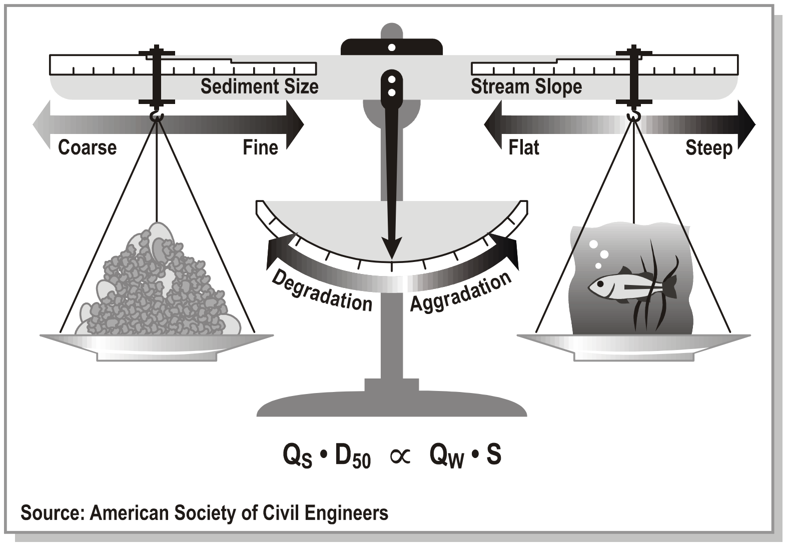
Appendix A
Channel Impacts from Watershed Changes

Channels are formed, maintained, and altered by the water and sediment they carry.

Channel equilibrium involves the interplay of four basic factors:

- Sediment discharge ($\mathbf{Q_S}$)
- Sediment particle size ($\mathbf{D_{50}}$)
- Streamflow ($\mathbf{Q_W}$)
- Stream slope (**S**)



Lane (1955) showed this relationship qualitatively as:

$$Q_s \bullet D_{50} \propto Q_w \bullet S$$

This equation is shown here as a balance with sediment load on one weighing pan and streamflow on the other.

The hook holding the sediment pan can slide along the horizontal arm to adjust according to sediment size. The hook holding the streamflow side can adjust according to stream slope.

Channel equilibrium occurs when all four variables are in balance. If a change occurs, the balance will temporarily be tipped and equilibrium lost. If one variable changes, one or more of the other variables must increase or decrease proportionally if equilibrium is to be maintained. For example, if channel slope is increased (e.g., by channel straightening) and streamflow remains the same, either the sediment load or the size of the particles must also increase. Likewise, if flow is increased (e.g., by an inter-basin transfer) and the slope stays the same, sediment load or sediment particle size has to increase to maintain channel equilibrium. Under these examples' conditions, a stream seeking a new equilibrium will tend to erode more of its banks and bed, transporting larger particle sizes and a greater sediment load.

Alluvial streams that are free to adjust to changes in these four variables generally do so and re-establish new equilibrium conditions. Non-alluvial streams such as bedrock or artificial, concrete channels are unable to follow Lane's relationship because of their inability to adjust the sediment size and quantity variables.

The stream balance equation is useful for making qualitative predictions concerning channel impacts due to changes in runoff or sediment loads from the watershed. Quantitative predictions, however, require the use of more complex equations. Sediment transport equations, for example, are used to compare sediment load and energy in the stream. If excess energy is left over after the load is moved, channel adjustment occurs as the stream picks up more load by eroding its banks or scouring its bed.