Nonpoint Source
News-Notes
May 2005, #75

The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds

SPECIAL FOCUS ISSUE: Economic Benefits of Nonpoint Source Pollution Control

Notes on the National Scene

Saving Money Through Source Water Protection

Preventing contamination of raw drinking water supplies generally is more efficient than trying to identify and remove that contamination from the water stream at the treatment plant. By dedicating funds to restore and protect source water areas, communities are saving tremendous amounts of money over the long term. The following discussion, excerpted from "Protecting the Source: Conserving Forests to Protect Water," an article in the May 2004 issue of the American Water Works Association's newsletter, addresses the wastewater treatment economic benefits gained by protecting source water.

Clean Source Water is Key

Advancements in science and technology have enabled water utilities to effectively treat most known contaminants from drinking water sources and to provide American citizens with some of the safest drinking water in the world. However, these advancements have contributed to a movement away from protecting and managing our source areas and to the unfortunate notion that the quality of our raw water supplies is less important.

Oh noooo! Look who's helping Governor Blanco save Louisiana's wetlands. See article on page 12.

Inside this Issue

Low-Impact Development Pays Off

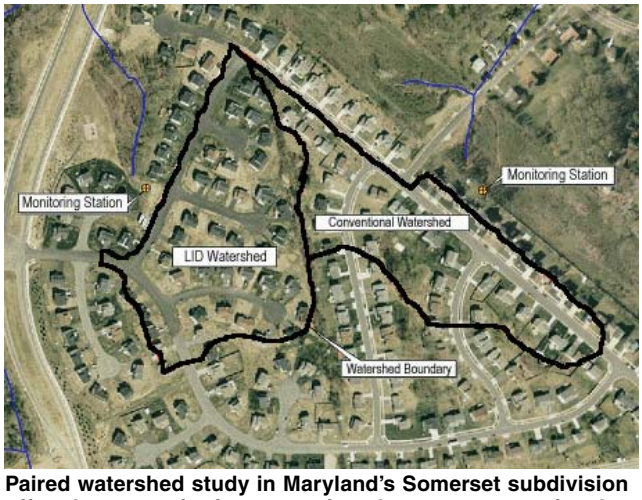
What exactly is low-impact development (LID), and how does it compare with conventional stormwater management? In traditional stormwater management, water from a development site is moved away as quickly as possible to a centralized facility, such as a stormwater pond or a local stream. LID attempts to mimic the drainage patterns that were present before development by encouraging runoff infiltration, storage, filtering, evaporation, and detention.

Estimates from pilot projects and case studies suggest that LID projects can be completed at a cost reduction of 25 to 30 percent over conventionally developed projects. The need for costly stormwater ponds, drainage pipes, curbs and gutters, and wide streets is eliminated or dramatically reduced, which usually more than offsets the cost of relatively less expensive LID features such as rain gardens, cisterns, and permeable surfaces. The following examples show how rapidly LID is gaining acceptance across the country.

Prince George's County, Maryland. In the early 1990s, Somerset subdivision became one of the first large residential communities to include rain gardens as part of an LID drainage design. Rain gardens were a local innovation when Larry Coffman, associate director of the county's Department of Environmental Resources, considered options for the Somerset project. Coffman helped design a plan to create open drainage swales and replace the typical ponds, curbs, gutters, and sidewalks with special gardens on each lot to capture the runoff. Rain gardens are inexpensive to build, need very little maintenance, and restore water to the soil. Somerset is an 80-acre subdivision containing about 200 homes valued at approximately $160,000 in 1995. Most 10,000-square-foot lots have a 300- to 400- square-foot rain garden, although some of the subdivision was completed prior to inclusion of LID.

Each rain garden cost about $150 for excavation and $350 for plants. About $100,000 was needed to install rain gardens at Somerset, in comparison to nearly $400,000 needed to install conventional detention ponds, which did not include the expense of curbs, gutters, and sidewalks. Elimination of the need for a stormwater pond allowed the development of six extra lots and resulted in a cost savings of more than $4,000 per lot.

In November 2000, Prince George's County initiated a field monitoring program to compare the stormwater hydrologic and water quality responses between two watersheds in Somerset subdivision. Development in the first watershed was completed in the early 1990s with conventional stormwater conveyance techniques (curb, gutters, and pipes). Development in the second watershed, located directly next to the first, was completed in 2000 and includes the rain garden and grassed swale LID techniques (see photo). Preliminary monitoring results indicate that the LID site experienced a 20 percent lower average annual runoff volume per unit area than did the conventionally designed watershed. The LID watershed generated fewer runoff-producing events overall (see table 2).



Paired watershed study in Maryland's Somerset subdivision offered opportunity for comparison between conventional and LID stormwater design techniques.

Table 2. Somerset Paired Watershed Study: 2-Year Hydrologic Summary

Measurement	Watershed	
	Conventional	LID
Number of events with measurable runoff >100 cubic feet*	104	83
Total runoff volume (cubic feet/acre)*	41,403	33,391
Percent of rainfall converted to total runoff*	19.0%	15.3%

* Difference is significant at the 95% confidence interval

Low-Impact Development Pays Off (continued)

Preliminary monitoring also showed that metal levels in the runoff in the LID watershed were significantly lower than in the conventional watershed (36%, 21%, and 37% lower for copper, lead, and zinc, respectively). However, nitrogen levels were the same in both watersheds, while phosphorus levels were actually higher in the LID watershed. Project leaders suspect the LID watershed has higher-than-expected nutrient levels because it is still relatively new and is experiencing unstable soils and over-fertilization by homeowners. Project leaders expect the water quality in the LID watershed to improve significantly over time.

Prince George's County is pleased with the performance of the LID techniques at Somerset. Residents are also pleased—they have enthusiastically accepted their rain gardens and maintain them like they do other parts of their yard. Originally viewed as "free landscaping" by many residents, the naturalized rain gardens have become a key part of subdivision's identity. (*Sources:* (1) *U.S. HUD, 2003.* The Practice of Low Impact Development *(LID). U.S. Department of Housing and Urban Development, Office of Policy Development and Research. Available online at www.lowimpactdevelopment.org/lid%20articles/practLowImpctDevel_jul03.pdf.* (2) Hydrological Responses from Low Impact Development comparing with Conventional Development*, by Mow-Soung Cheng, Larry S. Coffman, Yanping Zhang, and Z. John Licsko.*)

Sherwood, Arkansas. Developers of the Gap Creek Subdivision used LID concepts, allowing them to gain 17 additional lots. Each lot sold for $3,000 more than comparable competitors' lots, and lowered the total cost per lot by $4,800. The project also resulted in 23.5 acres of green space and parks, $2.2 million in additional profit, and national recognition. The new design worked with the land's features. For instance, drainage areas were preserved and buffered by green space called greenbelts. The network of greenbelts were connected to neighborhood hiking trails. Streets meandered with terrain to minimize excavation needs. By maximizing the number of lots that backed up to greenbelts, the developers provided homeowners with a sense of privacy which led to higher lot prices.

The original plan's street was changed to include green space buffers and traffic calming circles thus allowing the developer to reduce street widths from 36 to 27 feet. In addition, trees were allowed to stay close to the curb line. The site uses native vegetation such as buffalo grass, and cleared trees were transformed into mulch. The original plan preserved 1.5 acres of green space while the revised plan preserved 23.5 acres. Some of the development cost savings went to fund a neighborhood park with picnic facilities, a pavilion, and ball fields. (*Source: Tyne, Ron, 2000. Bridging the Gap: Developers Can See Green.* National Association of Home Builders Land Development Magazine, *Spring - Summer 2000, pp 27-31.*)

Aberdeen, North Carolina. Design engineers for the Poplar Street Apartments used an alternative LID stormwater control design for a new 270-unit apartment complex and saved the developer approximately 72 percent, or $175,000, of the conventional stormwater construction costs. At the site, almost all of the conventional underground storm drains associated with curb and gutter projects were eliminated. Strategically located bioretention areas, compact weir outfalls (see photo), depressions, grass channels, wetland swales, and specially designed stormwater basins were some of the LID techniques used. These design features allow for longer flow paths, reduce the amount of polluted runoff, and filter pollutants from stormwater runoff. (*Source: Storm Water Solutions For New Mandatory Federal Storm Water Regulations, Fall 1999 newsletter of* BLUE: Land, Water, and Infrastructure, *available at www.blwi.com/n_fall99.htm*)

In Aberdeen, NC, a compact weir releases water on all sides, distributing stormwater to bioretention cells.

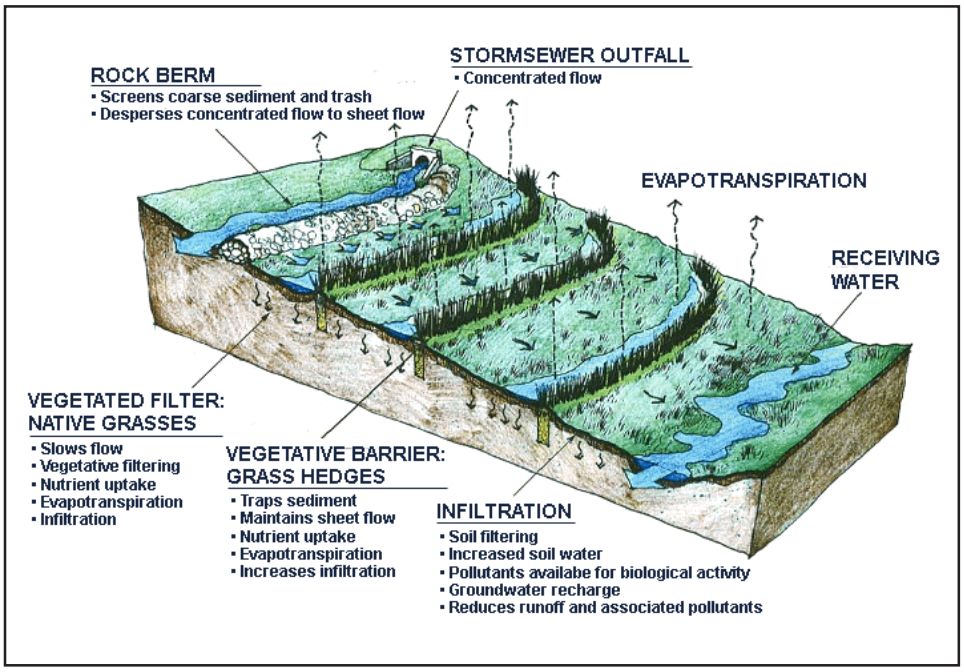
Largo, Maryland. At the Inglewood Demonstration Project, engineers retrofitted an existing parking facility with a bioretention area. They selected a landscaped island measuring

about 38 feet by 12 feet to be retrofitted to treat runoff from a half-acre of impervious surface. They cut a four-foot slot into the curb immediately before the storm drain inlet, excavated the landscaped island to a depth of four feet, and installed an underdrain that would allow the soil in the island to slowly drain, preventing oversaturation. Next, they covered the underdrain with eight inches of one- to two-inch gravel and backfilled with typical bioretention soil mix up to a depth of about 12 inches below the top of the curb. Finally, they planted the area and covered it with three inches of shredded hardwood mulch. Water collects in the island to a ponding depth of approximately six inches before a backwater is created at the curb opening.

Results showed that the project lowered runoff temperature by 12 degrees C, and significantly reduced metals and other pollutants present in the runoff. The retrofit cost $4,500 to construct, while usual methods of treating that runoff would have cost $15,000-$20,000 and involved fewer environmental benefits and higher maintenance costs. (*Source: USEPA, 2000.* Bioretention Applications. *Document 841-B-00-005A. Available online at epa.gov/nps/bioretention.pdf)*

Pierce County, Washington. Pierce County directed a study looking at the use of potential LID technologies in Kensington Estates, a conventional, 103-lot single-family development planned on 24 acres. The LID design of the roadways and utilities called for a reduced roadway width, porous paving, and cul-de-sac clusters. The cul-de-sac design included vegetated depressions in the center of each that would capture and retain six inches to one foot of runoff. These LID features generated costs that would be slightly higher than the costs for conventional materials and design. However, the study showed that over the entire 24-acre development site, the LID approach would generate construction cost savings of more than 20 percent over a conventional approach, preserve 62 percent of the site in open space, maintain the project density of 103 lots, reduce the need for, and size of, storm pond structures, eliminate catch basins and piped storm conveyances, and achieve "zero" effective impervious surfaces. *(Source: CH2MHill, 2001.* Pierce County Low Impact Development Study. *Available online at www.pierce.wsu.edu/Water_Quality/LID/CH_Final_LI_Report.pdf.)*

Austin, Texas. The City has had a plan for buffering streams for the protection of the Edwards Aquifer for many years, but in some cases, runoff from subdivisions was still collected by curb and gutter and discharged as a concentrated flow directly to the buffered streams. In Austin's Circle C Ranch subdivision, engineers converted the concentrated storm sewer point discharge to a system that encouraged sheet flow along the buffer (see picture). The redesign included placement of a rock berm along a drainage ditch located at the top of the grassed stream buffer. The runoff percolated through the berm and flowed across the entire width of the buffer before entering the stream. The engineers also planted a series of native grass hedges to help distribute flow along the buffer. This redesign created four biodetention areas at a total cost of $65,000, much less than the $250,000 sedimentation-filtration pond that would have otherwise been required. Per lot cost was approximately $450 compared to $1,700 for the sedimentation-filtration pond. Additional cost savings were realized through reductions in storm drain pipe sizes and trenching depth. (*Source: Scaief and Murfee. 2004.* Subdivision



At Austin, Texas' Circle C Ranch Subdivision, engineers designed a drainage system that encourages stormwater sheet flow across a vegetated buffer.

Low-Impact Development Pays Off (continued)

Design to Maximize Utilization of Stream Buffers*, from AWRA Summer Specialty Conference, June 28-30, 2004. Murfee Engineering Co., Inc., 1101 Capital of Texas Highway South, D-110, Austin, TX 78746; Phone: 512-327-9204; E-mail: jscaie@murfee.com*)

River Stars Program Saves Money and the Environment

The nonprofit Elizabeth River Project's River Stars Program exemplifies the notion that pollution prevention can yield profits for companies. The southeastern Virginia-based program encourages industry, government, and other facilities in the Elizabeth River watershed to pursue voluntary pollution prevention and wildlife habitat goals, and rewards them for their successes. Since its inception in 1997, the River Stars Program has documented a reduction of hazardous waste and other pollution by more than 144 million pounds and restoration or conservation of more than 220 acres of wildlife habitat. Thanks to a bit of innovative thinking, the River Stars Program facilities found economically feasible—and sometimes economically beneficial—ways to reduce pollution.

The 200-square mile Elizabeth River watershed includes the Virginia cities of Norfolk, Portsmouth, Chesapeake, and part of Virginia Beach. The Elizabeth River drains into the Chesapeake Bay, and has been identified by the Chesapeake Bay Program as one of the three most toxic regions of concern in the bay watershed, due to high levels of pollution in its waters and sediments.

Program Promotes Ongoing Achievement

Through the River Stars Program, the Elizabeth River Project promotes a non-regulatory, partnership-based approach with private industry and others to reduce and prevent pollution. Elizabeth River Project staff provide River Stars facilities with project recommendations, project funding acquisition, project design and other technical assistance, volunteer event planning, documentation of results, and public recognition of successes. River Stars projects typically include reduction, elimination, or recycling of waste materials in an industrial process, establishment or restoration of a wildlife habitat area, and onsite stormwater management improvements such as efforts to capture and reuse stormwater. Most companies have enjoyed corresponding cost savings through reduced need for materials, labor, and waste treatment or disposal.

About 50 facilities currently participate in this program. (The Elizabeth River Project also has a separate River Stars schools program.) The program provides for three levels of achievement, each of which requires different degrees of success with pollution prevention or wildlife habitat projects. This three-tiered, interdisciplinary approach allows facilities to start small and build on their successes. Many River Star facilities maintain their designated level of environmental excellence from year to year by adding to previously initiated projects and enlarging wildlife habitat areas. The River Stars Program encourages participating facilities to continually implement new projects so they can be recognized each year and/or be awarded a higher level of achievement.

Reducing Pollution and Costs

River Stars' impact on nonpoint source pollution is growing. Historically, many of the projects were associated with pollution reduction in industrial processes and the impact on water quality was an indirect one. This impact was largely associated with reductions in landfill waste, air emissions, and contaminants in treated wastewater. Now, more River Stars facilities are branching out into stormwater management and wildlife habitat projects—projects that can directly reduce nonpoint source pollution. Many of these projects have also provided unexpected economic benefits.

NOVA Chemicals, Inc., a manufacturer of polystyrene resin, created an 11-acre "no-mow" area of 3,000 native trees and shrubs, designed to provide food and shelter for migrating songbirds. The native plants also reduce soil erosion and improve the quality of stormwater runoff reaching the river. After implementing the project in 1999 at a cost of less than $8,000, the company found it was saving $16,000 annually by no longer mowing the land. "We tried to do the right thing for