

## APPENDIX B. Streambank Erosion Calculations within AVGWLF

A streambank erosion routine was implemented within GWLF as part of this particular study. This routine is based on a generic approach described by numerous researchers in the field of geomorphology in which estimates of sediment loads from streambank erosion are computed using empirically-derived lateral erosion rates and stream flow velocities (e.g., VanSickle and Beschta, 1983; Dietrich et al., 1999; Prosser et al., 2001; Green et al., 1999; and Bagnold, 1980). Within AVGWLF, monthly streambank erosion is estimated by first calculating a watershed-specific lateral erosion rate using the following equation:

$$\text{LER} = a * q^{0.6}$$

where: LER = an estimated lateral erosion rate (meters per month)

a = an empirically-derived constant related to the mass of soil eroded from the streambank depending upon various watershed conditions  
(sec/month \* (m<sup>2</sup>)<sup>-1</sup>)

q = mean monthly stream flow (cubic meters per second).

Within AVGWLF, this “a” constant is derived using the equation:

$$a = (0.000452 * \text{PD}) + (0.000033 * \text{AD}) + (0.000005 * \text{CN}) + (0.000522 * \text{KF}) - 0.000514$$

where: PD = Percent developed land in the watershed

AD = Animal density of the watershed in animal equivalent units (AEUs)

CN = Area-weighted curve number value of the watershed

KF = Area-weighted soil “k” factor value for the watershed.

The GWLF model calculates daily streamflow in units of centimeters of water depth over the surface area of the watershed, but reports the streamflow on a monthly basis due to size restrictions on output files. Within AVGWLF, mean monthly stream flow is computed by converting simulated streamflow in centimeters of water depth over the watershed per month to cubic meters per month (i.e., water depth (m) \* watershed area (m<sup>2</sup>)). The resultant value is then multiplied by the number of seconds in a month to derive mean monthly streamflow (m<sup>3</sup>/sec).

After a monthly value for LER has been computed using the equation given above, the monthly sediment load for the watershed generated via streambank erosion is then

calculated by multiplying the LER value by the total length of streams in the watershed (in meters), the average streambank height (in meters), and the average soil bulk density (in  $\text{kg/m}^3$ ). Within AVGWLF, default values of 1.5 and 1500 are used for average streambank height and soil bulk density, respectively. The total stream length is computed automatically using the digital stream layer that is part of the AVGWLF database.

Calculated sediment loads from streambank erosion are reported separately from upland sediment loads in both GWLF output files and summaries that can be viewed on a computer screen. These streambank and upland sediment loads are also summed to provide total sediment loads for the watershed.

Nutrient loads associated with channel-eroded sediment are also calculated using estimates of background concentrations of nitrogen and phosphorus in the soil. More specifically, the calculated sediment loss from streambank erosion is multiplied by the estimated percent background concentration of nitrogen and phosphorus in soil to compute the respective nutrient loads associated with this type of erosion.