Effectiveness of Low Impact Development

Proven LID Technologies Can Work for Your Community

LID Barrier Busters Fact Sheet Series

Low Impact Development (LID) includes a variety of practices such as bioswales and porous paving that mimic natural processes by retaining rain water and allowing it to soak into the ground. Studies have shown that LID practices offer significant environmental benefits over conventional stormwater management practices (where runoff is shunted quickly into detention basins or directly to streams). By holding water onsite, LID practices reduce the amount of runoff generated during a rainstorm, alleviating downstream erosion and stream habitat damage. In addition, LID practices filter out pollutants such as oil, bacteria, sediment and nutrients as the collected water seeps through vegetation and soil. The water that eventually reaches groundwater and surface water is much cleaner.

This fact sheet highlights the environmental benefits of several LID projects across the country. Separate fact sheets in EPA's *LID Barrier Busters* series focus on cost and aesthetic benefits achieved by LID.

FAQ

Isn't LID less effective than conventional stormwater management?

Barrier Busted!

LID successfully controls polluted runoff across the nation.

EPA's LID Barrier Busters fact sheet series… helping to overcome misperceptions that can block adoption of LID in your community

Case Studies: LID Environmental Successes Span the United States

Seattle, Washington

Seattle launched its Street Edge Alternatives (SEA Street) neighborhood demonstration project in 2000. The city incorporated LID practices to improve stormwater management on 600 linear feet of street (comprising a drainage area of 2.3 acres). The project reduced impervious surfaces by 11 percent when compared to a traditional street, provided surface detention in roadside swales, and added more than 1,200 new trees and shrubs.

Results? The volume of stormwater leaving the street declined by 99 percent. LID practices absorbed all dry season flow and 98 percent of wet season flow.

Seattle's SEA Street project (top of photo) uses numerous LID practices including rain gardens, vegetated swales and a narrow, winding street. A typical Seattle street (bottom of photo), by comparison, has a broad, wide street and flat yards with few natural depressions to capture and store stormwater runoff.

In 2003 Seattle implemented the Northwest 110th Cascade project, replacing 1,400 linear feet of existing ditches and culverts with a series of stair-stepped natural pools that slow damaging stormwater flows, encourage infiltration and trap pollutants from a 28-acre basin.

Results? The LID practices significantly reduce the amount of runoff that reaches a nearby creek. Discharge volumes declined between 48 and 74 percent. In fact, the basin released water into the creek in only 49 of 235 measurable storms. Monitoring showed that the LID practices also filtered out a lot of the pollution carried in the stormwater (Table 1).

For more information about the Seattle projects (including virtual tours), go to **www.seattle.gov** and type "natural drainage" into the search box.

Table 1. NW 110th Cascade Project: Pollutant Removal (2004–2006)

Pollutant	Pollutant Mass Loading Reductions[1]
Total suspended solids	84%
Total nitrogen	63%
Total phosphorus	63%
Total copper	83%
Dissolved copper	67%
Total zinc	76%
Dissolved zinc	55%
Total lead	90%
Motor oil	92%

[1] As compared to traditional street drainage

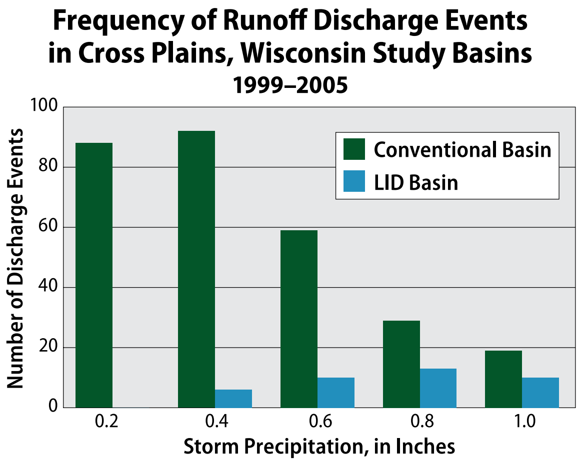
Source: Horner and Chapman, 2007. NW 110th Street Natural Drainage System Performance Monitoring (www.seattle.gov)

A stair-stepped pool slows runoff in Seattle's NW 110th Cascade project.

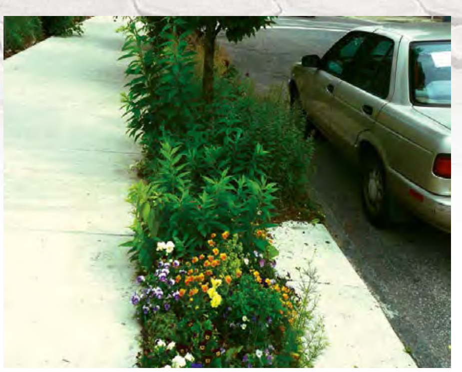
Cross Plains, Wisconsin

Between 1999 and 2005, the U.S. Geological Survey monitored water quality from two similar developments—one fitted with conventional drainage (wide streets, curbs, gutters and storm sewers leading to a detention basin) and the other with LID practices (grass swales, small detention areas followed by a large infiltration basin, infiltration trenches and narrow street widths).

Results? The LID basin reduced the frequency of discharge, runoff volume and peak flows for most storms, which also greatly reduced pollutant loads. Data show that for storms with precipitation depths of 0.4 inches or less, the LID basin discharged runoff only six times, compared to 180 times in the conventional basin (see chart). Overall, the LID basin released a total discharge volume roughly one-tenth that of the conventional basin.



(Adapted from Selbig, W.R., and Bannerman, R.T., 2008, A comparison of runoff quantity and quality from two small basins undergoing implementation of conventional- and low-impact-development (LID) strategies: Cross Plains, Wisconsin, water years 1999–2005: U.S. Geological Survey Scientific Investigations Report 2008–5008, 57 p.) (See *http://pubs.usgs.gov/sir/2008/5008*)



Stormwater planters in Philadelphia capture and filter stormwater runoff from an adjacent roadway.

A green roof on Philadelphia's Thin Flats housing units offers private green space for urban residents while also capturing rainwater.

Philadelphia, Pennsylvania

The city's sewer collection system includes 40 percent municipal separate storm sewer system (a pipe that carries stormwater runoff and empties into a local waterway) and 60 percent combined sewer (a pipe that carries both raw sewage and runoff to a treatment facility). In times of heavy rain, the runoff introduced into the combined sewer can overwhelm the collection system and lead to discharge of untreated sewage directly into surface waters. To reduce the amount of stormwater runoff reaching the combined sewer, Philadelphia is implementing LID practices such as stormwater planters, stormwater bump-outs, stormwater wetlands, rain gardens and porous paving, among others (see **www.phillywatersheds.org/BigGreenMap** for project locations).

Results? Over a two-year period the city replaced an estimated two square miles of impervious cover (e.g., parking lots, roads) with LID practices, reducing runoff during this time by a half billion gallons. Storing an equivalent amount of combined sewer overflow would have cost the city an estimated $340 million. One project, the Saylor Grove stormwater wetland, was designed by the Philadelphia Water Department to capture and filter the first 0.7 inch of every rainfall event falling over a 156-acre urban watershed—treating 70 million gallons of runoff and preventing approximately 13 tons of sediment from reaching the local creek each year. For a comprehensive look at benefits gained through Philadelphia's LID approach, see **http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_philadelphia_bottomline.pdf**.

Philadelphia constructed the one-acre Saylor Grove stormwater wetland in a park area to collect and treat 70 million gallons of urban stormwater generated in the storm sewershed each year.

An educational sign at Philadelphia's Saylor Grove stormwater wetland provides a diagram of the wetland and explains the benefits of natural stormwater management.

Need More Information to Share with Others?

The University of New Hampshire's Stormwater Center offers online presentations about the effectiveness of various types of LID practices (**www.unh.edu/unhsc/presentations**). For links to more LID resources, see **www.epa.gov/nps/lid**.

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