4 IMPROVED STORMWATER MANAGEMENT

> *"Past philosophy sought maximum convenience at an individual site by the most rapid possible elimination of excess surface water after a rainfall and the containment and disposal of that water as quickly as possible through a closed system. The cumulative effects of such approaches have been a major cause of increased frequency of downstream flooding, often accompanied by diminishing groundwater supplies."*
>
> -Urban Land Institute et al.,
> Residential Storm Water Management.

Background

Compared to some other techniques, the benefits of stormwater management may be less direct, but they are no less important to protecting the region's biodiversity. While other techniques mostly benefit the diversity of plants and animals living on land, the principal benefits of stormwater management relate to water environments. More specifically, without improved stormwater management, the integrity and quality of the region's aquatic systems—streams, lakes, and wetlands—will continue to be degraded and remaining high quality ecosystems will be destroyed.

Conventional urban development dramatically increases the amount of stormwater runoff generated by the landscape. The principal causes of this effect are impervious surfaces—streets, parking lots, and buildings—and compaction of the soil due to construction activities. Instead of soaking into the ground, rain that falls on an impermeable surface is converted quickly to runoff and is eliminated from the site via sewers and manmade channels.

Some common site development standards may actually worsen stormwater runoff problems. For example, development standards that require wide streets, expansive parking lots, and artificial drainage systems produce even more runoff than similar developments of 40 to 50 years ago. New development often incorporates stormwater detention to slow the release of stormwater runoff to downstream rivers, in recognition of the negative effect that increased runoff has had on flooding. While beneficial in controlling flood peak flows, this still leaves several runoff-related problems inadequately addressed.

- Stormwater runoff is contaminated with various water pollutants that are byproducts of urban activities such as automobile use, lawn care, and industrial fallout. If unchecked, these pollutants will damage aquatic life, including fish and other wildlife species that depend on water resources for food and habitat.
- Water that runs off urban landscapes cannot effectively recharge groundwater. As a consequence, wetlands and waterbodies that are naturally dependent on stable groundwater flow are subject to highly variable surface runoff causing long-term degradation. Specific impacts include a loss of sensitive plant species and a subsequent loss of wildlife habitat. Also, communities that depend on locally recharged groundwater aquifers are more likely to suffer water shortages that could limit future development and necessitate sprinkling bans and other restrictions.
- Urban runoff causes instability in the drainage system by increasing the high flows, which can cause streams to rapidly erode and degrade water habitat, and decreasing the low flows (or *baseflows*). Reduced baseflows can cause small streams and lakes to dry up and concentrate pollutants to damaging levels.
- While stormwater detention can effectively reduce runoff *rates*, thereby controlling localized flooding, it does little to control the increased *volume* of runoff caused by urbanization.

Recommended Approaches

Fortunately, there are development options involving alternative stormwater drainage and site design approaches that can substantially reduce the identified impacts. These alternative development techniques, commonly called *best management practices*, or *BMPs*, involve measures that accomplish two basic objectives:

1. reduce the amount of impervious surface area, thereby reducing runoff; and
2. utilize the landscape to naturally filter and absorb runoff before it leaves the development site.

Interestingly, the recommended development designs reflect both old and new design philosophies. For example, natural drainage and narrow street widths mirror a design philosophy that pre-dates the arrival of "modern" subdivision design in the 50's and 60's. Another recommendation, the use of native landscaping materials, emulates pre-settlement conditions. Cluster development, which reduces impervious area, is a relatively new design approach that has not yet been widely used in this region.

Local governments can ensure that environmentally friendly stormwater designs are implemented in their communities by establishing requirements in zoning and subdivision ordinances. Many communities adopt such ordinances to ensure adequate drainage, to limit offsite flow rates with detention basins, and to limit erosion from sites during construction. Another way to reduce stormwater impacts is to provide flexibility in local subdivision ordinances that allows and encourages natural drainage approaches, such as vegetated swales, to minimize impervious surfaces and soil compaction.

Specific recommendations for improved stormwater drainage and site design follow. It should be acknowledged that not all of these techniques are appropriate on all development sites. Also, while it can be demonstrated that nearly all of these techniques are less expensive to implement than conventional development designs, there may be other tradeoffs such as aesthetic perceptions and maintenance needs that should be considered.

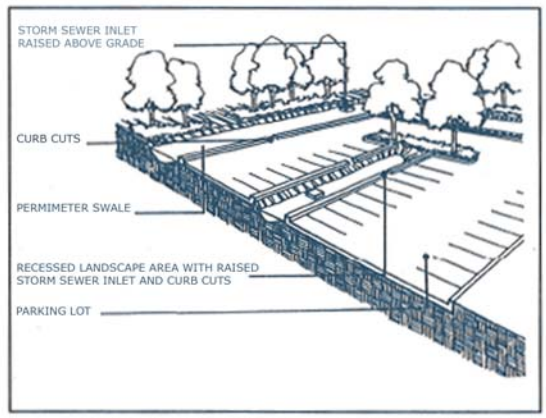
Natural Detention Basin Design, Management, and Maintenance

Natural detention basin designs incorporate features of natural wetland and lake systems, such as gradual shoreline slopes, a border of wetland and prairie vegetation, and areas of open water. In contrast, conventional designs feature dry bottoms or riprap-edged wet basins. Natural designs remove more stormwater pollutants than conventional wet and dry bottom basins, reduce nuisance goose populations, and can provide habitat for waterfowl, water insects, and amphibians.

To maximize the benefits of natural basin design, local officials should develop and adopt practices to manage and maintain the basins for optimal function.

Natural Drainage Measures

Use of drainage swales, vegetated filter strips, and other natural drainage approaches—in contrast to storm sewers, lined channels, and curbs and gutters—will reduce runoff volumes and greatly enhance the removal of damaging pollutants from runoff water. Communities should strive to maintain the natural drainage system, including natural stream channels, wetlands, and floodplains.



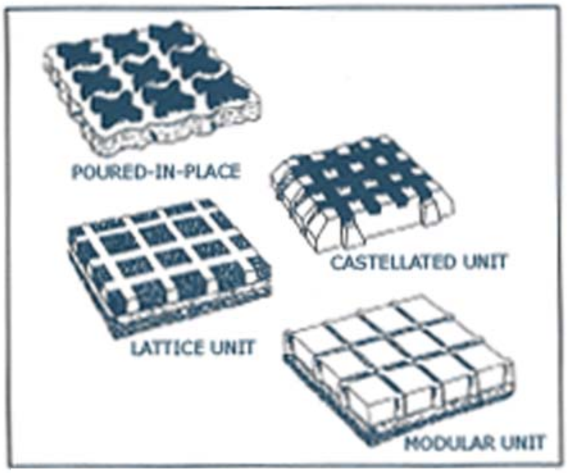
Parking lot swales (*Florida Department of Environmental Regulation*).

Infiltration Practices

Infiltration practices encourage stormwater to seep into the ground rather than travel over the surface of the soil, and to recharge groundwater supplies that are essential to the health of many streams and wetlands. Where soils are sufficiently permeable, infiltration trenches and basins dramatically reduce surface runoff volumes and naturally recharge groundwater supplies. Mass site grading, which strips water permeable topsoil and compacts underlying soils, also should be minimized.

Permeable Paving

The use of permeable paving blocks is a recommended alternative for low traffic parking areas, emergency access roads, and driveways to increase infiltration and reduce runoff volumes and pollutant loads.



Permeable paving blocks (*Virginia Soil and Water Conservation Commission*.)

Natural Landscaping

Natural landscaping approaches utilize native plants, particularly wildflowers, prairie grasses, and wetland species, as an alternative to conventional turf grass and ornamental plants. Natural landscaping, particularly appropriate in drainage swales and filter strips at the edges of roads and parking lots, can significantly reduce stormwater runoff by improving soil permeability, and reduce the maintenance needs of conventional turf grass landscaping such as mowing and irrigation. Natural landscaping also provides important localized habitats for birds and butterflies. This technique is discussed in greater detail in chapter 5.

Reduced Imperviousness via Alternative Residential and Parking Lot Designs

The area of impervious surfaces in a residential development can be reduced in several ways: utilizing narrower streets; reducing setbacks between streets and homes thereby reducing the length of driveways; and by reducing sidewalk widths. Impervious surfaces also can be reduced in parking lots by downsizing individual parking stalls, installing planting medians, sharing parking between adjacent users, adjusting peak demand assumptions, and banking raw land until parking demand builds.

Cluster Development/PUDs

Cluster development, described in chapter 3 of the guidebook, increases development density on portions of a development site to preserve natural features, sensitive habitats, and open space. This technique results in substantially less overall impervious area. Planned unit developments provide for greater flexibility in the site planning process, allowing the inclusion of many of the site design alternatives described above.

Maintenance Practices

In addition to these site design techniques, local governments can implement other programs to reduce the damaging effects of stormwater on aquatic ecosystems. For example, regular street sweeping in high traffic areas, particularly commercial districts, can substantially reduce runoff pollutants. Also, reducing the use of road salt, or substituting with less damaging chemicals, can reduce winter runoff impacts on sensitive wetlands, streams, and native prairies and woodlands.

Summary of Benefits

When used in combination on a development site, these techniques can substantially reduce both stormwater-related impacts and construction costs. Based on assessments of case studies in various parts of the country, it is estimated that alternative stormwater drainage and site design approaches can:

- reduce stormwater runoff volumes by 20 to 70 percent (in comparison to conventional development);
- reduce runoff pollutant loads by 60 to 90 percent;
- reduce site development costs by $1,000 to over $4,000 per lot for residential developments, and by $4,000 to $10,000 per acre for commercial and industrial developments.

Other documented benefits of these approaches include reduced infrastructure maintenance and replacement costs, enhanced site aesthetics, improved property values, and greater flexibility of site design. These techniques also will lead to improved protection and enhancement of sensitive natural areas and the region's waterbodies for supporting a diversity of wildlife.

Keeping water clean is almost always cheaper than cleaning it up later.

Local Examples

❖ *Earl Road Flood Control Facility*

The Sanitary District of Michigan City, Indiana, worked with Christopher B. Burke Engineering, Ltd., to design a project that has provided both a public amenity and flood insurance relief to local residents along a stream known as the Streibel Arm of Kintzele Ditch.

Since this project was designed for the public, it was beneficial to consult with Michigan City residents before construction began. Once the specific location and size of the project were determined in 2003, community meetings were held to receive input and feedback. Would the basin serve as a fishing pond or another type of recreational area? The focus remained, though, on designing a basin that would prevent flooding in adjacent neighborhoods if the area received a so-called '100-year' storm, which dumps about 5-1/2" of rain over a 24-hour period. The last '100-year' storm occurred in 1954 and forced numerous Michigan City families out of their homes.

In 2005, Tonn & Blank and Brown, Inc. moved 536,405 cubic years of material in order to construct the Earl Road Flood Control Basin that has a certified capacity of 83 million gallons of water. The 48-acre site also features an articulated concrete mat to attenuate soil erosion and thousands of native plantings to aid in water quality, erosion control, and aesthetic appeal. Picnic shelters, a gazebo, and more than a mile of paved walking trails have been constructed to allow the facility to truly serve as a multi-use city park. (No fishing though!)

Documentation was also sent to FEMA in order to receive the official Letter of Map Revision which removes the floodplain designation from portions of Michigan City. Once the new map becomes effective, the financial burden of flood insurance will be relieved on local homeowners.

The grand opening of the project was held in May 2006. Further details of the Earl Road Flood Control site can be found online at: *www.emichigancity.com/cityhall/department/sanitary*

(Source: www.cbbel.com)

❖ *U.S. Steel Yard: Gary SouthShore RailCats Baseball Stadium*

In 2000, the city of Gary, Indiana, chose a 20-acre site—a mix of residential and commercial properties—for the future home of the RailCats, their new baseball team. Ideally located in downtown Gary, the sandy site was not situated quite so favorably in terms of stormwater treatment. There was no storm sewer within several thousand feet, and the city's combined sewer system, which had handled runoff from the site prior to redevelopment, was already strained. Instead of cutting corners, Gary city officials decided on a forward thinking approach that would anticipate regulatory requirements and help protect the nearby Grand Calumet River. They looked at different technologies that would mitigate the pollutants entering the combined sewer system. DLZ Indiana, LLC, designed a stormwater treatment system that utilizes a combination of treatment technologies and exfiltration (the process of filtering the water "headed out" instead of "coming in") to achieve the city's goal of cleaning the water and reducing the volume of runoff from the site entering the city's sewer system.

The treatment system features two hydrodynamic separators. As the stormwater flows into the treatment systems, it enters a swirl chamber that separates and removes contaminated sediments from the runoff. The water then travels through a series of chambers where baffle walls trap oil, grease and floatables. The treated water is then sent to a series of underground, perforated pipes embedded in a stone trench. In all but the most severe storm events, the water exfiltrates into the ground, bypassing the combined sewer system altogether.

The city of Gary will inspect and maintain the system regularly through its contract with the White River Environmental Partnership. It should operate effectively for years to come if properly maintained.
(Source: www.stormwaterauthority.org)

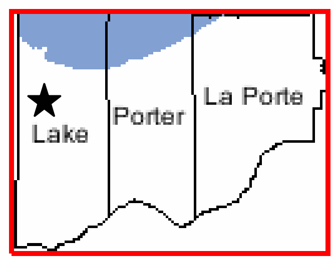
❖ *Porter County Convention Recreation and Visitor Center*

As part of the Dunes Creek watershed management effort currently underway, the Save the Dunes Conservation Fund (SDCF) is demonstrating appropriate best management practices (BMPs) at the new visitor center site for the Porter County Convention Recreation and Visitor Commission (PCCRVC). The 7407-acre Dunes Creek watershed is located along the shore of Lake Michigan in northern Porter County, Indiana. Dunes Creek flows into Lake Michigan at the swimming beach at the Indiana Dunes State Park. The new visitor center is located in the headwaters of the Dunes Creek watershed. The partnership between the PCCRVC and SDCF presents an extraordinary opportunity to educate people on water quality issues and demonstrate practices that can protect water quality. Recommended enhancements include vegetated swales, a rain garden, a combination permeable sidewalk/boardwalk, and a two-stage ditch.
The purpose of installing these BMPs is to reduce the impact of the new development on water quality in Dunes Creek and ultimately on Lake Michigan. Interpretive signage is also being installed at the visitor center to educate the public on these innovative ways to protect our water resources.

Dunes Creek (Munson Ditch) located in front of the new Porter County Visitor Center. The current drainage channel design modified the natural stream's habitat, nutrient cycling, and capacity for flood control.

SDCF is facilitating the construction of a two-stage ditch at the Porter County Visitor Center. Two-stage ditch channel design is more stable than conventional design and will improve Dunes Creek water quality by stabilizing the ditch and improving ecological function.

❖ *Funding a Stormwater Management Mandate*



In response to an unfunded mandate, or a law which requires a community to take a particular action but does not provide the funds needed for it, the town of Griffith, Indiana, along with numerous other municipalities in Indiana, must develop and implement a process for the following:

- Public education and outreach
- Public participation/involvement
- Illicit discharge detection
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention

- Measuring, monitoring, and improving the cleanliness of runoff
- Finding a source of funding

Perhaps the most daunting task of those listed above is the last. Where do you find money to pay for all of it? In response, the town of Griffith proposed a *monthly* fee schedule to generate the funds necessary to meet the federal and state requirements:

- Single Family Residence $7.50
- Duplexes $15.00
- Churches/Not-for-Profits $20.00
- Commercial $22.00
- Industrial/Schools $40.00
- Rental/Condo Units
  - 3-4 units per building $20.00
  - 5-8 units per building $30.00
  - 9+ units per building $40.00

Griffith also recognized that larger properties may cause more runoff issues than smaller ones. A study will be conducted to further assess this; an adjustment of fees might be necessary. Although at the time this was printed, the fee schedule had not been adopted yet, the schedule itself serves as a possible source of stormwater management funding for any community. *(Source: www.griffithindiana.com)*

Suggested Reading

Best Management Practice Guidebook for Urban Development. D. W. Dreher and T. H. Price. 1992. Northeastern Illinois Planning Commission. Chicago.

Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. T.R. Schueler. 1987. Metropolitan Washington Council of Governments. Washington, D.C.

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