URBAN STORMWATER RUNOFF

DEFINITION

Introducing impervious surfaces (sidewalks, roofs, roads, driveways, etc.) to a landscape can substantially impact receiving streams and waterbodies by increasing both stormwater runoff and its associated pollutants. In addition, data indicates a direct relationship between the amount of imperviousness in a given watershed and the degree of degradation. That is as imperviousness increases, degradation is also likely to increase.

WATER QUALITY IMPACTS & TYPICAL LOADINGS

Nitrogen is a nutrient associated with the *soluble* component of stormwater runoff. Although necessary for plant growth, excess nitrogen in water becomes a pollutant—and stimulates growth of algae and other less-desirable plants. Nitrogen enrichment is typically more problematic in estuarine ecosystems. Major sources in an urban setting include fertilizers, septic systems, and atmospheric deposition. Typical loadings for total nitrogen from urban land uses range from 10 to 15 lbs/ac/yr.

Phosphorus is a nutrient more often associated with the *particulate* component of stormwater runoff, since it readily adsorbs—that is, attaches—to sediment. Also necessary for plant growth, excess phosphorous becomes a pollutant typically more problematic in freshwater ecosystems than in estuarine ecosystems. The major source of phosphorus in an urban setting is fertilizer. Phosphorus can also be released into water during the construction phase of development. Some soluble phosphorus can be traced to septic systems; however, the use of low phosphorus detergents has significantly reduced this source. Typical loadings for total phosphorus from urban land uses range from 0.75 to 1.25 lbs/ac/yr.

MANAGEMENT TECHNIQUES & TYPICAL REDUCTIONS

A wide selection of best management practices (BMPs)—including manmade ponds, filtration systems, and infiltration structures—can control pollutants associated with urban stormwater runoff. Until recently, however, such BMPs have largely sought to control the particulate pollutants found in surface runoff—such as sediment and those pollutants which tend to adsorb to sediment, such as phosphorus. Soluble pollutants—such as nitrogen—can be found in both surface runoff *and* subsurface flow.

BMPs, which have a vegetative component, designed for nutrient uptake and/or an anaerobic component to induce denitrification—such as constructed wetlands, biofiltration systems, and bioretention structures—can reduce these pollutants. Current urban BMP designs remove 25 to 84 percent of total nitrogen, and 19 to 70 percent of total phosphorous.

BMP	**Total Nitrogen** (% reduction)	**Total Phosphorus** (% reduction)
Stormwater Wet Ponds	33	51
Filtering Practices	38	59
Stormwater Dry Ponds	25	19
Stormwater Wetlands	30	49
Infiltration Practices	51	70
Water Quality Swales	84	34

TYPICAL COSTS

Unique site conditions make "typical urban BMP costs" difficult to determine. Additionally, "per-acre-treated costs" are difficult to provide—mostly due to the economy-of-scale that affords large projects relatively lower costs. Pond construction costs, however, can provide a basis for comparisons:

- ***Residential*** sites with a small project of 10-20 acres typically begin at $25,000, whereas a large project of 100+ acres can exceed $100,000. Median cost is about $50,000.
- ***Commercial*** sites vary greatly. Fast food restaurants or gas stations may be as small as 1 acre; Department or home-improvement stores may be around 50 acres; and shopping centers/malls can exceed 100 acres. Commercial sites typically cost $50,000 to $200,00. Median cost is about $100,000.

More stringent nutrient reduction requirements—particularly for nitrogen—may increase traditional BMP costs 25 to 50 percent. Use of non-traditional techniques such as the Conservation Design approach, however, could check—and, in some cases, actually reduce—costs to below those for current traditional BMPs. (See CONSERVATION DESIGN FOR STORMWATER MANAGEMENT fact sheet).

One way to fund the implementation of stormwater management BMP's is through the formation of a Stormwater Utility. The user is typically assessed a fee based on the amount of impervious area their parcel contains. Based on information collected from various stormwater utilities in place around the country, fees for residential parcels range from approx. $20-$100 per year. Fees for commercial/institutional/industrial sites can reach the $1,000+ range. The fees are used for operations and maintenance costs as well as capital improvement projects, depending on how the utility is structured. The Delaware Sediment & Stormwater Regulations already have statutory authority for allowing the formation of a utility in Delaware if a local jurisdiction is so inclined.

IMPLEMENTATION ISSUES

Stormwater runoff *from particular industries* is regulated through the federal National Pollutant Discharge Elimination System (NPDES) program, administered by the Surface Water Discharges Section within DNREC's Division of Water Resources.

Stormwater runoff *associated with new development* is regulated under the Delaware Sediment & Stormwater Regulations (the Regulations), administered within the Division of Soil & Water Conservation. The water quality goal under the current Regulations is 80 percent removal of the average annual load of total suspended solids (TSS). The Sediment & Stormwater Program is currently in the process of revising the Regulations. This initial round will have provisions that will facilitate the implementation of non-structural stormwater management BMP's and correct some minor inconsistencies with the Federal NPDES Program. A second round of revisions will be more sweeping and will incorporate the Pollution Control Strategies being developed Statewide through the TMDL process.

Once these goals have been defined, Regulation revision is fairly straightforward and involves a public review process. Confusion or lack of consensus among stakeholders can complicate Regulation revision, so preparatory education efforts will be key to successful implementation.

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APPOQUINIMINK WATERSHED

This fact sheet was prepared by the Delaware Department of Natural Resources and Environmental Control's Whole Basin Team, at the request of the Appoquinimink Tributary Action Teams, for citizens and stakeholders interested in one of Delaware's most environmentally and economically attractive areas—the Appoquinimink River and its surrounding lands, surface and ground waters.

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