

**ATTACHMENT E**  
Determination of Erosion Potential

$E_p$  is determined as follows- The *total effective work* done on the channel boundary is derived and used as a metric to predict the likelihood of channel adjustment given watershed and stream hydrologic and geomorphic variables. The index under urbanized conditions is compared to the index under pre-urban conditions expressed as a ratio ( $E_p$ ). The effective work index ( $W$ ) is computed as the excess shear stress that exceeds a critical value for streambed mobility or bank material erosion integrated over time and represents the total work done on the channel boundary:

$$W = \sum_{i=1}^n (\tau_i - \tau_c)^{1.5} \cdot V \cdot \Delta t_i \quad (1)$$

Where  $\tau_c$  = critical shear stress that initiates bed mobility or erodes the weakest bank layer,  $\tau_i$  = applied hydraulic shear stress,  $\Delta t$  = duration of flows (in hours), and  $n$  = length of flow record. The effective work index for presumed stable stream channels under pre-urban conditions is compared to stable and unstable channels under current urbanized conditions. The comparison, expressed as a ratio, is defined as the Erosion Potential ( $E_p$ )<sup>1</sup> (McRae (1992, 1996)).

$$E_p = \frac{W_{post}}{W_{pre}} \quad (2)$$

where:

$W_{post}$  = work index estimated for the post-urban condition  
 $W_{pre}$  = work index estimated for the pre-urban condition

<sup>1</sup> MacRae, C.R. 1992. The Role of Moderate Flow Events and Bank Structure in the Determination of Channel Response to Urbanization. Resolving conflicts and uncertainty in water management: Proceedings of the 45th Annual Conference of the Canadian Water Resources Association. Shrubsole, D, ed. 1992, pg. 12.1-12.21; MacRae, C.R. 1996. Experience from Morphological Research on Canadian Streams: Is Control of the Two-Year Frequency Runoff Event the Best Basis for Stream Channel Protection. Effects of Watershed Development and Management on Aquatic Ecosystems, ASCE Engineering Foundation Conference, Snowbird, Utah, pg. 144-162