

SEDIMENT TRANSPORT AND SOURCES IN AN URBANIZING WATERSHED, JOHNSON COUNTY, KANSAS, 2006-07

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ABSTRACT

Urban development substantially affects stream hydrology and sediment transport. The U.S. Geological Survey, in cooperation with the Johnson County, Kansas, Stormwater Management Program, conducted a study to estimate sources of in-stream, suspended-sediment concentrations in an urbanizing, 63-square-mile watershed. A network of nine streamgauge and turbidity sensors was used to estimate suspended-sediment concentration and loading in subwatersheds of varying land use (4- to 36-percent impervious surface). Turbidity and suspended-sediment samples were statistically related to develop models used to estimate suspended-sediment concentrations in 5-minute increments. These estimates were combined with streamflow to calculate suspended-sediment loads. Suspended-sediment loads for individual storms were statistically related to precipitation and land-use characteristics.

Sediment yields were larger and hydraulically limited in subwatersheds with ongoing urban development. In subwatersheds where urbanization is nearly complete, sediment loading generally was supply limited. Geochemical suspended-sediment sourcing techniques were used in an effort to characterize sediment-source areas (surface or channel-bank soils) using trace elements and the radionuclides beryllium-7, cesium-137, and lead-210. The sediment-source analysis was hindered by redistribution of surface soils and chemical changes to the sediment during erosion.

Johnson County and its cities are required to implement erosion and sediment controls during construction and post-construction runoff controls to comply with National Pollutant Discharge Elimination System Phase II Stormwater requirements. The Johnson County Stormwater Management Program is using the data collected from this study to characterize sediment loads from active construction sites and to evaluate the effectiveness of post-construction runoff controls such as stream buffers, detention ponds, and wetlands. The results from this study will be used to target best management practices in areas contributing to increased loading of suspended sediment throughout the county.

KEYWORDS

Suspended sediment, Urbanization, Turbidity, Sediment sources