ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

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The Urban Environment And NPS Pollution

Urbanization And How It Affects Water Quality

Although the relationship between urbanization and water pollution is complex, it is relatively easy to understand. Urban areas contain many people in relatively small areas, and the activities of these people produce pollutants and cause pollution. Fortunately, most urban area pollutants are of a point source nature and are controlled by discharge regulations. However, as an area is urbanized, the land is altered to meet the needs of the people who live there. This alteration of the land accelerates nonpoint source pollution because it changes the way water moves, increases surface runoff, and causes erosion. Moving with the water and eroded soil are other pollutants, which cause numerous water quality problems downstream.

Specific factors involved in the negative impact urban sites have on water quality include the following:

- Large numbers of people in a small area.
- Location of urban areas.
- Activities of people.
- Alteration of land.
- Transportation of pollutants.

Large Numbers Of People

Three-fourths of U.S. citizens now live in urban environments. In some states more than 90 percent of the people live in urban areas, and even in Alabama, a state considered to be relatively rural, more than 60 percent of the people live in urban environments. On a land use basis, however, urban land makes up only a small percentage of the total land base in many states. In Alabama, for example, urban land accounts for less than 3 percent of the total land base. Since pollution is associated directly with human waste and the activities of people, large volumes of pollutants are generated within these densely populated and relatively small land areas. This creates special waste management problems that municipal officials must constantly address.

Location Of Urban Areas

Urban areas are usually located near water sources. Urban development is impossible without dependable fresh water that is readily available to meet both domestic and industrial needs. Early development was also dependent on coastal waters for food and transportation. Thus, most urbanization in the U.S. originated adjacent to freshwater streams and often not far from the coast. This growth pattern has continued, with approximately 80 percent of the U.S. population now living on major streams in coastal zones. The results have been negative impacts not only on local lakes, streams, and groundwater but on coastal and estuarine waters as well.

Activities Of People

Nonpoint source pollution is directly associated with the activities of people. Table 1 shows the variety of nonpoint pollutants common to some urban activities and land uses. This table does not include the numerous household chemicals and maintenance products that may also contribute to nonpoint source water pollution if not handled and disposed of correctly.

Alteration Of Land

Changes In Water Movement. As urbanization occurs, the natural hydrology or water movement of an area changes in response to site clearing, grading, and the addition of impervious areas. Even natural depressions that once temporarily ponded water and delayed runoff are graded to a uniform slope. The cumulative effects of this paving, filling, grading, and compacting of the soil are enormous. The most common problems are the increased runoff and associated erosion and sediment loadings to surface waters. Streams experience more rapid flows and greater volumes, and banks erode as channels change their contours to accommodate the increased flows.

Increased Surface Runoff. In an urbanized watershed, surface runoff is further magnified after con-

Table 1. Nonpoint Source Pollutants From Urban Activities And Land Uses.

Activity Or Land Use	Potential Pollutants
Paved Areas	Asphalt and concrete particles, road marking paints, crack fillers and join compounds; anti-skid compounds (salts, sand, and ash); dirt and other spills
Motor Vehicles	Leaked fuel, battery acid, antifreeze, car-care products, and lubricants; tire, clutch, and brake lining parts; larger pieces of metal and glass; bulk materials spilled from open trucks (sand, dirt, and chemicals)
Industrial/Commercial	Smoke stack emissions; oil and grease leakages from parking lots, salvage yards, service stations, and roadways; overflowing trash and seepage from dumpsters and temporary waste storage areas
Lawns And Gardens	Organics like leaves, bark, seeds, twigs, and grass clippings; pesticides; fertilizers; domestic animal wastes
Construction And Demolition Areas	Primarily sediment; petroleum products and construction materials; solid wastes from construction materials and workers; wash water from concrete mixers
Litter Disposal	Waste items disposed of in streets, along water courses, and in other areas

Source: Weinberg 1979.

struction is completed. The excessive flow from all the impervious surfaces such as rooftops, roads, parking lots, and sidewalks decreases infiltration. This makes it necessary to construct other runoff conveyances or modify existing drainage systems to handle all the extra runoff while avoiding erosion of stream banks and steep slopes. Not only is frequency and severity of flooding increased during rainstorms but stream flow is reduced during prolonged periods of dry weather because the level of groundwater recharge has been lowered. This lower stream flow during dry periods may severely disrupt downstream environments such as wetlands, floodplains, and estuaries that depend on a continuous flow of fresh water. Under low flow conditions, the quality of wastewater discharge may have to be improved to meet minimum water quality standards of adjacent streams.

Increased Erosion. Land development seriously accelerates erosion. Erosion on a construction site may be ten thousand times that of undeveloped land. The resulting sediment can be very destructive in water. It can clog the gills of fish; block light transmission and kill aquatic plants; increase water temperatures; accelerate flooding by filling channels, lakes, and reservoirs; and transport other pollutants.

Sedimentation products from urban areas are generally more hazardous than natural mineral sediments. They are more hazardous because they usually contain more adsorbed chemicals from atmospheric deposition and surface-added particulates that result from tire wear, automobile exhausts, numerous spills, and road surface decomposition.

Transportation Of Pollutants

Urban stormwater runoff is the primary transport mechanism for many contaminants associated with urban land uses and may include the following: settled air pollutants; food wastes, wash water, and trash discarded onto streets; rubbish or other materials dumped into stormwater drains such as used antifreeze and crankcase oil; and a multitude of chemicals from spills, leaks, corrosion by-products, deicing salts, and lawn-care products.

The runoff from a typical American city during the first hour of a storm may carry more pollutants than that same city's untreated sewage would during the same period. Stormwater runoff and water pollution from urban areas are discussed in greater detail in another article in the water quality series.

Alabama Case Study

A 1981 in-stream monitoring study of Village Creek in Birmingham provides a classic example of stream degradation because of intense urban development. At the stream's origin at Roebuck Springs, the creek had excellent physical and chemical characteristics and supported watercress and other vegetation. By the time the stream passed under Vanderbilt Road, it had turned grey-green, had an oily sheen, and contained significant debris. Further downstream at the western limits of Birmingham, the creek was dark green, had a putrid odor, and contained considerable oil and grease. At this point the creek was often anaerobic and contained no fish or other biological life. This study found that, on an annual basis, more

than 90 percent of the copper loadings, more than 75 percent of the chromium and zinc loadings, and about 40 percent of the lead loadings originated from urban runoff.

Conclusion

When stormwater moves through urban areas, its velocity and volume give it the potential to pick up a multitude of pollutants from many sources. Unlike rural areas, the lack of buffer zones and natural filters generally causes urban stormwater to have high concentrations of certain types of chemicals, especially metals. Although treatment plants have been built to clean up most municipal and industrial wastewaters, there is no effective way to collect, treat, and discharge all contaminated water that runs off urban landscapes, just as there is no practical way to treat all stormwater that runs off rural landscapes. It is generally more practical and effective to control urban nonpoint source pollutants with management near their sources. Basic principles for reducing urban nonpoint source pollution have been developed.

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