LANDSCAPE PERFORMANCE TO DEMONSTRATE IMPACT
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 over $3 million in research since 1986
- Awarded over $1.25 million in scholarships to over 550 students
Make the **MOST** of this **MOMENT IN TIME**
LANDSCAPE PERFORMANCE
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$^2$ of energy annually, a 39% reduction from base case
- Reduces carbon emissions by 19 lbs CO$_2$/ft$^2$, 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
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.
THE ONLINE RESOURCE

The LPS is…

- A collection of resources
- Designed to make “landscape performance” as well-known as “building performance”
- NOT a rating system
- Focused on built, performing projects
- A resource that will grow over time and with your participation
- Generating demand for sustainable landscape solutions

LandscapePerformance.org
**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**
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
THE ONLINE RESOURCE

LANDSCAPE PERFORMANCE SERIES

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
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.

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

Parks and open space increase nearby property values. A review of numerous studies indicates that a 20% increase is a reasonable estimate, though the impact varies with park size, use, and design.

An 8-year longitudinal study suggests that if all children had commensurate access to parkland and recreation programs, 9.5% of boys and 8.3% of girls would move from being overweight to normal weight.

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

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

THE ONLINE RESOURCE

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i-Tree Design v6.0

USDA Forest Service

i-Tree Design allows users to estimate the benefits provided by individual trees based on their location, species, tree size, and condition. Users may virtually ‘plant’ a tree in order to determine its effects on building energy use and benefits related to greenhouse gas mitigation, air quality improvements, and stormwater interception. It allows for the addition of multiple trees to give a complete picture of a property’s trees and can estimate benefits over time. i-Tree Design was derived from the beta “National Tree Benefit Calculator” developed by Casey Trees and The Davey Tree Expert Co.

http://design.itreetools.org/
Vegetable Garden Value Calculator

Plangarden

This straightforward calculator uses the inputs of produce type and planted area to determine the total pounds grown and market value of individual or multiple crops. Over 50 kinds of vegetables, fruits, and herbs are available in the drop-down menu. Calculations are based on default values for yield and price per pound, though these parameters may be changed. The user may also select grocery, farmer’s market or organic to adjust the average price per pound.

http://www.plangarden.com/app/vegetable_value/
THE ONLINE RESOURCE

LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

www.LandscapePerformance.org

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Themed LPS highlights curated by LAF and leading thinkers
Renaissance Park

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 enameled 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.
Landscape Performance Benefits

ENVIRONMENTAL

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► 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.

View/Download a PDF showing how the landscape performance benefits were derived.
2. 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.

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.
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
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 floodplain. 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 0.32 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. Cipions, buffered with wetland plantings, artfully establish the water’s meandering path through the wetland.
CASE STUDY BRIEFS

At a Glance

**DESIGNER**
Hargreaves Associates

**PROJECT TYPE**
Park/Open space  
Waterfront redevelopment

**LOCATION**
100 Manufacturers Road  
Chattanooga, Tennessee  
37405  
Map it

**CLIMATE ZONE**
Humid subtropical

**FORMER LAND USE**
Brownfield Park/Open space

**SIZE**
22 acres

**BUDGET**
$8 million

**COMPLETION DATE**
2006

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...
CASE STUDY BRIEFS

At a Glance

- **DESIGNER:** Hargreaves Associates
- **LOCATION:** 100 Manufacturers Road, Chattanooga, Tennessee 37405
- **SIZE:** 22 acres
- **BUDGET:** $6 million
- **CLIMATE ZONE:** Humid subtropical
- **COMPLETION DATE:** 2006
- **PROJECT TYPE:** Park/Open space, Waterfront redevelopment
- **FORMER LAND USE:** Brownfield Park/Open space

---

- 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.
- Remediation 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.
CASE STUDY BRIEFS

At a Glance

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- 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.
CASE STUDY BRIEFS

At a Glance

DESIGNER: Hargreaves Associates

LOCATION: 100 Manufacturers Road
Chattanooga, Tennessee 37405

SIZE: 22 acres

PROJECT TYPE:
Park/Open space
Waterfront redevelopment

CLIMATE ZONE: Humid subtropical

BUDGET: $8 million

COMPLETION DATE: 2006

FORMER LAND USE:
Brownfield Park/Open space

Overview

Sustainable Features

Challenge/Solution

Cost Comparison

Lessons Learned

PRODUCTS

PROJECT TEAM

Wetland Liner: CETCO Bentomat geosynthetic clay liner
Wetland Inlets & Outlets: Agri Drain
Light Poles: Hess
Prefabricated Bridges: Mosman Bridge
Site Furniture: Maglin
**CASE STUDY BRIEFS**

**At a Glance**

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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 Moretz Stone
- **General Contractor:** Stein Construction Corporation
- **Landscape Contractor:** Earthscapes
- **Client:** River City Company for Chattanooga Downtown Redevelopment Corporation
CASE STUDY BRIEFS

Additional Images

References and Resources
Hargreaves Associates: Renaissance Park
Heffterin+Kronenberg Architects: Renaissance Park Outdoor Pavilion
East Tennessee River Valley Geotourism MapGuide
The Chattanoogan “Renaissance Park Wins Governor’s Award,” 2007

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
THE ONLINE RESOURCE

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Collections
Themed LPS highlights curated by LAF and leading thinkers
COLLECTIONS

- Themed LPS content
- Curated by LAF and leading thinkers
- Compiled around:
  - Project typology
  - Advocacy issue
  - “8 Great” lists
  - Additional insights
BROWSE AND SEARCH

Filter LPS content by:
- Landscape Performance Benefit
- Feature (e.g., green roof, trail, greywater reuse)
- Tag (e.g., active living, placemaking, play)

Filter within components:
- Case Study Briefs by project type, location, size, budget, and climate zone
- Fast Facts by Author
- Benefits Toolkit by Source

Open search

Related content
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
PROJECTS AND BENEFITS
Expected to reduce traffic accidents by 35%.
Captures and reuses 1.4 million gallons of runoff.
Increased nearby property values by $1,500,000.
Retains up to **424,000** gallons of rainwater on the green roofs (95th percentile storm).

Reduces maximum surface temperatures on green roof by **10-12°F** compared to conventional rubber roof.

Provides outdoor space for employees, with **336** individuals observed in one 6-hour period.
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.
DIRECTOR PARK PORTLAND, OR | OLIN

Attracts an average of 1,495 people per day in summer and 376 per day in winter.

Generates an average annual gross revenue of over $34,000 in event rentals.

Created 8 full-time jobs, including two maintenance staff, an events coordinator, and café employees.
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.
UT DALLAS CAMPUS LANDSCAPE ENHANCEMENTS

Improves perception of the campus for **87%** of the **334** UT Dallas campus users surveyed.

Influenced decision to apply/enroll at UT Dallas for **44%** of students surveyed.

Stimulated university fundraising, with **$31.2 million** in project-related funds raised to-date.
Increased channel capacity by 40% to accommodate the 100-year flood.

Restored 75% of historic wetlands, resulting in 71 species of migratory and resident birds observed on-site.

Created 1,373 temporary and 1,248 permanent jobs on properties developed in anticipation of protection.
Attracts 3,000 trail users each weekday and over 10,000 users each weekend day.

Promotes physical activity with 70% of 100 trail users saying they exercise more since the trail opened.

Catalyzed economic development with more than $638 million in new real estate investment planned.
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.
CASE STUDY INVESTIGATION (CSI)
CASE STUDY INVESTIGATION (CSI)

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

Bridging the **GAP** between **RESEARCH** and **PRACTICE**
Collaboration is a critical success factor.

It is hard to show performance without performance objectives and baseline data.

Including landscape performance in design education is fundamental.

Need to consider performance during the design process

• What are performance objectives?
• How will performance be measured?
• What baseline data is needed?

"We will NEVER approach DESIGN THE SAME way again."

-- CSI Participants
LONGER-TERM PARTNERSHIPS

- **TKF Foundation**
  - “Landscapes of Resilience” Butterfly Gardens and Overlook project, Joplin, Missouri
  - Researcher: Stephanie Rolley of Kansas State University

- **General Service Administration (GSA)**
  - United States Coast Guard Headquarters, Washington, DC
  - Researcher: Dr. Chris Ellis of the University of Maryland
THE GUIDEBOOK TO EVALUATE PERFORMANCE
GUIDEBOOK FOR METRIC SELECTION

- **Metrics**
  - Understandable and meaningful to land development decision-makers
  - Over 100 metrics in 34 benefit categories

- **Methods**
  - Relatively easy to use
  - Generally applicable
  - Useful in a short (≥6 months) timeframe
  - Defensible

- **Positioning information**

- **Examples**

---

**Project Overview**
This streetscape project was designed to be Denver’s premier outdoor shopping area, preserving the district’s history and character while strengthening the retail environment and improving the safety of pedestrians and shoppers.

**Method**
The upgraded infrastructure and new lighting system helped to create a safe environment for pedestrians.

The crime reduction benefit was quantified by consulting Denver Crime Statistics and Maps freely available online. The crime statistics use the National Incident-Based Reporting System (NIBRS), a thorough and comprehensive system in which agencies collect data on every individual crime occurrence. The crime numbers in the 36-block District was reduced from 360 incidents in 2009 to 110 and 2011.

A limitation of this assessment was a lack of information on whether or not other factors aside from the design, such as an increased police presence, may also have affected crime numbers.
GUIDE TO EVALUATE PERFORMANCE

01 Environmental Benefits

Land
1. Land Efficiency & Preservation
2. Soil Creation, Preservation & Restoration

Water
3. Stormwater Management
4. Water Conservation
5. Water Quality
6. Flood Protection
7. Water Body/Groundwater Recharge

Habitat
8. Habitat Creation, Preservation & Restoration
9. Habitat Quality
10. Populations & Species Richness

Carbon, Energy, & Air Quality
11. Energy Use & Emissions
12. Air Quality
13. Temperature & Urban Heat Island
14. Carbon Sequestration

Materials & Waste
15. Reused/Recycled Materials
16. Local Materials
17. Waste Reduction

02 Social Benefits

1. Recreational & Social Value
2. Cultural Preservation
3. Health & Well-Being
4. Safety
5. Educational Value
6. Noise Mitigation
7. Food Production
8. Scenic Quality & Views
9. Transportation
10. Access & Equity

03 Economics Benefits

1. Property Value
2. Operations & Maintenance Savings
3. Construction Cost Savings
4. Job Creation
5. Visitor Spending
6. Increased Tax Base/Revenue
7. Economic Development
Reduction in potable water consumption (overall)

Reduction in potable water consumption from plant selection

Reduction in potable water consumption from efficient irrigation

Percent of water consumption from harvested or recycled water

Cost savings from reduced potable water consumption
METRICS: SCENIC QUALITY & VIEWS

Introduction
Quantification of landscape aesthetics is a notoriously thorny research avenue (Manning & Freimund, 2004). Although one of the primary goals of landscape architecture is the improvement of the aesthetic beauty of a site, and despite the wide acceptance of the role of visual aesthetics in promoting social sustainability, there are few projects that are able to quantify the benefits of scenic quality and views. In order to reflect the vital function this benefit category plays in landscape design, researchers must standardize methods for measuring such benefits (Dramstad, Twiet, Fjellstad, & Fry, 2006).

Assessment Considerations
The best practice methodology for obtaining benefits in this category depends largely on the specific metric being measured. In general, the most successful assessment methodologies will measure both quantifiable and qualitative data, compare and integrate the two, and seek to confirm results through consultation with professionals who can give an expert opinion. A well-prepared research team could achieve this goal in a single site visit, though repeated visits would be preferable. Remote-sensing data may be appropriate in cases when site visits are not feasible, though limitations should be recognized.

A digital camera and access to digital photography manipulation software (such as Adobe Photoshop) may be required.

POTENTIAL METRICS
Change in score on a visual quality scale
• Use the U.S. Forest Service Visual Quality Assessment.
• Use or develop a Travel Route Rating such as that used by the Tahoe Regional Planning Agency or other local entity.

Percent of unwanted views screened or desirable views retained
• Digital photography and computer software to determine relative size of views.
• Traditional photography and planimeters to determine relative size of views.
• 3-D simulation using computer-aided design software.

Perception of improved aesthetic
• Survey visitors to determine their perceptions of the visual quality of the site.
• Survey experts in the field to determine their perceptions of the visual quality of the site.

Resources
USFS Handbook for Scenery Management
http://fs.usda.gov/1wImGT
BLM Visual Resource Management
http://www.blm.gov/13/brmg
Travel Route Ratings for Roadway Travel Units
http://tahoe-monitoring.org/people/viewscape/347.html

▪ Change in score on a visual quality scale
  ▪ U.S. Forest Service Visual Quality Assessment
  ▪ Regional index

▪ Percent of unwanted views screened or desirable views retained
  ▪ Photography
  ▪ Computer simulations

▪ Perception of improved aesthetic
  ▪ Surveys
HOW TO USE THE GUIDEBOOK

For built projects…

- Initially assess what could be measured based on project goals (and data availability)
- Discover metrics and methods for a particular type of benefit

For projects in concept or design phase…

- Think through measurement protocols and what baseline information to collect
- Set specific performance objectives

As much an IDEA GENERATOR as a HOW-TO
LPS RESULTS

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

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