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The Urban Environment And NPS Pollution

Best Management Practices To Control Urban NPS Pollution

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In a general sense, entire cities and towns may be thought of as point source generators of pollution. Technically, pollutants such as auto exhaust and industrial waste do originate from point sources, places that can literally be pointed out. However, many urban pollutants are more accurately defined as nonpoint source (NPS) pollutants because they are widespread in urban areas and find their way to lakes and streams not through direct discharge but through stormwater runoff. Although much less obvious than point sources, they can be equally as hazardous.

Options for dealing with urban nonpoint source pollution range from doing nothing to catching all the stormwater runoff, storing it, and channeling it through treatment facilities. Doing nothing only neglects the problem until waterways become open sewers. On the other hand, building large treatment plants or separating combined sewers would cost billions of dollars.

Other management alternatives are available. They are called best management practices or BMPs. Because of the numerous BMPs to select from and the availability of several manuals to aid in this selection process, only general information about management strategies, practices, and principles will be discussed in this article.

Management Strategies

Three major strategies for controlling nonpoint source pollution through best management practices are: (1) source control, (2) runoff control, and (3) treatment. Source control BMPs are usually considered more cost effective but are not always applicable, especially in urban environments where land and water resources are often overexploited.

Source Control. The first management strategy attempts to reduce the sources of pollutants in urban stormwater runoff. A major source of suspended solids in established urban areas is runoff from streets. Street contaminants originate from a variety of sources, including dust and dirt, street litter, chemicals, dead vegetation, eroded materials, traffic residuals, and animal droppings. Nonpoint source runoff from commercial land areas such as shopping centers, business districts, office parks, and large parking lots and garages often contain higher levels of hydrocarbons and heavy metals than other urban runoff.

Source control measures reduce either the amount of pollutants or their potential for transport in runoff. Examples of source controls are reducing automobile emissions, applying less road salt, improving street sweeping, and implementing anti-litter or leaf pick-up programs.

Urban areas can accomplish many source control measures at little or no cost with the cooperation of citizens. Some of the activities causing NPS pollution in urban areas that can be effectively addressed through pollution prevention and education programs include the following:

- The improper storage, use, and disposal of household hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc.
- Lawn and garden activities, including the application and disposal of lawn- and garden-care products, and the improper disposal of leaves and yard trimmings.
- Turf management on golf courses, parks, and recreational areas.
- Improper operation and maintenance of onsite disposal systems.
- Discharge of pollutants into storm drains including floatables, waste oil, and litter.
- Commercial activities including parking lots, gas stations, and other entities not under National Pollutant Discharge Elimination System (NPDES) purview.
- Improper disposal of pet and other animal wastes.

Runoff Control. A second management strategy attempts to reduce runoff quantity and peak runoff rates by soaking up or storing water during heavy rainstorms. Infiltration can be increased by using fewer

impervious surfaces, using porous pavement, redirecting roof downspouts to grassy areas, and using natural drainage systems wherever possible. To collect, store, and gradually release stormwater, surface ponds, subsurface tunnels, holding tanks, and specially designed rooftops or parking lots are effective.

Directing downspouts to areas where water can soak in instead of connecting them to a storm sewer is a relatively low-cost measure. It is very expensive, however, to install other runoff-reducing mechanisms in stable, developed areas. In developing areas it may cost less to install these measures during development rather than to build expensive stormwater treatment facilities later.

Treatment. The final management strategy is to either treat or remove pollutants from stormwater. In established urban areas this is often the only practical alternative. The costs, however, can be substantial. Treatment facilities must be able to handle the large volumes of water rapidly generated during rainfall. Treatment systems often incorporate some form of temporary stormwater storage to reduce required treatment capacity.

Physical treatment processes are very effective in removing suspended solids and are widely used. Often some form of chemical treatment is used to augment solids removal. Physical and chemical processes commonly include some type of liquid-solid separation and disinfection with chlorine.

Biological treatment processes use bacteria or biochemical action to remove organic pollutants. These processes are not used widely to treat urban stormwater runoff because it is difficult to keep the necessary organisms alive between runoff periods. Biological treatment processes include high rate trickling filtration and various types of oxidation lagoons. They produce a high quality effluent for a relatively low cost.

Management Practices

Management practices to control urban runoff and its pollutants are of two types: nonstructural and structural. Nonstructural BMPs are used to reduce sources of pollution while structural BMPS are generally more effective at controlling runoff and treating pollution. Combinations of both types of management practices may be needed to effectively control and treat NPS pollutants from urban environments.

Nonstructural BMPs. The most common nonstructural BMPs are those actions or practices adopted by people to remove or prevent pollutants from reaching the waste stream. These approaches range from improved urban maintenance programs to land use controls such as zoning to keep pollution-prone industries away from watercourses. They may also include erosion controls in building codes and subdivision regulations and controls on the use of herbicides and pesticides. Nonstructural measures are often less costly than structural measures.

Nonstructural controls include the following:

- Open storage regulations.
- Anti-litter laws.
- Air pollution abatement.
- Catch basin cleaning.
- Improved de-icing methods.
- Public education.
- Street cleaning.
- Land use ordinances.
- Erosion control and chemical usage regulations.

Structural BMPs. These practices involve the construction of physical features such as catch basins and dams. These structures are designed to reduce runoff and erosion by soaking up or storing water during heavy rainstorms. In addition to erosion and flood control, structural BMPs result in cleaner neighborhoods and environmental benefits. Some structural BMPs, however, are relatively expensive.

Structural controls include the following:

- Porous pavement.
- Parking lot ponding.
- Infiltration systems.
- Diversion structures.
- Vegetation seeding and mulching.
- Rooftop ponding.
- Detention basins.
- Grade stabilization.
- Drain systems.

During recent years, much research and development have gone into designing a multitude of engineering structures to help control NPS pollution. Many engineering firms and the USDA Soil Conservation Service provide specifications for these structures. The Alabama Soil and Water Conservation Committee has a handbook that includes information on stormwater management in urban areas. (See references.)

Management Principles

Best management practices to control urban runoff are primarily structural practices that rely on three basic principles: filtration, infiltration, and detention.

Filtration practices such as filter strips, grassed swales, and sand filters treat runoff by using vegetation or sand to filter and settle pollutants. In some cases infiltration and treatment in the subsoil may also occur. After passing through the filtration media,

the treated water can be routed into streams, drainage channels, or other waterbodies; evaporated; or percolated into groundwater. Sand filters are particularly useful for groundwater protection.

Infiltration devices rely on absorption of runoff to treat urban runoff discharges. Water is percolated through soils, where filtration and biological action remove pollutants. Infiltration trenches, basins, porous and concrete block pavements, and permeable surfaces are examples of infiltration devices. Systems that rely on absorption require deep permeable soils and a distance of at least 4 feet between the bottom of the structure and seasonal groundwater table.

Infiltration devices are very useful in restoring pre-development hydrology to increase dry-weather baseflow and reduce flooding frequency. However, infiltration devices may not be appropriate where groundwater protection is a high priority. Also, they may not be appropriate where they can be clogged with heavy sediment loads from disturbed area runoff.

Detention practices temporarily impound runoff to control the speed of flow and to settle and retain suspended solids and associated pollutants. Rooftop ponding, parking lot ponding, detention ponds, and wet ponds fall within this category. Constructed wetlands and multiple-pond systems also remove pollutants by detaining flows that lead to sedimentation, which is gravitational settling of suspended solids. These systems treat runoff through the processes of adsorption, plant uptake, filtration, volatilization, and microbial decomposition. Properly designed ponds protect downstream channels by controlling discharge velocities, which reduce bank-cutting erosion and frequency of flooding. If landscapes are planted with appropriate vegetation, these systems not only reduce pollutant loads but also provide for terrestrial and aquatic wildlife habitat. Inundation and heavy sediment loads can render these areas ineffective and periodic maintenance is required.

For More Information

Additional BMP guidance documents on urban stormwater management are available at a cost from ADEM. Call the Mining and Nonpoint Source Section or the Industrial Branch in the Water Division of the Montgomery office (334-271-7700).

Conclusion

Nonpoint source problems are variable, widespread, and serious. While many practices are available to control urban NPS pollution, BMPs must be tailored to fit the needs of particular sources and circumstances. In urban areas management strategies, practices, and principles must be evaluated.

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