by down cutting of the channel bed (incision), scour of the streambanks or both. The incision locally steepens the channel slope, compounding the driving force for more erosion. This local steepening of bed slope is called a knick point. Knick points migrate upstream liberating sediment as they progress. When the streambanks exceed their critical height, mass failure ensues. This reconfiguring of the channel geometry continues until the equilibrium described by Lane is reestablished.

Initial change: Q_W ⇑*; followed by the response:* S ⇓*.* If the channel bed is relatively resistant to incision such as in the reaches with clay in the bed, the stream may respond to increased flows by decreasing its slope. The stream accomplishes this decrease in slope by meandering or increasing the channel length over the same change in elevation. The downstream progression of point bars (crescent-shaped sediment deposited on the inside bank of stream bends) opposite the downstream progression of eroding and failing cut banks (steeper outside banks of stream bends) are classic signs of meandering.

Initial change: S ⇑*; followed by the response:* Q_S ⇑*.* Increasing channel slope is often accomplished through channel straightening or dredging to achieve greater flood conveyance or to optimize land development. This increase in slope causes an increase in sediment load, in mobile D_{50} size or both. Bed and banks erode to generate the sediment that deposits downstream where channel slopes are flatter. The effective change in water surface slope may extend upstream well beyond the actual channel straightening or dredging, extending the accelerated erosion. The sediment eroded from upstream of the channelization or dredging and deposited downstream counteracts the effect of the channelization or dredging and improvements in flood conveyance are often less than anticipated.

Lane's Relationship is useful for broad conceptual understanding of stream behavior. The following models address stream process more specifically.

3.1.3 Channel Evolution – Evaluating Channel Changes in Cross Section

When considering streams from a management perspective, it is especially helpful to note that streams trend toward the equilibrium condition. In other words, they respond to changes in their watershed by adjusting their shape until they are back in equilibrium. Schumm (1984) and most recently Simon (1989) have described a process by which streams reacquire equilibrium after a disturbance in the watershed. Simon separates changes in channel morphology into six stages: I) Pre-Disturbance, II) Disturbance, III) Incision, IV) Widening, V) Deposition, and VI) Recovery and Reconstruction. Determining the phase of channel evolution in the various project reaches was an important part of the analysis. **Figures 3.1.2 and 3.1.3** illustrate these phases.