First FLUSH Brings FACTS

A watershed-based monitoring project identifies urban land use pollutants; implements solutions accordingly

By Mary P. Skopec, Ph.D. & Rebecca Kauten

The Dry Run Creek watershed improvement project is located in Black Hawk County in eastern Iowa. The county has a population of roughly 123,000 people, most of whom live within the Waterloo-Cedar Falls metro area.

The Dry Run Creek watershed encompasses approximately 15,000 acres, and 85 percent of the land use is urban or residential. The remaining land is currently in farm production, but growth pressure is an issue for this watershed, as it is prime real estate slated for new development.

Project Background

The Iowa Department of Natural Resources (DNR) designated Dry Run Creek as an impaired water body in 2002 after studies showed that it failed to support aquatic life. Further investigation into the potential causes of this impairment found that hydrologic alteration and heavy sediment loading were likely reducing habitat availability. Additionally, routine monitoring throughout the watershed found high levels of *E. coli* bacteria in Dry Run Creek, which borders several parks and walking paths.

UNI, a watershed landowner, has implemented storm water management practices, including permeable pavers.

A grant was submitted in November 2005 to the Iowa Watershed Improvement Review Board (WIRB) by the Black Hawk Soil & Water Conservation District (SWCD). The WIRB program was developed by the state to fill funding gaps for water quality improvement. WIRB funding is more flexible in that it allows watershed groups to pay for improvement practices that are not normally covered using U.S. Environmental Protection Agency Clean Water Act Section 319 grants. In early 2006, the SWCD was awarded $500,000 to implement a series of demonstration projects and monitoring within the watershed.

One unique feature of this project is that the University of Northern Iowa (UNI) is located within the watershed and is one of its largest landowners. The urban campus has a high level of impervious coverage and near-constant construction projects. To raise awareness of the effectiveness of urban storm water control practices, demonstration practices were installed on campus: Two parking lots on either side of campus have bioretention cells treating runoff; workers stabilized streambanks along the branch of Dry Run that intersects campus; two parking lots on the west side of campus are treated with sections of pervious concrete; and a detention basin retrofit project increases oxygen and drops sediment out of the headwaters of the university branch of the creek.

The university features these practices as part of a campus-wide sustainability initiative and has expanded the scope of the project beyond its initial proposal by re-engineering the concrete library plaza with permeable pavers.

Monitoring Tools & Methods

In order to assess the effectiveness of the various storm water best management practices used in the Dry Run Creek watershed, a series of monitoring stations was installed. Ten creek sites have been monitored since 2005; some are located on major tributary branches and at the contact points between rural and urban land uses.

Also, two university parking lots are sampled using GKY First Flush devices. The first-flush units are recessed into the parking lot and capture the initial volume of water moving as sheet flow as a result of rainfall. One first-flush device was placed up-gradient of a biocell to measure the level of contaminants entering the lot's biocell, and another unit was placed in a curb cut of an untreated parking lot on the opposite side of the creek.

When the units are full, they prevent further collection of water into the device and therefore are not subject to dilution of contaminants as a rainfall event progresses. Water samples are then analyzed for total suspended

solids (TSS), hydrocarbons and polychlorinated biphenyl (PCB). Field data collection includes in-stream temperature, dissolved oxygen and pH.

Research Results

To date, results from the monitoring show that the biocell is successfully reducing runoff from the parking lot to the stream. Postevent monitoring has shown that water entering the biocell is not leaving via the subdrain to the stream. The absence of flow in the subdrain leads to the possible conclusion that all water entering the cell is infiltrating through the soil matrix and has not accumulated to a saturation point within the cell. Also, water does not flow out of the biocell and into the stream, so it is effectively eliminating contaminant delivery.

Fourteen percent of the samples in the parking lot above the biocell treatment—four of 29—had detectable levels of hydrocarbons, with an average concentration of 7.05 mg/L. Of the samples from the untreated parking lot, 48 percent had detectable levels of hydrocarbons, with an average concentration of 9.6 mg/L. TSS levels in the first-flush above the biocell averaged 254 mg/L, while the untreated parking lot had an average concentration of 732 mg/L.

Monitoring of PCBs in the first-flush devices showed that the unit above the biocell detected Aroclor 1254 in all five samples taken in 2007, but none of the samples in the untreated parking lot had detectable levels. Stream samples in this section of the creek have not shown detectable PCB levels, but the first-flush monitoring shows a potential source near the creek.

As with many storm water retention cells, the main focus of the parking lot biocell is to reduce sediment and water entering the creek. The detection of PCBs above the biocell, however, demonstrates the added benefit and protection that biocell provides by capturing runoff with contaminants that had not previously been documented. Ongoing work is needed to isolate the source of PCBs up-gradient of the biocell. SWS

Monitoring results show a biocell is reducing parking lot runoff.

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