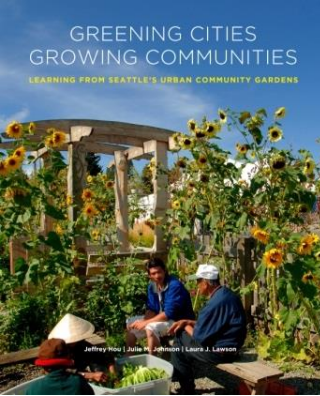




LANDSCAPE ARCHITECTURE FOUNDATION

# LANDSCAPE PERFORMANCE SERIES



# LANDSCAPE ARCHITECTURE FOUNDATION



- 501(c)(3) nonprofit based in Washington, DC
- Founded in 1966 to preserve, improve and enhance the environment
- Increase our collective capacity to achieve sustainability:
  - Invested **\$2.2 million** in research since 1986
  - Awarded nearly **\$1.1 million** in scholarships to over **500** students



An aerial photograph of New York City, showing a dense urban landscape with numerous skyscrapers and residential buildings. Central Park is visible on the left side, and the Hudson River is on the right. The sky is clear and blue.

# LANDSCAPE PERFORMANCE

# MEASURING SUSTAINABILITY

Triple Bottom Line



Living Building Challenge



One Planet Principles

- 1 Zero carbon
- 2 Zero waste
- 3 Sustainable transport
- 4 Sustainable materials
- 5 Local and sustainable food
- 6 Sustainable water
- 7 Land use and wildlife
- 8 Culture and heritage
- 9 Equity and local economy
- 10 Health and happiness

Can't achieve **SUSTAINABILITY**  
without considering **LANDSCAPE**



## A CASE STUDY COMPARISON

- Reduces water use by 30% compared to a building with standard code-compliant fixtures
- Uses 51,300 kBtu/ft<sup>2</sup> of energy annually, a 39% reduction from base case
- Reduces carbon emissions by 19 lbs CO<sub>2</sub>/ft<sup>2</sup>, or 50% by purchasing renewable energy.
- Provides daylight for 75% of regularly occupied spaces and views for 90% of occupied work areas



## A CASE STUDY COMPARISON

- Stormwater planters
- 20 new street trees
- Native and adapted plants
- 5 new outdoor dining areas
- Energy-efficient light blades
- Benches made from local stone



## A CASE STUDY COMPARISON

- Captures and cleans stormwater runoff
- Reduces the urban heat island effect
- Sequesters carbon
- Reduces potable water use
- Reduced energy use
- Increases social value of space



## FROM FEATURES TO CLAIMS TO BENEFITS

- Captures and infiltrates **50%** of all rain falling on sidewalks.
- Sequesters **3,000** lbs of carbon annually in tree biomass.
- Reduced energy consumption for outdoor lighting by **55,000** kilowatts, saving **\$3,200** annually. □
- Increased restaurant patronage by **30%** on weekdays and **50%** on weekends.



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F



LANDSCAPE  
PERFORMANCE  
SERIES

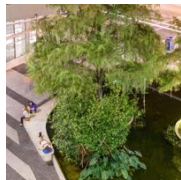
## THE ONLINE RESOURCE

Meet The Next-Generation

# LANDSCAPE PERFORMANCE SERIES

presented by the  
Landscape Architecture Foundation

[www.LandscapePerformance.org](http://www.LandscapePerformance.org)



### Case Study Briefs

Database of over 100 exemplary projects with quantified landscape benefits



### Fast Fact Library

Nearly 200 facts on the benefits of landscape derived from published research



### Benefits Toolkit

Dozens of online calculators and tools to estimate landscape performance



### Collections

Themed LPS highlights curated by LAF and leading thinkers

- Find precedents, show value, and make the case for sustainable landscape solutions
- Explore metrics and methods to quantify environmental, social, and economic benefits
- Earn professional development hours (PDHs) by attending a presentation or webinar
- Browse and share teaching materials to integrate landscape performance into design curricula
- Stay current on landscape performance news and trends

Not just  
for  
**LANDSCAPE  
ARCHITECTS**

## LPS TARGET AUDIENCES

- Landscape architects
- Allied design/development professionals
  - Planners
  - Architects
  - Engineers
  - Developers
- Non-profit organizations advocating for sustainable development
- Federal and municipal agencies
- Corporations with sustainability agendas

## LPS AND SITES

### SITES

- Modeled after LEED
- For sites that will be protected, developed, or redeveloped
- Encourages setting numerical goals
- Requires collection of baseline data
- Provides tools to estimate performance
- Encourages “Human Health and Well Being”

### LPS

- Not a rating system
- Focuses on measurable performance of built landscapes
- Easier to evaluate with numerical goals
- Requires collection of baseline data
- Provides tools to estimate performance
- Measures social and economic impact

**COMPLEMENTARY** approaches  
which **STRENGTHEN** one another

Meet The Next-Generation

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## FAST FACT LIBRARY

Empirical evidence indicates “livable” street treatments are safer than conventional roadway designs. In analyzing crash data, livable sections had fewer accidents and pedestrian crashes.

Dumbaugh, Eric. (2005). Safe Streets, Livable Streets. *Journal of the American Planning Association* 71(3), 283-300.



## FAST FACT LIBRARY

The first protected bike lanes in the US, on 8<sup>th</sup> and 9<sup>th</sup> Avenues in Manhattan, led to a 35% decrease in injuries to all users on 8<sup>th</sup> Avenue and a 58% decrease in injuries to all users on 9<sup>th</sup> Avenue.

New York City Department of Transportation. (2012) "Measuring the Street: New Metrics for 21<sup>st</sup> Century Streets."



## FAST FACT LIBRARY

A Modesto, California study found that asphalt on streets shaded by large canopy trees lasts longer than asphalt on unshaded streets, reducing maintenance costs by 60% over 30 years.

McPherson, E. Gregory, Muchnick, Jules, (2005). Effects of Street Tree Shade on Asphalt Concrete Pavement Performance. *Journal of Arboriculture*, 31, 303-310.





## FAST FACT LIBRARY

Children with Attention Deficit Hyperactivity Disorder (ADHD) concentrate better after a walk in a city park than after walks in other urban settings.

Faber Taylor, Andrea, Kuo, Frances E., (2009). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders*, 12, 402-409.



## FAST FACT LIBRARY

Recovering surgery patients with window views of trees had 10% shorter hospital stays, took fewer potent pain killers, and had fewer negative notes recorded by their attending nurses than patients with views of a brick wall.

Ulrich, Roger S., (1984) View through a window may influence recovery from surgery. *Science*, 224(4647) 420-421.



## FAST FACT LIBRARY

Consumers are willing to spend 9-12% more for goods and services in central business districts with high quality tree canopy.

Wolf, Kathleen L., (2005). Business district streetscapes, trees, and consumer response. *Journal of Forestry* 103(8): 396-400 □



## FAST FACT LIBRARY

Atlanta's promotion of public transportation during the 1996 Summer Olympic Games led to a 22% decline in traffic counts, 28% decline in ozone concentrations, and a 41% decrease in asthma acute-care events.

Friedman, Michael S., Graham, LeRoy M., Hutwagner, Lori, Powell, Kenneth E., Teague, W. Gerald, (2001). Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *Journal of the American Medical Association*, 285, 897-905.

# BENEFITS TOOLKIT



## GBRL Green Roof Energy Calculator (v 2.0)

Green Roofs for Healthy Cities, Portland State University, University of Toronto

This calculator compares the annual energy performance of a building with a green roof to the same building with either a conventional dark roof or a highly-reflective white roof. Inputs include nearest major city, total roof area, percent green roof cover, growing media depth, and leaf area index of plants. Results are the electrical, gas, and energy cost savings, heat exchange between the roof and the urban environment, and an estimate of the annual roof water balance, including net runoff.

[http://greenbuilding.pdx.edu/GR\\_CALC\\_v2/grcalc\\_v2.php#retain](http://greenbuilding.pdx.edu/GR_CALC_v2/grcalc_v2.php#retain)

# Renaissance Park



BEFORE AFTER

## Landscape Performance Benefits

### ENVIRONMENTAL

- ▶ Removed 34,000 cu yd of contaminated soil from the 100-year floodplain and sealed it safely within the park's iconic landforms. This includes 12,000 cu yd of soil commingled with enamel frit, which was leaching contaminants into groundwater.
- ▶ Increased floodplain storage by 9.32 acre feet (15,047 cu yd) through excavation of contaminated soil and creation of a constructed wetland.

# CASE STUDY BRIEFS

## Landscape Performance Benefits

### ENVIRONMENTAL

- ▶ Removed 34,000 cu yd of contaminated soil from the 100-year floodplain and sealed it safely within the park's iconic landforms. This includes 12,000 cu yd of soil commingled with enamel frit, which was leaching contaminants into groundwater.
- ▶ Increased floodplain storage by 9.32 acre feet (15,047 cu yd) through excavation of contaminated soil and creation of a constructed wetland.

### SOCIAL

- ▶ Promotes a healthy lifestyle, according to 85% of 85 park users surveyed. 81% agree that the park increases their outdoor activity.
- ▶ Attracts an estimated 145,220 visitors annually, many of whom also patronize local businesses. 89% of 85 surveyed park users shop or dine within 1/2 mile of the park before or after visiting the park.

### ECONOMIC

- ▶ Stimulates economic development and neighborhood reinvestment. Since 2005, \$55 million has been invested in two redevelopment projects adjacent to Renaissance Park. Five additional properties within 1/4 mile of the park were redeveloped between 2005 and 2013.

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View/Download a PDF showing how the landscape performance benefits were derived.

[DOWNLOAD METHODS](#) 

## CASE STUDY BRIEFS

- Increases floodplain storage by 9.33 acre feet (15,047 cu yd.) due to excavation of contaminated soil below 100 year floodplain elevation and creation of a constructed wetland.***

### Methodology:

This performance indicator is based on the thorough review of information provided and cut/fill calculations performed by the project's consulting team as well as calculations performed by the research team.



Figure 4. 100 Year Floodplain

The portion of the site where contaminated soils were excavated from capped waste cells of enamel frit was excavated as much as 10' below finished grade. This +/- one acre area is creatively redesigned as a one-acre constructed wetland that receives, retains, and treats runoff from the site while increasing the storage capacity of the 100 year flood by 9.33 acre feet



# CASE STUDY BRIEFS

## At a Glance

### DESIGNER

Hargreaves Associates

### LOCATION

100 Manufacturers Road  
Chattanooga, Tennessee

### SIZE

22 acres

### PROJECT TYPE

Park/Open space  
Waterfront redevelopment

37405

[Map it](#)

### BUDGET

\$8 million

### FORMER LAND USE

Brownfield Park/Open space

### CLIMATE ZONE

Humid subtropical

### COMPLETION DATE

2006

## OVERVIEW



## SUSTAINABLE FEATURES



## CHALLENGE/ SOLUTION



## COST COMPARISON



## LESSONS LEARNED



## PRODUCTS



## PROJECT TEAM



Renaissance Park is a 22-acre urban brownfield redevelopment project within Chattanooga's nationally-recognized Tennessee River Park and the final phase of the 21st Century Waterfront Master Plan. Completed in 2006, this riverfront project transformed a blighted post-industrial site known to be leaching contaminants into surface and groundwater resources into a celebrated public park that has been a catalyst for reinvestment in Chattanooga's growing Northshore neighborhood. Renaissance Park provides a canvas for social engagement, healthy lifestyles, and environmental education, leveraging ecosystem services of preserved floodplain forest, meadow plantings and a constructed wetland that treats site stormwater and increases floodplain storage capacity. Preservation areas and native meadows reduce construction and maintenance costs, while iconic landforms safely and artistically enclose contaminated soils. The park hosts public events, exhibitions of public art, and commemorates the site's role in significant historic

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SUSTAINABLE  
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CHALLENGE/  
SOLUTION



COST  
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LESSONS  
LEARNED



PRODUCTS



PROJECT  
TEAM



- ▶ Test wells indicated a bloom of contaminated groundwater down-gradient from the known location of previously capped industrial waste settling ponds within the 100-year flood plain. 34,000 cu yd of contaminated soils were excavated and placed in upland containment cells, safely sealed within the park's iconic landforms. A drainage system beneath the cells diverts any lingering leachate to the sanitary sewer.
- ▶ The portion of the site from which contaminated soils were excavated was creatively redesigned as a one-acre constructed wetland. This feature receives, holds and treats runoff from the site while increasing floodplain storage capacity by 9.32 acre feet. The wetland is lined with a bentonite geosynthetic clay liner to prevent further groundwater contamination. Two feet of freeboard is provided between the wetland's normal pool level and outfall orifices which discharge into the stream. Gabions, buffered with wetland plantings, artfully establish the water's meandering path through the wetland.

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SUSTAINABLE  
FEATURES



CHALLENGE/  
SOLUTION



COST  
COMPARISON



LESSONS  
LEARNED



PRODUCTS



PROJECT  
TEAM



## Challenge

Monitoring wells installed as part of environmental assessment efforts indicated that capped waste cells located within the site's 100-year flood plain were leaching semi-volatile organic compounds (SVOCs) and heavy metal contaminants into the groundwater. These cells contained postindustrial waste from the site's previous use as an appliance manufacturing and enameling facility. Until environmental regulation outlawed such practices, post-process wastes – including enamel frit – were disposed of on-site in receiving cells that were capped once full.

## Solution

Following extensive analysis of historic site topographic maps to determine the probable

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SOLUTION



COST  
COMPARISON



LESSONS  
LEARNED



PRODUCTS



PROJECT  
TEAM



- ▶ The client explored alternative “hard engineering solutions” to manage contaminated soils and prevent further groundwater contamination, such as subterranean groundwater diversion walls and an asphalt cap. The implemented “soft” approach was 25% less expensive than these alternatives.
- ▶ Remediating 12,000 cubic yards of leaching soil containing commingled frit on site cost \$180,000, 75% less than the \$720,000 estimated cost to haul the same volume of soil to a proper landfill.

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PROJECT  
TEAM



- ▶ Accurately calculating the volume of contaminated soil that would be excavated and remediated was critical to managing project budgets. The cost of excavation and remediation activities would limit budget available for other site development agendas and features, and the volume of soil to be treated would dictate the amount of area to be committed to the encapsulation of contaminated soil. The design team was not comfortable basing estimates on conventional methods of extrapolating data from a grid of soil borings alone. Therefore, they conducted a “forensic” topographic analysis using historical maps of the site’s undeveloped and post-industrial conditions, in addition to analysis of 60 soil borings and groundwater monitoring data to generate three-dimensional models of the likely extent of contaminated soil. This in-depth analysis gave the design team the information necessary to allocate budget for remediation activities and design the site accounting for proper soil storage capacity.

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**Wetland Liner:** CETCO Bentomat geosynthetic clay liner

**Wetland Inlets & Outlets:** Agri Drain

**Light Poles:** Hess

**Prefabricated Bridges:** Moosman Bridge

**Site Furniture:** Maglin

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## Project Team

**Landscape Architect & Lead Designer:** Hargreaves Associates

**Structural & Electrical Engineer:** Moffatt & Nichol Engineers

**Environmental Engineer:** S&ME

**Lighting Designer:** LAM Partners, Inc.

**Pavilion Architects:** Eskew+Dumez+Ripple, Hefferlin+Kronenberg Architects

**Pavilion Engineer:** March Adams & Associates, Inc.

**Pavilion Lighting Designer:** Fisher Marantz Stone

**General Contractor:** Stein Construction Corporation

**Landscape Contractor:** Earthscapes

**Client:** River City Company for Chattanooga Downtown Redevelopment Corporation

**Architectural Consultant:** Turner Townsend, Inc. (Environmental Consultant: H&E)

# CASE STUDY BRIEFS

## Additional Images



## References and Resources

[Hargreaves Associates: Renaissance Park](#)

[Hefferlin+Kronenberg Architects: Renaissance Park Outdoor Pavilion](#)

[East Tennessee River Valley Geotourism MapGuide](#)

[Bloomberg Businessweek, "Chattanooga Reinvents Its Downtown," 2009](#)

[The Chattanooga "Renaissance Park Wins Governor's Award," 2007](#)

[Tennessee Valley Authority, "Wetland thrives in downtown Chattanooga," 2006](#)

[George Hargreaves, J. Czerniak, A. Berrizbeitia, L. Campbell Kelly, "Landscape Alchemy: The Work of Hargreaves Associates," ORO Editions, 2009.](#)

## Share Your Photos

No photos have been tagged yet.

Have you visited this project site? Share your experience by tagging your photos on flickr with this machine tag:

laf:casestudy=738

[Need Help?](#)





# PROJECTS AND BENEFITS



# UPTOWN NORMAL CIRCLE NORMAL, IL | HOERR SCHAUDT



## DUTCH KILLS GREEN NEW YORK, NY | WRT

Increased bicycle traffic by **12%** to **3,500** cyclists per day.

Helped reduce pedestrian and cyclist fatalities from a high of **18** to **<1** per year.

Increased estimated market value of surrounding properties by **37%**.



# MILLIKEN STATE PARK DETROIT, MI | SMITHGROUPJJR

BEFORE



AFTER



Filters **4.5 million** gallons of runoff from **12.5** acres.

Provides habitat for **62** confirmed species birds.

Expected to catalyze **\$152.3 million** in development.



# BLUE HOLE REGIONAL PARK WIMBERLEY, TX | DESIGN WORKSHOP

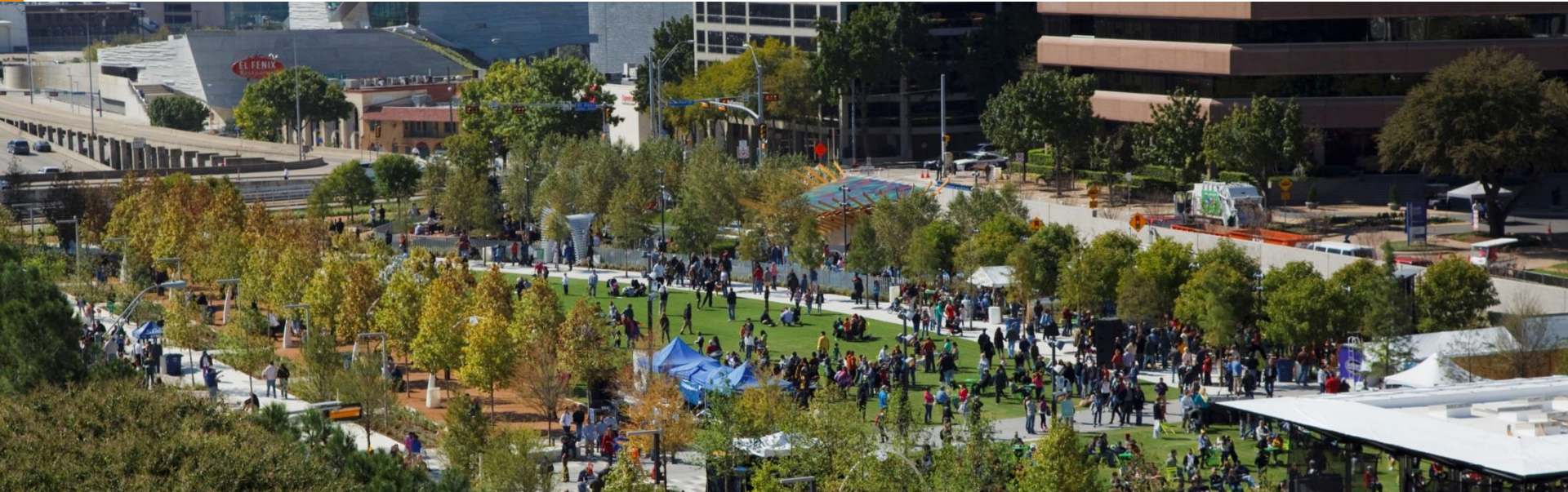
Protects **93** acres or **96%** of the undisturbed area of the site.

Improved user satisfaction with park amenities by **165%** and perceptions of safety by **101%**.

Tripled annual visitation, generating **\$217,000** in entry fee revenue.



# KLYDE WARREN PARK DALLAS, TX | OFFICE OF JAMES BURNETT



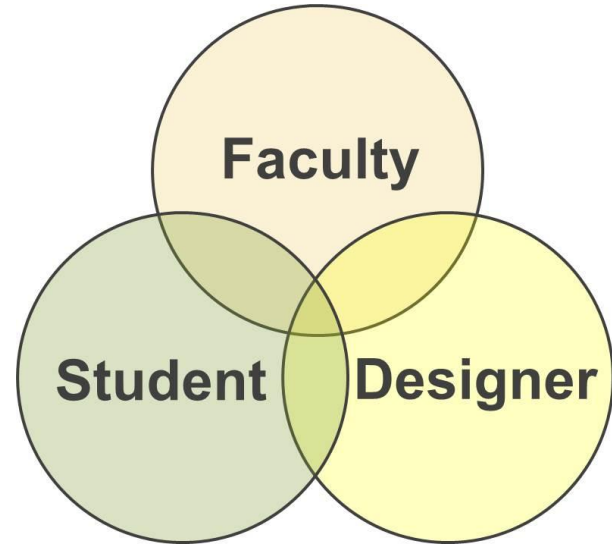
Projected to generate **\$312.7** million in economic development and **\$12.7 million** in tax revenue.

Improves the quality of life for **91%** of the **224** park users surveyed.

Contributed to a **61%** increase in ridership on the M-Line trolley, which connects downtown and uptown.

## CASE STUDY INVESTIGATION (CSI)

- Unique research collaboration
  - Faculty Research Fellow
  - Student Research Assistant
  - Practitioner
- Document high-performing landscapes
  - New LPS Case Study Briefs



Guided by **PRACTICE**

Enhanced by **RESEARCH**

A woman wearing a blue button-down shirt, a light-colored cap, and sunglasses is standing on a solar panel array. She is holding a smartphone and looking towards the camera. The solar panels are tilted and arranged in rows. In the background, there is a green field with a wooden fence, rolling hills, and snow-capped mountains under a clear blue sky. A large, leafy green bush is on the right side of the frame.

# NEW APPROACHES TO RESEARCH



## Longer-term Partnerships



**Nature Sacred**  
Helping communities heal from the outside.



- **TKF Foundation**

- Joplin, Missouri “Landscapes of Resilience” Butterfly Gardens and Overlook project, a 2014 TKF “Open Spaces, Sacred Places” award recipient

- Research Team: Stephanie Rolley and graduate student assistant of the Kansas State University Landscape Architecture Program

- **General Services Administration (GSA)**

- United States Coast Guard Headquarters in Washington, DC neighborhood of St. Elizabeths/Congress Heights

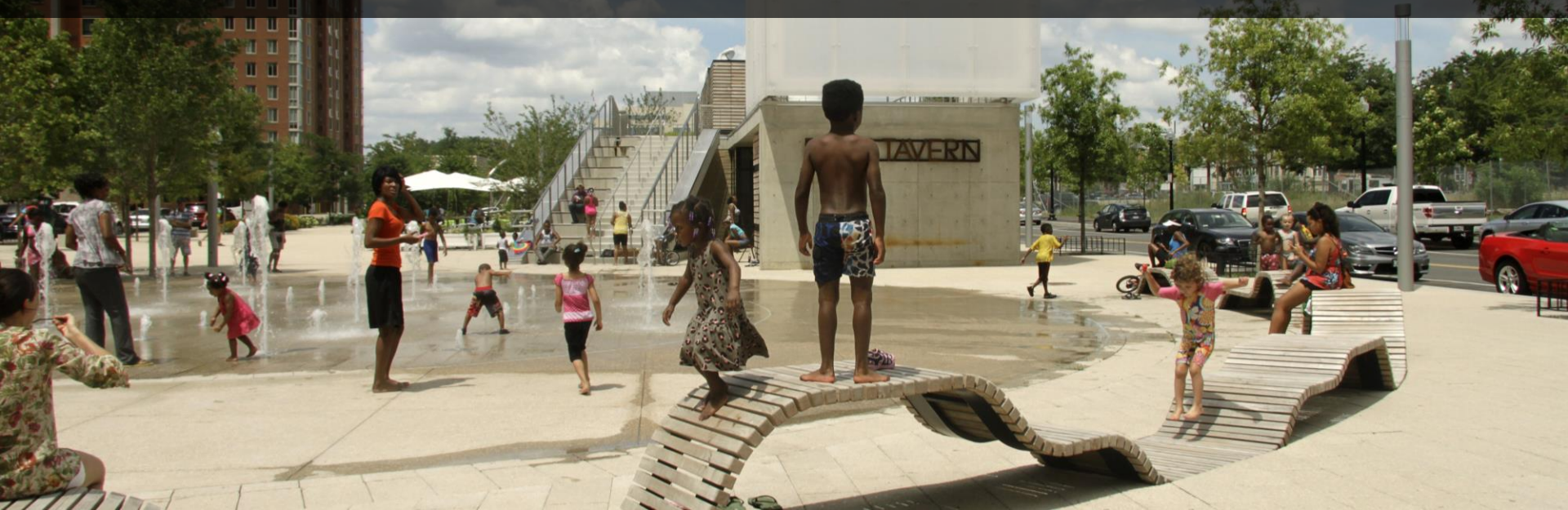
- Research Team: Dr. Chris Ellis and Dylan Reilly of the University of Maryland Landscape Architecture Program

## CANAL PARK WASHINGTON, DC | OLIN

Serves local residents and workers, with **78%** of visitors come from within 1/2 mile of the park.

Encourages social interaction, with **25%** of survey respondents having made new acquaintances in the park.

Improves neighborhood safety for **81%** of those surveyed, compared to **45%** in 2008.

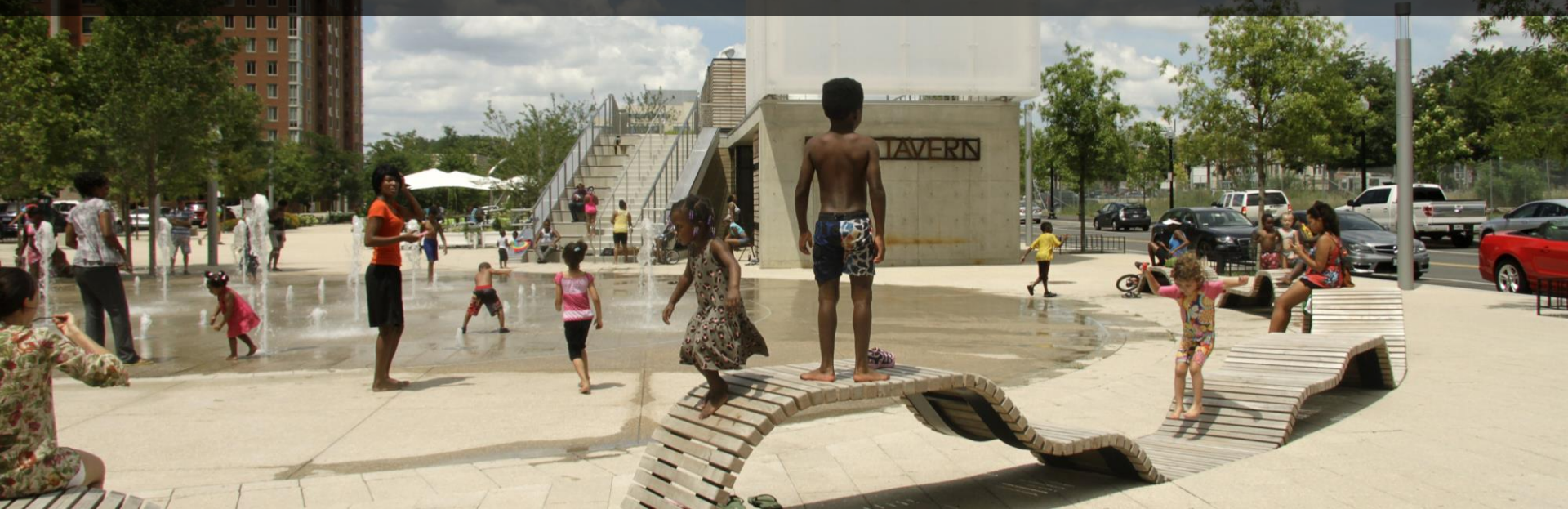


## CANAL PARK WASHINGTON, DC | OLIN

Most people surveyed only walk 1-2 blocks to get to the park, not the standard ¼ mile assumption.

Despite research indicating people like the high vantage point, the roof viewing platform is **not** utilized.

Roof-mounted cameras were used to take photos every 3 seconds; surveys taken every season.





Founding Partner



AILA/Yamagami/Hope Fellowship



AMERICAN SOCIETY OF  
LANDSCAPE ARCHITECTS

Promotional Partner

## LPS RESULTS

- Transforming design practice, education, and industry
- Making advocates more effective
- Building the body of knowledge
- Operationalizing and energizing aspirations for change

[LandscapePerformance.org](http://LandscapePerformance.org)



LANDSCAPE ARCHITECTURE FOUNDATION

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Executive Director  
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**[www.LandscapePerformance.org](http://www.LandscapePerformance.org)**