NONPOINT SOURCE SUCCESS STORY

District of Columbia

Stream Restoration Effort in Linnean Park Improves Broad Branch Tributary

Waterbody Improved

The Linnean Park stream is an impaired, un-named tributary of Broad Branch, which empties into Rock Creek in northwest Washington, DC (the District). Stormwater runoff entering the Linnean Park stream caused streambed and streambank erosion, which exposed a sanitary sewer line that potentially contributed to diminished water quality conditions. The District Department of Energy and Environment used a regenerative stream channel (RSC) approach to stream restoration in an effort to encourage groundwater recharge, reconnect the stream to its floodplain, reduce scour from stormwater and treat stormwater pollution.

Problem

The 63.7-acre Linnean Park stream watershed represents about 6 percent of the total Broad Branch watershed. Land use in the Linnean Park stream watershed primarily includes single family homes and parkland area, with 12.3 impervious acres (20 percent impervious cover) (Figure 1). Overall land use in the Linnean Park stream watershed is similar to that of the larger Broad Branch watershed. In both watersheds the stream in the upper part of the watershed is piped and is discharged onto parkland as a free-flowing stream. The larger Broad Branch watershed was listed as impaired in 2004 for organics and *Escherichia coli* primarily from urban stormwater pollution.

Uncontrolled stormwater flow from upland impervious areas has led to streambed and streambank erosion in the existing stream channel, creating gully-like conditions which had disconnected the stream from its floodplain, created near-vertical bank conditions, and exposed sanitary sewer lines which potentially contributed to diminished water quality conditions. In 2010 the District Department of Energy and Environment developed a watershed implementation plan (WIP) for nearby Rock Creek that included activities to improve water quality in Broad Branch and its tributaries. The primary approach to restoration in the WIP involves slowing down, treating, and infiltrating stormwater pollution from historical development that had been constructed without stormwater controls.

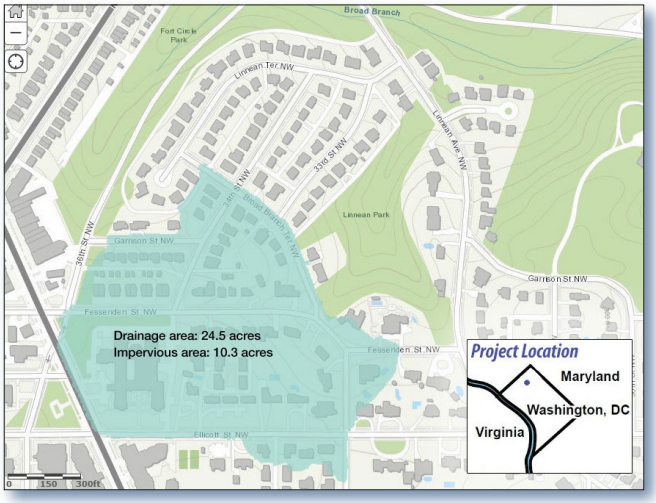

Figure 1. The Linnean Park stream watershed drains into Broad Branch in northwest Washington, DC.

Project Highlights

The intent of the Linnean Park stream restoration project was to design and install stream restoration using an RSC approach, and to monitor its effectiveness at stabilizing the stream, treating and reducing pollutant loads (nutrients, sediments, trace metals and bacteria), restoring habitat, and recharging groundwater. The project used a paired-watershed approach using Linnean Park stream as the restoration watershed and Spring Valley—a watershed of similar size and land use—as the control watershed. Pre-restoration monitoring took place from January 2013 through July 2014 (an 18-month period). The stream restoration work

Figure 2. Photographs of the midpoint of the Linnean Park stream, before (top) and after (bottom) restoration efforts were completed, show that the previously incised channel has been smoothed and reconnected to its floodplain.

itself took place from June 2014 through September 2014, restoring 900 linear feet of stream. The project's RSC designs include open-channel, sand-seepage filtering systems that use a series of shallow aquatic pools, riffle weir grade controls, native vegetation, and an underlying sand channel to treat and safely detain and convey storm flow (Figure 2). The post-construction monitoring period ran from August 2014 through August 2016.

Results

Post-restoration data has shown that the stream restoration work has been highly successful. The RSC installation resulted in an almost immediate 4-foot increase in groundwater levels around the project area, and also improved the volume and duration of perennial stream flow. After restoration was complete, surface waters showed significant improvement in the RSC reach when compared to the control watershed (Figure 3).

Constituent loads measured in this study generally decreased after restoration when compared to the pre-construction period in the RSC catchment. Of all the constituents measured, the largest contrast between sites was evident with area yields of total nitrogen, total phosphorous and total suspended solids, which decreased 53, 4 and 12 times more in the RSC compared to the control catchment, respectively.

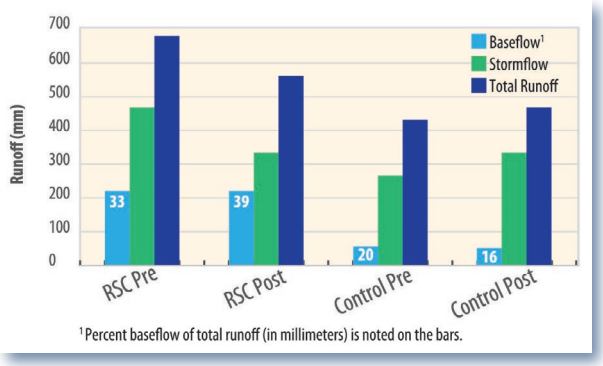

Figure 3. Total annual baseflow, stormflow and total runoff for both the RSC site and control site during the pre- and post-construction periods indicate that the RSC stream improved after construction compared to the control site.

Bacteria increased substantially in the control catchment compared to a similar decrease in the RSC catchment in the post-construction period. Of note is that the area yields of iron increased by a factor of 10 times in the RSC area. Although the loads increased, they remain well below stream impairment levels and will continue to be monitored. Finally, rapid biological assessments of the RSC and control sewersheds show that although both sites remained considerably impaired in the post-construction period, the RSC site has shown improvement while the control watershed has shown degradation.

Partners and Funding

The partners involved in this project include the National Fish and Wildlife Foundation (NFWF), Biohabitats (designer/installer), the University of Maryland (UMD), the District Department of Parks and Recreation, DC Water, and the District Department of Energy and Environment. The total project cost for this effort including design, construction and monitoring was $2,500,000. Of that cost, $700,000 was provided from a grant from NFWF; $650,000 of in-kind costs came from DC Water through sanitary sewer lining that was performed in the project area; and $136,000 of in-kind funding came from the UMD who undertook the monitoring and analysis work for this project. The remaining $1,000,000 in funding came from District of Columbia local funds. CWA section 319 dollars supported the District Department of Energy and Environment staff who managed project planning and implementation.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-17-001N
August 2017

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