

Prepared in cooperation with the Johnson County Stormwater Management Program

Stormwater Runoff: What it is and why it is important in Johnson County, Kansas

By Teresa J. Rasmussen¹ and Heather C. Schmidt²

Stormwater runoff is a leading contributor to pollution in streams, rivers, and lakes in Johnson County, Kansas, and nationwide. Because stormwater runoff contains pollutants from many different sources, decreasing pollution from stormwater runoff is a challenging task. It requires cooperation from residents, businesses, and municipalities. An important step in protecting streams from stormwater pollution is understanding watershed processes, stormwater characteristics, and their combined effects on streams and water quality.

What is a watershed?

A watershed is the area of land where all of the water that falls in it and drains off of it goes into the same place. Watersheds range from a few acres draining to a neighborhood stream, to hundreds of thousands of square miles draining to a major river, such as the Missouri and Mississippi Rivers. Watersheds cross municipal, county, state, and national boundaries, so the actions of one community affect downstream neighbors.

What is stormwater runoff and why is it a problem?

During rainfall, part of the precipitation is captured by plants or infiltrates into the ground, and the remainder flows over the land surface as stormwater runoff to the nearest ditch or creek. In urban areas the percentage of precipitation that becomes stormwater runoff is much larger than in non-urban areas. Natural land cover that once absorbed rainfall has been replaced with impervious surfaces including streets, parking lots, and rooftops that prevent stormwater from soaking into the ground, and instead forces more water to flow at a faster rate into the storm drainage system (fig. 1). As it flows over the land surface, stormwater picks up potential pollutants that may include sediment, nutrients (from lawn fertilizers), bacteria (from animal and human waste), pesticides (from lawn and garden chemicals), metals (from rooftops and roadways), and petroleum by-products (from leaking vehicles). Pollution originating over a large land area without a single point of origin and generally carried by stormwater is considered non-point pollution. In contrast, point sources of pollution originate from a single point, such as a municipal or industrial discharge pipe. Polluted stormwater runoff can be harmful to plants, animals, and people.

What water-quality concerns exist in Johnson County and what causes them?

To better understand water-quality conditions in Johnson County streams, the U.S. Geological Survey, in cooperation with the Johnson County Stormwater Management Program, collected data on water and sediment chemistry and aquatic insect populations in the county's five largest watersheds (Cedar, Indian, Kill, and Mill Creeks and the Blue River) and found that most water-quality concerns in county streams are related to excessive sediment, nutrients, and bacteria.

In large concentrations, sediment in streams reduces light penetration, smothers aquatic habitat, and transports and stores other



Figure 1. Impervious surfaces such as streets, parking lots, and rooftops increase the amount of stormwater runoff in urban areas.

contaminants like nutrients and bacteria (fig. 2). Sediment can enter streams from surface erosion and streambank erosion. Surface erosion occurs when soil is disturbed and left exposed, which is common during construction of roads and buildings. A study of sediment in the Mill Creek watershed indicated that areas with the most construction activity contributed substantially more sediment to streams than established urban areas (Lee and others, 2009). Impervious surfaces increase the amount and rate of water flowing in a stream after intense rainfall and can cause stream banks to erode and the stream bed to shift. In 2005–06, about 90 percent of the total suspended sediment in streams was transported in less than 2 percent of the time, or about 7 days per year, and occurred during large storms that generated substantial runoff (Rasmussen and others, 2008).

Streams and lakes need a certain level of nutrients (nitrogen and phosphorus) to support proper plant and animal growth; however, excessive nutrients can lead to excessive plant growth that disrupts natural ecosystems. When these plants die and decay it causes lower concentrations of dissolved oxygen in the streams and can lead to changes in plant and animal populations. Common sources of nutrients from stormwater runoff include fertilizers, animal waste, and soil erosion.



Figure 2. Large amounts of sediment occur in Johnson County streams during stormwater runoff (Blue River near Kenneth Road).

¹ U.S. Geological Survey, Lawrence, Kansas.

² Johnson County Stormwater Management Program, Johnson County, Kansas.

Bacteria such as *Escherichia coli* (*E. coli*) and fecal coliform commonly are used as indicators of the sanitary quality of streams and lakes for recreational use. Larger amounts of these bacteria indicate an increased risk that the water contains pathogens present in feces of warm-blooded animals. Potential urban non-point sources of bacteria include failing septic systems, leaking sewer lines, and pet and wildlife waste. As an example of how rapidly water-quality conditions in streams can change during storms, *E. coli* bacteria density in Kill Creek increased from about 180 col/100mL to about 100,000 col/100mL in less than 12 hours when about 1.5 inches of rain fell over the Kill Creek watershed in May 2007 (Rasmussen, 2008).

How has stormwater runoff from urban areas affected the water quality of lakes, rivers, and streams in Johnson County?

Generally, as the population of an area increases, so does the amount of impervious surface area and non-point source pollutants available to stormwater runoff. These factors, in addition to loss of natural vegetation adjacent to streams, affect the ecology and overall quality of urban streams.

Data indicated that several stream contaminants are more common in urban areas than in rural areas. *E. coli* bacteria densities are larger in more urban watersheds (Lee and others, 2005). Sediment concentrations are nearly always largest in Mill Creek, which is Johnson County's most rapidly developing watershed (Rasmussen and others, 2008). Chloride concentrations in urban streams are elevated during winter as a result of runoff from road salt application (Rasmussen and others, 2008). Also, the biological quality of Johnson County streams, determined using aquatic insect data, generally decreased as urbanization increased (fig. 3; Poulton and others, 2007). Aquatic insect populations in more urban streams generally have shifted from a diverse population of insect species that are intolerant of pollution (such as mayflies, stoneflies and caddisflies), to fewer different species that are more tolerant of pollution (such as midges, leeches, and worms).

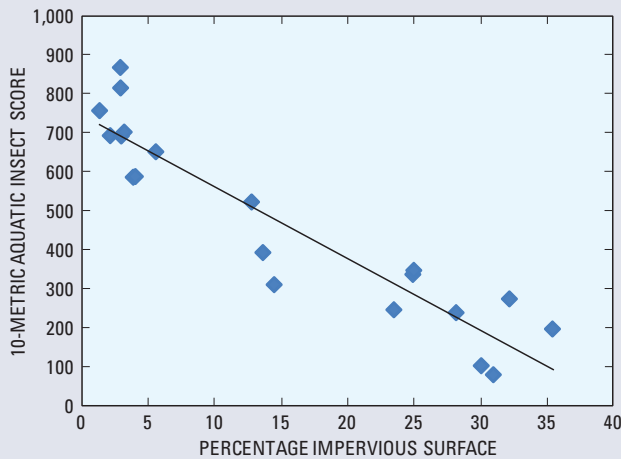


Figure 3. Percentage of impervious surface (a general measure of urbanization) compared to a 10-metric aquatic insect score (a measure of overall stream health) at stream sites in Johnson County, Kansas, indicated that as urbanization increased stream health decreased (Poulton and others, 2007).

What practices are being implemented to manage stormwater and protect water quality in Johnson County?

As the focus of the federally mandated Clean Water Act has shifted from point to non-point source pollution (U.S. Environmental Protection Agency, 2005), stormwater quality has become increasingly important to local governments. In Johnson County, the Stormwater Management Program is a department of the county's government that coordinates with the 20 cities in the county through the Johnson County Stormwater Management Advisory Council as well as other cities, counties, and agencies in the Kansas City metropolitan region to address stormwater management issues.

City and county governments in urbanized areas are responsible for minimizing pollution in stormwater runoff. To achieve this, local governments have passed laws to reduce the amount of sediment entering the waterways from construction activities; to prevent illegal dumping of pollutants (such as used motor oil, paint, and chlorinated pool water) into the storm drain system; and to require treatment of stormwater runoff from new developments through best management practices such as preserving open space and incorporating systems to treat stormwater runoff.

References Cited

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What can Johnson County residents do to help protect streams?

The Johnson County Stormwater Management Program recommends the following actions to help protect streams from the damaging effects of stormwater runoff:

- Never dump anything down a storm drain or any waterway, and properly dispose of trash and yard waste. In Johnson County, report stormwater pollution by calling the Stormwater Hotline 913–715–6969 or online at <http://stormwater.jocogov.org/stormwaterpollution/reportpollution.shtml>
- Have soil tested to determine what treatment is needed for lawns and gardens. Use lawn chemicals sparingly.
- Clean up pet waste and dispose of it in the trash or other appropriate location.
- Purchase only chemicals that are needed and dispose of household hazardous waste properly. In Johnson County call 913–715–6900 to schedule an appointment to drop off household hazardous waste.
- Repair and contain vehicle fluid leaks.
- Have onsite wastewater treatment (septic) systems inspected and maintained regularly.
- Reduce runoff by re-directing roof drains away from pavement and toward vegetated areas. Consider using native plants and rain gardens to capture and infiltrate stormwater on your property. Use pervious stones or pavement for driveways. Use rain barrels or cisterns to capture rainwater from downspouts and use it to water plants.

For additional information, visit:

<http://ks.water.usgs.gov>
<http://stormwater.jocogov.org>