Determination of total and clay suspended-sediment loads from in-stream turbidity data in the North Santiam River Basin, Oregon; 1998-2000

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Abstract

A method to estimate suspended-sediment load was developed using linear regression to correlate continuous turbidity-monitor data and suspended-sediment concentrations. In 1998, the U.S. Geological Survey began a cooperative study with the City of Salem, in Oregon to investigate the sources and dynamics of turbidity and suspended sediment within the North Santiam River-reservoir system. Three real-time sampling sites were established in October 1998 in the upper North Santiam River Basin upstream of Detroit Lake, a large, controlled reservoir, to collect water samples and continuously monitor turbidity, streamflow, water temperature, specific conductance, and pH from the three main tributary inputs to the lake. Suspended-sediment samples also were collected at the location of the turbidity monitors. The suspended-sediment concentration data correlated better with turbidity than streamflow. Erosion of glacial and landslide deposits in the North Santiam River Basin are not as proportional to streamflow as turbidity, making streamflow unreliable for estimating suspended-sediment concentration. Rating curves obtained by least-squares regression estimated suspended-sediment concentration from the in-stream turbidity monitor data in 30 minute increments. Suspended-sediment loads were computed from these estimated suspended-sediment concentrations and corresponding streamflow data. A method for predicting suspended-clay load from the persistent or residual turbidity was developed. Separate samples evaluating the change in turbidity over time were collected during the suspended-sediment sampling. Clay fraction (2 micrometer diameter) estimates of the suspended sediment load were derived from regression analysis of the turbidity decay curves and from particle fall times computed using Stoke's Law. Colloidal particles held in suspension have been difficult and expensive to remove by the slow-sand filtration system used in the North Santiam River Basin by the City of Salem, Oregon. Data collected by this study and techniques developed during the study will assist the City of Salem water treatment planners in understanding the water quality of their watershed and municipal managers in managing and allocating drinking-water supplies from surface water sources with persistent turbidity problems.