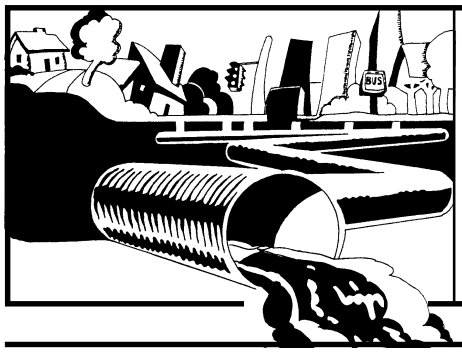

Stormwater Control Principles & Practices

Stormwater Fact Sheet No. 2

This fact sheet is No. 2 of a four-part series for local government officials on stormwater runoff problems and control strategies. The series covers:

1) Stormwater Problems and Impacts
2) Control Principles and Practices
3) Roles and Regulations
4) Local Program Elements and Funding Alternatives

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Overview

The first fact sheet explained the problems and impacts associated with stormwater runoff, including downstream flooding, streambank erosion and water pollution. This fact sheet describes the stormwater control principles and practices utilized to address these problems.

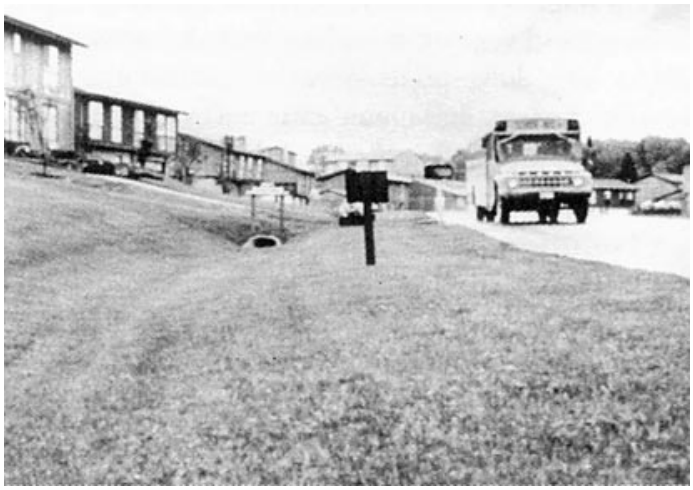
Principles of Stormwater Management

❑ Traditional Approach

Draining runoff into a pipe as quickly as possible to prevent ponding is the traditional approach to stormwater management. The traditional approach does not typically attempt to minimize the generation of runoff or prevent or control stormwater pollution. This often results in downstream flooding and water quality problems.

❑ Current Integrated Systems Approach

The current trend is toward a more comprehensive "systems approach" to managing stormwater runoff. An integrated system of preventive and control practices is used to accomplish stormwater management goals. The first principle is to minimize the generation of runoff and pollutants through a variety of techniques. The second principle is to manage any runoff with its associated pollutants to minimize its impacts on humans and the environment in a cost effective manner. This approach stresses optimum site planning and the use of more natural drainage systems, rather than traditional curb and gutter and piped systems. This "soft approach" can often reduce the cost of stormwater management on development sites.



The Soft Approach Uses More Natural Drainage Fea-

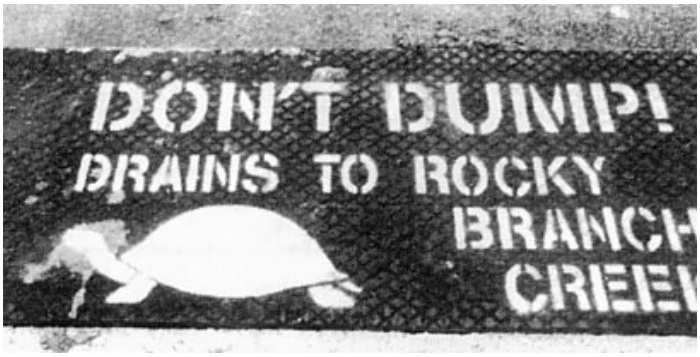
Stormwater Management Practices

❑ Preventive Measures

Preventive measures include nonstructural practices that help prevent the generation of runoff and the contamination of runoff by pollutants. Preventive measures are considered the "first line of defense" in an integrated stormwater management system. These measures are usually very cost effective compared to structural control measures, which can have significant capital and operation and maintenance costs. Many of these measures involve changing the behavior of individuals and/or procedures used in carrying out various activities. Examples of preventive measures include:

• **Land Use Planning and Management Techniques** - All growth should be planned and managed to minimize the quantity and quality impacts of runoff. Sensitive areas such as floodplains, wetlands, water supply watersheds, high quality and unique waters, etc., deserve special planning and protection measures. Specific techniques include establishing greenways along waterways, limiting the amount of impervious surfaces, setting minimum lot sizes, requiring building setbacks and vegetative buffers along streams, discharging downspouts from roof gutters into vegetated areas, and eliminating curbs and gutters and allowing runoff to flow off the street or parking area in a sheet flow.

• **Pollution Prevention Techniques** - There are many ways to prevent the generation of pollutants or their entry into stormwater. Everyone can practice preventive maintenance to reduce leaks, breakdowns, spills and accidents that could result in contaminated runoff. Materials stored outside, such as road salt or coal piles, should be covered to prevent exposure to rainfall or runoff. Facilities that handle hazardous chemicals should develop effective spill control plans and response programs. Local governments should establish collection and disposal programs for household hazardous wastes and used oil to prevent their entry into storm drains. Sanitary sewers should be maintained to prevent leaks and overflows into urban streams.



Storm Drain Stenciling Helps Prevent Dumping.

Photos by George Johnson. Courtesy of Sea Grant Program.

• **Public Education and Involvement Programs** - Educating employees and the public about stormwater problems, best management practices (BMPs) and the individual's role in minimizing runoff and protecting water quality is a very cost effective preventive BMP. Changing citizen behavior and practices is key to a successful program. Citizens need to learn environmentally sound lawn care practices and how to properly dispose of used oil, yard wastes, pesticides and other chemicals. Stenciling storm drains warns citizens that dumping into storm sewers can pollute local waterways.

• **Erosion and Sedimentation Control Programs** - Sediment is a major pollutant in stormwater runoff. Local erosion control programs may be the most effective means of preventing the contamination of stormwater runoff and protecting waterbodies in developing areas.

• **Illicit Connection Elimination Programs** - Illicit connections such as sanitary sewer interconnections, floor drains, washing machines, and other inappropriate discharges of non-stormwater, represent another significant source of pollutants entering storm sewers. Local officials should develop programs to identify and eliminate these connections.

❑ Control Measures

Control measures are structural practices that control the volume and peak discharge rate and/or reduce the pollutant concentration of stormwater runoff. They utilize the processes of detention/retention, settling, percolation, evaporation, evapotranspiration, filtration, absorption and biological uptake to reduce flows and remove pollutants. Control measures are generally more land intensive and expensive than preventive nonstructural measures.

• **Vegetative Practices -** Filter strips and grassed swales are vegetative practices that act as nature's biofilters to reduce stormwater flows and pollution. Vegetative practices are popular because they can be attractive and are low cost relative to other structural control measures. Filter strips are grass or forested strips of land placed between developed areas and sensitive areas such as streams, lakes, wetlands, estuaries, etc. Stormwater is discharged into the filter in a thin, sheet flow to maximize infiltration, filtration and biological uptake of pollutants by the vegetation. Grassed swales are engineered, earthen channels with heavy vegetative coverings designed to convey stormwater without eroding. Swales are cheaper than traditional curb and gutter systems and should be used wherever possible as a component of an integrated stormwater management system.

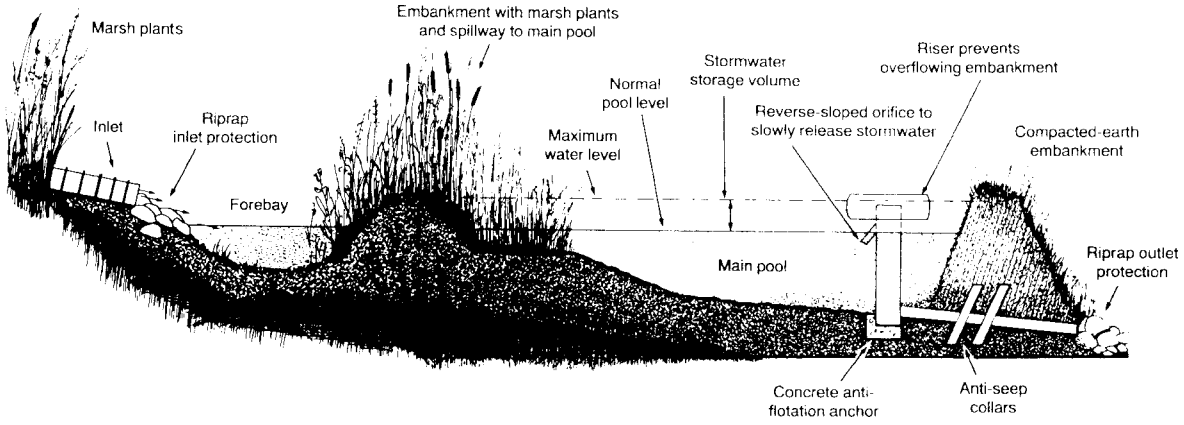
• **Detention/Retention Practices -** Detention/Retention practices use the processes of detention and retention to reduce peak discharge rates and pollutant loadings. Examples include dry detention basins, wet retention ponds, and artificial wetlands. These practices are more land intensive than many other BMPs and are more expensive to construct and maintain. However, studies have shown these practices to be effective in reducing flows and many stormwater pollutants. Their longevity can be 20 years or more, representing a major advantage over other BMPs such as infiltration devices

• **Infiltration Devices -** Infiltration devices capture and retain a portion of runoff onsite and allow it to infiltrate into the soil, and in the case of surface basins, evaporate into the air. If properly sited, designed, constructed and regularly maintained, these devices can be very effective in reducing peak discharge rates and stormwater volumes and removing pollutants from the first flush of runoff. Examples include infiltration trenches, infiltration basins, dry wells, leaching catch basins, porous pavement/blocks and infiltration islands within parking areas.

• **Other Control Practices -** Sand filters are used to filter pollutants from runoff from large buildings, access roads and parking lots. Oil and grease trap catch basins are underground devices that remove oil, grease, litter and coarse sediments from runoff. Neither of these practices control runoff volumes or rates.

Conclusion

Each stormwater BMP has different advantages and disadvantages and set of unique characteristics, making it suitable or unsuitable for use in different situations. An effective stormwater management plan will utilize a number of BMPs in an integrated system to achieve the particular goals and objectives. Early planning is critical. Preventive measures should be given a high priority as they are often the most cost-effective and efficient means of managing stormwater runoff.



Wet Retention Pond – Side Cutaway View (Source: Arnold, et al. 1993)

For More Information

❑ Reference Documents

• Stormwater Management in NC: A Guide For Local Officials, 1994, Land-of-Sky Regional Council. Tel. (704) 254-8131.

• Stormwater Management Guidance Manual, 1994, NC Cooperative Extension Service and NC DEHNR. Tel. (919) 515-3723.

• Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, 1987, Metropolitan Washington Council of Governments. Tel. (202) 962-3256.

• A Current Assessment of Urban BMPs, Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone, 1992, WashCOG. Tel. (202) 962-3256.

❑ Contacts

• EPA Stormwater Hotline - (703) 821-4823.

• NC DEM Stormwater Management Group - (919) 733-5083.

• Jon Arnold, NCSU Water Quality Group - (919) 515-3723.

• NC Office of Waste Reduction - (919) 571-4100.

Next Fact Sheet

Fact Sheet #3 describes the Roles and Regulations associated with stormwater management in North Carolina.

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