Landscape Performance and Sustainable Landscape Design

- Case Study of Green Infrastructure -

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Ⅰ. Introduction

Overflows occur when sewage and stormwater pipes overflow due to rainfall, wet weather events, or system deterioration. Many communities are looking for ways to reduce overflows with resilient and affordable solutions that meet many objectives at once.

This study examines the benefits of Green Infrastructure which can be used at a wide range of landscape scales to support the principles of Low Impact Development (LID). Environmental, social, and economic benefits of Green Infrastructure were measured at three different scales.

Ⅱ. Case Study

1. One Drop at a Time

This project is the first residential green roof and stormwater demonstration project in the Chicago suburbs. The self-sufficient, on-site hydrologic regime includes a green roof, permeable pavement, bioswales, rain gardens, rain barrels, and a cistern, which collectively capture rainwater and treat stormwater runoff before it enters local storm sewer drains. This project also features a prairie landscape of native plants, a look which is unique yet compatible with the traditional lawn aesthetic of the adjacent residential properties.

1) Sustainable Features

· The on-site rainwater and stormwater management feature include a 250 ft^2 green roof, 6 rain barrels, a 1200 gallon underground cistern, 1162 ft^2 of porous pavement, 258 ft^2 of gravel grass, a 2000 ft^2 of rain garden and a 393 ft^2 bioswale.

· Nearly 30 species of native prairie grasses, sedges, and forbs are in the rain gardens, bioswale, and gravel grass.

2) Landscape Performance Benefits

· Infiltrates or reuses rainwater falling on the site, preventing up to an estimated 85% of the 1-year storm from entering the local municipal stormwater system and eliminating the need for potable water for irrigation.

· Sequesters 140 lbs of carbon annually through prolific uses of native prairie grasses and sedges.

· Saved approximately $5,400 by using salvaged materials and reusing found materials on-site.

· Educated more than 1,300 visitors through private and public site tours.

2. Boneyard Creek Restoration

This project restored the curvilinear alignment of the original waterway using natural stone terraces to control erosion. The design increased stormwater holding capacity and enhanced ecological function, while creating new spaces for recreation and enjoyment. The detention basin provides 100-year flood protection in the setting of an attractive park, which along with the adjacent park, links downtown and the university with open space, winding trails, and a wide pedestrian promenade.

1) Sustainable Features

· Two retention basins with a total storage capacity of 47 acre-feet manage runoff from a 100-year storm while providing over 5 acres of open space for recreational use

during non-flood conditions.

· The original meander of Boneyard Creek was restored, replacing the previously channelized design.

· A 0.25-acre rain garden creates 0.13 acres of wetland habitat and manages stormwater runoff to the site.

· A bioswale and rain garden work together to drain and filter the first flush of water from the adjacent parking lot.

2) Landscape Performance Benefits

· Provides 100-year flood protection by containing the 15 million gallons of stormwater generated during a 100-year storm event.

· Improved habitat value of the site from "poor/marginal" to "suboptimal."

· Improved physical characteristics and water quality in the creek.

· Provides educational and volunteer opportunities for the community.

· Provides the first complete bike path connection between the University of Illinois campus and downtown Champaign.

3. Chicago Botanic Garden Lake Shoreline Enhancement

Restored lake shorelines and re-created native habitat functions in conjunction with innovative bio-engineering techniques. Carefully designed habitats abate shoreline erosion, while offering a widely accepted visual appeal. The re-created habitats are healthy native ecosystems that support communities of native plants and animals, improving species richness, as well as lake water quality.

1) Sustainable Features

· Three miles of unstable, eroding shorelines were replaced with heavily vegetated shallow water, wetland "shelves" and adjacent floodplain banks that are responsive to unique site conditions and constraints.

· The created shorelines integrated a combination of plants and structure to provide additional stability needed to deal with wave action and water levels that fluctuate by as much as 6 ft within the larger lake system.

· 500,000 native shoreline plants were planted, representing 244 species, 100% of which are native perennials.

· The shorelines are surrounded with many walking paths that allow visitors and staff to get long views, as well as up-close interface with the new native habitats.

2) Landscape Performance Benefits

· Increased species richness of the shoreline plant collections from 23 to 244 species, 100% of which are native perennials.

· Provides 6.05 acres of new and improved habitat for at least 217 observed species of waterfowl and shoreline birds, fish, turtles, mussels, frogs, and aquatic insects, 98% of which are native species.

· Improved the garden's lake water quality as measured by in-lake nutrient concentrations.

· Educated nearly 10,000 children and adults in 2013 in garden-sponsored shoreline ecology/aquatics education programs held along the restored shoreline areas.

· Demonstrates that ecologically-based shoreline restoration can be visually appealing.

III. Conclusion

This study investigated the benefits of Green Infrastructure which is a network of decentralized stormwater management practise in various scales. Sustainable landscape design provides not only stormwater management, but also wildlife habitat enhancement, and social values. Quantification of these benefits is important for landscape architect, planner and policy maker because it can provide better strategies of green infrastructure planning.

Further study of economic and social benefits can be conducted using various factors such as number of building permit, visitors of restaurant, crime, and hospital visit.

References

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3. Cellini, J. (2013) 2012 Annual Monitoring Report for the Boneyard Creek Project Site in Champaign, Illinois. (AES Project #12-0248).