STREAMLINES

A Newsletter for North Carolina Water Supply Watershed Administrators

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Non-Point Source (NPS) Pollution

This issue of Streamlines provides basic information on the number-one threat to water quality in North Carolina: non-point source (NPS) pollution. It is hoped that a better understanding of this threat will help local governments to better protect surface water supply watersheds.

Types of Water Pollution

Water pollution is commonly classified according to its source. The two major categories are point source and nonpoint source. A point source refers to any structural conveyance with the capacity to discharge wastes, stormwater, or other material into surface waters. As defined by the State, a "conveyance" includes "... any pipe, ditch, channel, tunnel, conduit, well, discreet fissure, container, rolling stock, or concentrated animal-feeding operation." Before any point source discharge can be made, a permit must be obtained.

DEHNR defines a nonpoint source as "... precipitation and subsequent runoff from lands which have been disturbed by man's activities," including all water pollution sources that are not designated by the State as point sources. Since this type of pollution is so diverse and diffuse, it is more difficult to isolate, monitor, and control than point source discharges.

Nonpoint Source Pollution and the Water Cycle

To get a clearer picture of nonpoint source pollution, it is useful to examine the water cycle.

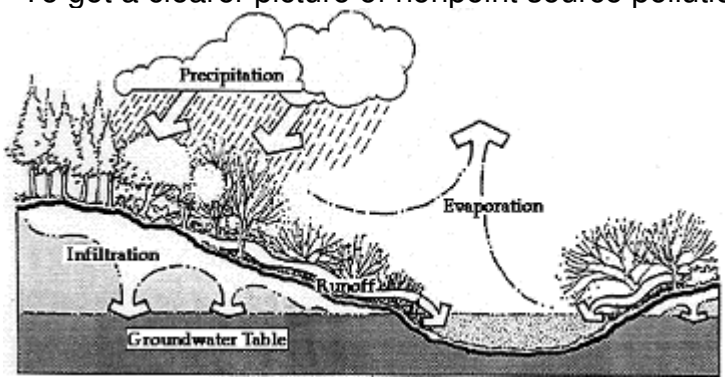

Figure 1. Basic Water Cycle -- Natural (Undisturbed) Site.

About 25% of the moisture that falls on a natural, undeveloped site is returned to the atmosphere through evapotranspiration from soil and plants. Approximately 30% filters into the groundwater; and the remaining 45% runs off the land into surface waters. This runoff picks up and carries into surface waters relatively small amounts of soil and vegetation (see Figure 1, above).

On a developed or cleared site, the picture changes (see Figure 2, below).

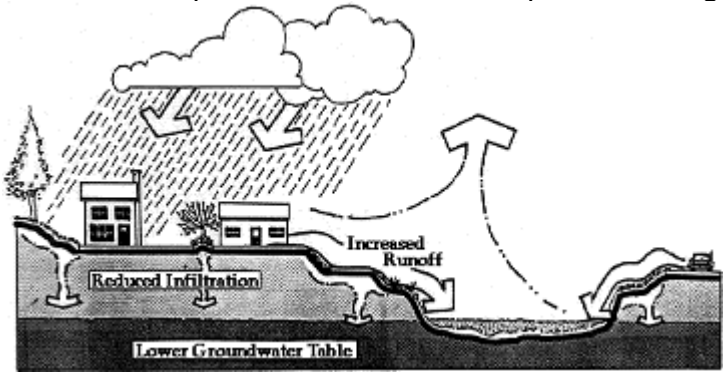

Figure 2. Basic Water Cycle -- Developed (Built-Upon) Site.

Where vegetation once served to slow runoff and retain soil allowing part of the precipitation to be absorbed, there is now impervious surfaces and bare ground. Since less water is able to infiltrate to the groundwater, both the amount and speed of runoff increases.

Development often brings increased use of contaminants such as gasoline, oils, fertilizers, pesticides, building materials, and chemicals. Since both the amount and speed of runoff has increased, large concentrations of these contaminants are carried off impervious surfaces and into surface waters. Land disturbing activities that remove vegetation also lead to an increase in sediments carried into surface waters.

NPS Threats and Controls

Impervious Surfaces

As runoff flows across impermeable surfaces, it collects and carries contaminants off the surface and into streams, rivers and lakes. Contaminants that collect on impervious surfaces include petroleum compounds, building materials, soil, nutrients, and anything else that has been applied, leaked, or discharged on to the surface.

Built-upon areas including paved surfaces such as walkways, roads, and parking lots collect contaminants from leaky automobiles or other machinery. Bacteria from waste deposits of birds and other animals is an additional source of contaminants. Accidental spills can also occur. Contaminants from rooftops include flaking paints and other potentially harmful building materials. In areas where curbs and gutters are used, these contaminants are efficiently collected into stormwater systems and quickly discharged into surface waters. Vegetated drainage swales pose less of a threat to area surface waters because they allow infiltration and settling of pollutants.

The amount of contaminants entering surface waters increases with the amount of impervious surfaces in an area. Individually, these surfaces cause less of an impact on water quality than they do when they are concentrated in highly developed, urbanized places such as central business districts, residential subdivisions, apartment complexes, parking lots, and industrial areas.

Runoff from Disturbed Lands

Clearing vegetation from land is one of the primary sources of surface water pollution. Plant cover stabilizes soil so that only small amounts are washed away during rainfall events. When plant cover is removed, large loads of sediments and nutrients can quickly erode into surface

waters, filling them with sediment. Clearing vegetation along water courses and lakes also exposes waters once cooled by shade to the heat of the sun creating conditions which may not support aquatic life.

Disturbed lands can occur in both urban and agricultural settings. Urban threats to water quality come primarily from development and construction projects, while agricultural threats occur when best management practices are not used on highly erodible lands.

- *Construction and Development*. During the process of construction, significant amounts of sediment and nutrients can erode into surface waters. In response to this problem, the State legislature adopted the Sedimentation Pollution Control Act of 1973 which regulates specific land disturbing activities in order to control erosion and sedimentation into water courses and lakes. It also allows local governments to adopt their own ordinances in accordance with the act. But only about 80% of the sediment eroded from a site can be captured using the best sediment control measures currently available. And developments disturbing less than one acre of land are often exempt and can continue to impact water quality.

- *Agricultural Practices*. When agricultural Best Management Practices (BMPs) are not employed on highly erodible fields, there is potential for excess sediments to be discharged into surface waters. Agricultural BMPs efficiently use resources such as soil, fertilizers, and water to reduce environmental impacts such as the loss of topsoil and pollution of surface waters. The two farm practices which have the greatest potential to damage water quality are row cropping and fallow fields.

  Planting crops in rows that run up and down slopes encourages runoff. While this practice is used to quickly drain water away from those crops that can be damaged by standing water (e.g., tobacco) it also drains away topsoil, pesticides, and fertilizers into adjacent surface waters. Contour cropping, crop rotation, and border plantings can reduce excess runoff, loss of topsoil, and the use of pesticides and fertilizers. Runoff carrying sediments can also occur when fallow fields or the soil between planted rows is not covered with vegetation. Since plants help retain topsoil, BMPs include cover crops, strip cropping, no-till planting, and border plantings.

- *Use, Storage, Distribution, and Manufacture of Contaminants*. Contaminants that are used, manufactured, stored, sold, or distributed within a watershed pose a potential threat to water quality. These contaminants include industrial and household chemicals, petroleum, concrete, plastic products, trace metals, fertilizers, and pesticides. Through accidental spills, improper use, or dumping into discharges, these materials or their by-products can eventually enter surface waters where they are potentially toxic to plants, animals, or people.

  A variety of land uses generate potential threats from contaminants. Many industrial and commercial businesses use contaminates or their by-products. If they discharge a toxic material directly into surface water they must obtain a permit. But spills, leaks or improper use causes chemicals to accumulate and be carried off into surface waters. Service stations and motor vehicle repair businesses can spill or drain oil, gasoline, or other potentially harmful fluids. Businesses that store or distribute chemicals, pesticides, fertilizers and other contaminants could also spill or leak them onto surfaces. Other manufactures use and store wood by-products, plastics, and other potential

contaminants that could find their way into surface waters.

Residential uses are another potential source of chemical contamination. When used or disposed of improperly, household chemicals such as those used in cleaning, paints and paint removers, fertilizers, pesticides, and petroleum products can be carried by runoff over land or into stormwater sewer systems and eventually enter surface waters.

Many intensively planted or landscaped sites such as agricultural lands, golf courses, and nurseries use heavy applications of fertilizers, herbicides, and pesticides for maintenance. Excess amounts not absorbed by plants can be carried by runoff into surface waters or leached into groundwater and cause a number of threats to water quality.

Waste Storage and Disposal

Certain land uses require storing and disposing of human or animal wastes. These liquid or solid wastes are collected in holding ponds and septic tanks which require periodic cleaning, or are disposed of in landfills or by incineration. If not managed properly, these wastes can be carried by runoff into surface waters contributing bacteria, nutrients, toxic chemicals, and oxygen reducing substances.

- *Large Agribusiness Operations*. Agribusiness operations such as dairy farms, large feed lot operations, and large poultry operations can impact water quality through improper storage and disposal of animal wastes or remains. If an animal waste lagoon or holding pond is near capacity, rains can cause it to overflow, carrying runoff directly into surface waters. Contamination also occurs when a land owner or contractor cleans out ponds and improperly disposes of sediment and waste directly into surface waters. Improper disposal of dead animals can also lead to water quality problems.

- *Landfills*. Unless controlled, runoff from landfills may carry excessive nutrients, bacteria, sediment and toxic compounds into surface waters. Legislation and regulations set by the E.P.A. and the State require control of both runoff and leachate from landfills. Before construction, landfills must first be permitted by the DEHNR Solid Waste Management Division. No new landfill sites are allowed in water supply watershed critical areas.

  Improvements and future mandates in technologies, liners, monitoring, and collection devices may reduce the potential impact of landfills on water quality. However, many landfills have been constructed prior to the development and requirement of new technologies. The possible impact of these older landfills that are either closed or have limited life on waters in a drainage area is generally not known.

- *Septic Tanks*. A permit must be obtained from the county health department or DEHNR to operate a septic tank system. Before a permit is received, the appropriate agency examines location, soils, and topography to determine if it is safe to operate a standard septic tank system. In some cases, an alternative may be prescribed if conditions are not satisfactory for a standard system. Once a permit is granted for either system, it is the owner's responsibility to inspect and maintain it.

  Periodically, septic tank systems can break down or overflow. A new permit will not be issued until the owner corrects the situation. A few counties have set up programs to

annually inspect alternative septic tank systems. But, in most of the state, scheduled inspections do not occur.

Conclusion

NPS pollution is the largest cause of water quality problems in North Carolina and the United States. Public education and the implementation of strong local Water Supply Watershed Protection plans and ordinances can be excellent first steps in controlling this type of pollution and protecting surface water supplies.

Resources

This article was reprinted with permission from a Piedmont Triad Council of Governments report: *A Local Official's Guide to Watershed Protection*, dated July 1990. For more information regarding this report, please contact Virginia Booker at (910) 294-4950. The original guide was based on information contained in The *Upper Deep River Watershed Protection Study*, published by the Piedmont Triad Council of Governments in March 1990 and funded by a 205(j)(1) Water Quality Planning Grant from the N.C. Division of Environmental Management. Thanks to PTCOG for their permission to reprint this information. The following additional publications are highly recommended for those seeking additional information regarding nonpoint source pollution and related issues:

- U.S. EPA NPS page

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