which is approximately 37,000 square feet, serves as an open, common area for students, faculty, staff and visitors of the West Side of campus. Users of the plaza enjoy the space for leisure and also access the plaza to travel on campus and to surrounding facilities, including UIC's seven health science colleges and various healthcare facilities within the Illinois Medical District.

Historical Site Context

In [1958](#), the area was originally housing and parking lots with intact infrastructure. The area was then reconstructed as a private university-owned street (Arthington Street) to connect Damen Ave to Wolcott St. in [1964](#) dotted with honey locust trees. As the University built up the medical campus in the [1970's](#), Arthington Street became Arthington Mall with benches and shrubbery. By [1996](#), the street was redesigned to be a pedestrian mall with concrete paths, grass, trees, additional shrubbery and benches.

Yet, for the past 25 years, the plaza has experienced urban flooding during heavy rain events coupled with heavy pedestrian use which caused the plaza's pavers to deteriorate over time. For a period of a couple of years in the early 2010's, much of the area was fenced off and not accessible to the community. The pavers were removed in 2015 and replaced with traditional turf and asphalt, retaining the existing honey locust trees.

Campus and Regional Planning Documents

UIC Master Plan

Two master campus planning documents support the intention of this project. In 2010 UIC Campus Master Plan recommended improved landscaping to the plaza and the closing off adjacent Wolcott Avenue to create a more pedestrian oriented and accessible Arthington Mall Plaza. In 2015, UIC's Chancellor Amiridis tasked a Master Plan Advisory Committee to create a master plan update to the 2010 Plan to provide feasible recommendations for the campus's facilities and grounds for the next ten years. Included in the [Master Plan 2018 update](#) is Arthington Mall Plaza. It was recommended to reactivate the space with green infrastructure and pedestrian safety improvements that will reduce storm water runoff and improve the flow of pedestrians. UIC has identified matching funding from internal funds designated for capital projects to support the renovation of Arthington Mall Plaza.

UIC Climate Commitments

The UIC Climate Commitments are a new level of commitment that extends beyond existing efforts to support carbon reduction, including a commitment to take steps toward making the Chicago region more resilient. The UIC Climate Commitments include goals to become a Climate Neutral Campus, a Zero Waste Campus, a Net Zero Water Campus, and Biodiverse Campus. Net Zero Water goals include managing and reducing stormwater through design and retrofitting of hardscapes and landscapes. Biodiverse Campus goals include using sustainable landscaping methods.

Climate Action Implementation Plan (CAIP)

The main objective of the CAIP is to help UIC accelerate through the phases of implementing tangible solutions. The CAIP derives from initial strategies of the 2009 UIC Climate Action Plan (CAP) as well as the goals of the UIC Climate Commitments. Both ultimately led to the development of a refined cost-effective portfolio of solutions to be implemented by 2028; as well as a variety of additional strategic solutions to be supported, developed, invested in, implemented, or reevaluated on a 5-year incremental basis through 2050.

The CAIP also enhances the four strategic priorities of the campus through student learning & success, efficient capital projects, health and well-being of the UIC and broader community, and positioning UIC to be an innovator through collaborative research and teaching.

Arthington Mall personifies the goals of Strategy 4.0 *Natural Resources and Ecosystems Services* by implementing the three landscape-related solutions: 4.1.1 *Green Stormwater Infrastructure Implementation Plan*, 4.3.1 *Campus Pollinator Habitat Plan* and 4.3.2 *Tree Care Plan*.

4.1.1 Green Stormwater Infrastructure Implementation Plan

In 2014, an interdisciplinary team of students and university stakeholders developed a green infrastructure master plan for the Environmental Protection Agency's Campus Rainworks Challenge, which won first place. This planning document, referred to as Urban Transformations, demonstrates an incremental, scalable, and adaptive approach to implementing green infrastructure in a highly urbanized context and has provided guidance to campus planning efforts including the university-adopted stormwater plan.

UIC stormwater management plan for the campus includes a 3-phased implementation plan. Phase 1: Demonstrate and Analyze, Phase 2: Expand and Standardize, Phase 3: Transform and Upgrade. It includes recommendations to focus on the results of case studies, pilot projects, calculations and stormwater model predictions. The planning document proposes that the university should install green infrastructure at every opportunity during new construction and major renovation projects, evaluate effectiveness and maintenance requirements, consult stormwater modeling (Landscape Green Infrastructure Design model) for optimal placement of green infrastructure during design and to seek partnerships from the City of Chicago and the Metropolitan Water Reclamation District of Greater Chicago.

The goal of solution 4.1.1 is to increase natural campus flood mitigation strategies through bioswales and landscape alterations by adhering to recommendation in Urban Transformation v2.0 by 2050.

4.3.1 Campus Pollinator Habitat Plan

The goal of this solution is to increase pollinator habitats to encompass greater percentages of campus land. The development of this plan arose as information that pollinator populations have been on the decline throughout the United States which affects not only natural ecosystems in place but also the production of crops and other plants that can remove air pollutants. The purpose of the Campus Habitat Pollinator Plan is to create a set of recommendations and practices that allow pollinators to thrive at UIC through planting recommendations, maintenance policies and educational tools. The campus is prioritizing its role in climate change mitigation by increasing biodiversity and has a comprehensive list of native and diverse plant species. UIC takes pride in the fact that Xerces Society granted UIC Bee Campus USA status; the first university in Illinois to gain this recognition.

4.3.2 Tree Care Plan

The goal of this solution is to ensure a robust tree inventory by dedicating a funding source to maintain the health of the current tree inventory, prioritizing the large, mature trees; as well as planting new trees to replace any tree lost due to factors like weather, disease, or construction. The Tree Care Plan encourages a greater diversity and care within UIC's tree inventory. UIC is among a few universities that participate in the Tree Campus Higher Education program. This program promotes effective tree management, campus community involvement, and nature connectivity among faculty, staff, and students through forestry efforts. Planting priority is given to those species of trees that will increase the UIC tree inventory, are a diverse set of species, have the ability to thrive and adapt in Chicago's changing climate and soil, and are able to mitigate harsh environmental conditions like flooding, pollution, and greenhouse gas emissions.

Funding Opportunities

National Fish and Wildlife Foundation

UIC was awarded roughly \$250,000 from the National Fish and Wildlife Foundation's (NFWF) Chi-Cal Rivers Fund help redesign the site in order to address existing storm water management challenges via storm water runoff reduction, increasing infiltration while enhancing the environment for all visitors to the space. The design is based on best practices to reduce flooding in the area. Prof. Benjamin O'Connor from the UIC College of Engineering's Department of Civil and Materials Management used the EPA Stormwater Calculator to analyze the changes in runoff and infiltration (see Figure 1) and the outcome of "volume of stormwater prevented". The other 3 outcomes are achieved through the design and installation of planned green infrastructure (bioretention, removal of impervious surfaces and installation of permeable paving) on this site. This is estimated to increase rainfall infiltration by 63% and is critical to diverting stormwater from the sewer system. The funding of this project helped to make this possible, as this infrastructure (and the full demolition of the old road below) would not be possible without the grant funding.

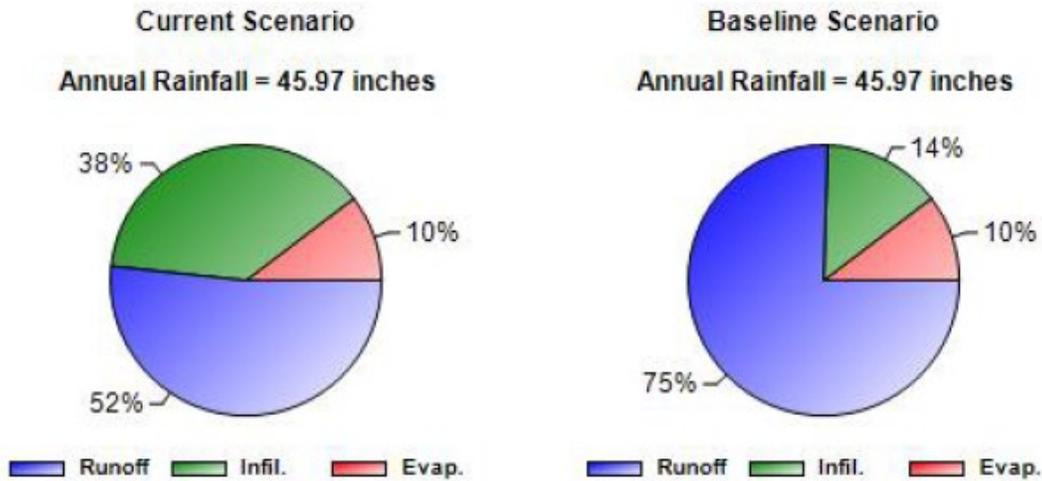


Figure 1 Comparison of runoff between the "baseline" scenario of UIC's existing conditions to the "current" aka planned scenario that would reduce run-off from 75% to 52%.

Metropolitan Water Reclamation District of Greater Chicago

UIC entered into an intergovernmental agreement with the Metropolitan Water Reclamation District of Greater Chicago (MWRD) shortly after the NFWF award to further improve the stormwater reduction capabilities of Arthington Mall. Noting that Parking Lot B2 is located directly adjacent to and south of Arthington Mall Plaza, and in need of repairs, the scope of the project was expanded to renovate Lot B2 with permeable pavers to mitigate flooding and storm water runoff. More rain gardens were planted directly next to the north side of Lot B2 so that storm water can drain outward from the lot into the raingardens.

Sustainable Features

Goals

The Goal of the UIC Arthington Mall Renovation project is to provide a welcoming, hospitable space that retains stormwater on-site and is part of the larger campus greenspace system of pedestrian streets and promenades that will:

- Detain stormwater by incorporating green infrastructure components such as permeable paving, native plants, and rain gardens;
- Incorporate monitoring stations (rain gauges) to evaluate the efficacy of the green infrastructure components;
- Reduce the square footage of impervious paving on-site;
- Implement energy-efficient and sustainable site design and utility standards;
- Create areas for flexible use by students, faculty, and staff.
- Create a comprehensive Operations and Maintenance Plan of which the responsibility for management of the site falls to the Superintendent of Grounds. Training for appropriate grounds keeping staff is an important component of long-term health of the areas.

Rain Gardens

One of the main goals of the renovation of Arthington Mall is to retain stormwater onsite by incorporating green infrastructure components such as nativeplant rain gardens. This area features over 11,000 square feet of rain gardens.

Oil, detergents, pesticides, and other chemicals picked up by rainwater runoff are a significant contributor to stormwater pollution. These depressed garden beds help to filter pollutants out of stormwater by trapping them in the soil where they break down over time. The rain gardens and other areas with native plantings use MWRD biosolids in amendmets performed to the soil.

Permeable Pavement

Another effective means of green infrastructure is permeable pavement. Chicago has one combined system for sewage and rainwater, leading to sewage backups in basements and waterways during heavy rains. But, unlike traditional concrete, the spaces between these pavers allow water to infiltrate the soil, diverting rainwater from storm drains while also reducing urban flooding.

The renovation of Arthington Mall installed 10,350 square feet of permeable pavement while also reduced the square footage of impervious paving onsite by 19,000 square feet. This is predicted to increase the retention of 653,060 gallons of runoff water annually, or 188,709 per rain event. These preliminary estimates of stormwater reduction were made using the EPA's Storm water Calculator, which suggested a stormwater volume reduction of 55,069 gallons for a 100-year storm event, an overall runoff reduction of 23%, and an increase in infiltration of 24%.

Trees

One may argue that the most visible stars of Arthington Mall Plaza are its trees, which include a variety of young flowering ornamentals growing under a broad canopy formed by 24 mature, healthy honey-locust trees. Although honey-locusts are abundant on the UIC campus, these individuals are highly valued residents not only in the Arthington Mall Plaza itself, but the near west side community in general, prized for their aesthetic benefits, for the cooling shade they provide, and for their contributions to controlling water runoff, stabilizing the soil, and sequestering atmospheric carbon.

To properly protect the trees during construction, trees were pruned to remove up to 25% of the canopy, focusing on dead, broken, diseased, and interfering branches. This diverted the trees' energy from the canopy into root regrowth, helping them become more resilient to storm damage, branch failure and disease. The project also implemented directional boring to install new electrical infrastructure, rather than a traditional trench method. This avoided cutting through critical roots.

Pollinator Habitats

Established native plants are great for urban ecosystems. They do not require any additional water as rainfall is enough to give the plants what they need. They also create a perfect habitat for local pollinators, helping to increase their populations and overall biodiversity.

In Arthington Mall, there is nearly 14,500 square feet of soft landscaping comprised of native plantings like the Eastern Redbud, Common Milkweed, Canada Anemone, Red Columbine, Sugar Shack Buttonbush, Wild Hyacinth, Black-Eyed Susan, Prairie Dock, among others. These plants are visited by urban pollinators including the common eastern bumble bee, green sweat bee, calligrapher fly, and the star of the show, the monarch butterfly.

A Welcoming Outdoor Space

Arthington Mall creates areas for flexible use by students, faculty, and staff. Arthington Mall enhances UIC's identity by creating a welcoming setting that safely connects people across UIC's West Campus and encourages them to linger. Installation of new walkways, seating options, artwork, landscaping and exterior lighting transformed Arthington Mall into a vibrant and open outdoor space.

The property on which Arthington Mall sits was part of Native American sacred land, and nature plays a part in the healing tradition. In a nod to the site's Native American roots, Arthington Mall is anchored by the sculpture, "Tussle" by Ted Sitting Crow Garner, a UIC alumnus and a member of the Standing Rock Sioux Tribe.

Green spaces are a good predictor of human health. They offer a wide range of environmental, health and economic benefits at the individual, community, and social level. These benefits include improved air quality, increased mental and physical activity, and create a sense of community with and social connections.

Monitoring Plan

The monitoring system includes a rain gauge for the site to measure local precipitation. Installed below the surfaces of the rain garden, permeable pavement, and native vegetation regions are depth profiles of soil moisture and soil water potential probes, as well as drain gauges in deeper regions. These instruments allow for the quantification of infiltration and evapotranspiration processes of the water budget. The 2-year monitoring and model development program quantifies the water balance for the site using monitoring data that will support the development of a hydrologic model. The monitoring data and hydrologic model are used to assess storm water reductions and changes to the water balance generated by the green infrastructure implementations. The water budget for a localized urban landscape can be generalized as a balance between precipitation, infiltration, evapotranspiration, and runoff processes.

The University prepares a report detailing its annual inspection, observations, and conclusions including whether the green infrastructure is operating as designed, functioning, and providing the intended public benefit. The annual inspection report is conducted by professors of Civil and Materials Engineering who is also knowledgeable of the project scope and goals and has prior working experience with the design aspects of the project.

Education

The project includes educational signage that describes the green infrastructure, its function, and significance. The signs support continued institutional awareness and management of green infrastructure projects, which is critical to the long-term functioning of such dynamic infrastructure. Educational signage is contemplated to help maintain consistent knowledge of green infrastructure and as well as provide public awareness for the green infrastructure that is around them. The four educational signs at Arthington Mall describe the rain gardens, permeable pavement, pollinator habitats (native plants) and trees.

Long-term Operations and Maintenance

It is necessary to have permeable pavement maintained according to best management practices to keep plants from rooting into the pavement. This includes monitoring and maintenance of the infiltration rates (vacuum sweep once to twice annually), and snow removal with a rubber blade or by sweeping. Rain gardens (i.e. wetlands) are checked every couple of weeks to see that water is being retained appropriately such that wetland vegetation is supported. They are also inspected in the winter to make sure that unfrozen water is not stagnant; the water should not be stagnant in a wetland.

Seasonal mowing of emergent areas as well as removal of weeds, woody growth, and trash help ensure that the wetland maintains its effectiveness.

A comprehensive operations and maintenance plan for the green infrastructure at Arthington Mall outlines the maintenance needed to keep nature-based infrastructure functional for the long-term and designed to keep the plants healthy, and the storage voids open in order to keep infiltrating water over the lifetime of the project, monitored and revised as necessary. It is available as a calendar-based spreadsheet [online](#).

Training for appropriate grounds keeping staff is an important component of long-term health of the areas as well. UIC invited Horticulturalists and Master Gardeners from the University of Illinois Extension to teach staff how to maintain a native plant garden.

The Design & Construction Process

Arthington Mall Project is an intensive landscaping project that redefines a gathering open space that includes civil engineering to reduce stormwater with a budget of nearly \$3.0M. The site is constrained by three university buildings (an academic building, student union, and a fitness center), a surface parking lot, a major throughfare, and a local street. The site's unique location within the urban environment of UIC's west campus correlates to high foot traffic by both the University population and public at large. This project was therefore opportunity to significantly enhance the user experience and perception of those on campus while also addressing pour stormwater management on the site.

The Team

The design aspects for the renovation of the site was awarded to Primera Engineers and Hitchcock Design Group who developed goals for the project overall, incorporating the goals of the UIC Master Plan update, the Climate Action Implementation Plan, as well as the requirements set forth by NFWF and MWRD. A Landscape Architect lead the team. Primera Engineers were the engineers behind the civil and electrical design that included experts who understood well the nuances of stormwater capture and efficient lighting technology in an urban environment. The team was rounded out with owners and users of the area from the university, including designers from UIC'S Planning, Sustainability, and Project Management department, as well as those in charge of its maintenance from Grounds (Facilities Maintenance), and a Ph.D. candidate who was instrumental in the design of the space's green infrastructure and how to monitor its performance.

The construction contracts were awarded to F.H. Paschen, S.N. Nielsen & Associates LLC and Airport Electric. Both firms had extensive experience with similar projects, most recently F.H. Paschen's redevelopment of the Chicago River Walk.

Design Challenges

The site previously was a residential city block with three-flat apartment buildings, alleyways, and city utilities before it was redeveloped by the University of Illinois during the mid-twentieth century. Prior to being converted to a pedestrian-only greenspace, the site hosted a vehicular driveway to access the facilities abutting the property. The site's history posed numerous challenges during design and construction including the presence of contaminated soils and characteristics thereof that were difficult to fully characterize prior to excavation, conflicts with old and abandoned buried utilities that were sometimes not accurately represented on record documents, and the logistics of coordinating a project of this size in the heart of an active campus community.

This project also received significant funding from the Metropolitan Water Reclamation District of Greater Chicago, which while a gracious and welcomed contribution, posed bureaucratic challenges

because both UIC and MWRD are separate government agencies with differing policies and procedures. Specifically, there were differences in contract requirements that required legal counsel to amend standard contract language, design milestone deliverables that required our design team to adapt to, and a need to reconcile technical differences with budget constraints.

One of the biggest lessons learned would have been to conduct a more thorough site investigation during design. This would include things such as taking more soil samples, testing for contamination at smaller intervals, and conducting additional record searches

Cost comparison of sustainable vs. conventional strategies

Comparing cost differences between sustainable and conventional strategies is difficult because oftentimes there is extensive additional required scope intrinsically linked to a sustainable strategy. A simple comparison is that between pavers and concrete, and amounted to about \$200,000. A more complex comparison is the rain garden vs turf grass or a traditional planting bed. This is complex because of the inter-relationships with the storm sewer (which would not be needed in the alternative, traditional scenario). A rough estimate of the difference amounts to \$500,000.

The Sustainable SITES Initiative

The Arthington Mall Project decided to pursue SITES certification after design was complete, but before construction began as everything in the design was already compliant with SITES goals. To date, only Chicago's Navy Pier, the Morton Arboretum and a private company in Burr Ridge have been SITES certified in Illinois. Eight universities in America have been SITES certified, but none in Illinois (or the Midwest). UIC would be the first to be certified in Illinois. This project is looking to achieve Silver level, at minimum.

The Sustainable SITES Initiative (SITES) is a comprehensive land design and development rating system that is being used by both private and public sectors all around the world. SITES certification is given to landscapes, site infrastructure and spaces that demonstrate a high level of environmental and social sustainability.

Just as LEED has undeniably transformed the built environment, SITES has the ability to transform land development and use under the administration of GBCI. Like LEED, pursuing SITES certification and using the rating system also ensures that projects meet high standards and keeps everyone accountable. Yet the focus of SITES is driving sustainability beyond the building. The SITES rating system takes sustainability outside and into our landscapes, open spaces, parks, and natural resources.

Goals for projects looking to achieve SITES certification include

- Creating regenerative systems and fostering resiliency by protecting and restoring natural resources, enhancing landscape and encouraging biodiversity, mitigation for evolving hazards and natural disasters, and planning for monitoring and adaptive management
- Ensuring future resource supply and mitigation of Climate Change by minimizing energy consumption and encouraging the use of renewables, eliminating greenhouse gases and pollutants, reducing, reusing, and upcycling materials, conserving water, and creating carbon sinks with plants.
- Transforming the market through design, development, and maintenance practices by fostering leadership in professional practices, using a systems thinking, collaborative design approach using Life Cycle Analysis (LCA) to inform decisions, and supporting local economies and sustainability policies.

- Enhancing human well-being and strengthening community by reconnecting humans to nature and improving human health, promoting the understanding of natural systems recognizing the value of the area, encouraging cultural integrity and promoting regional identity, and providing opportunities for community involvement.

Because of this project, UIC has committed for all other landscape projects over \$2.5M to also obtain SITES certification while adhering to the Climate Action Implementation Plan-specific SITES checklist for projects at the University of Illinois at Chicago, thus ensuring UIC's Sustainability goals, and the goals of SITES are integrated into every major landscape project.