Connectivity within and between Channel Belt Reservoirs: A Trip down the Mississippi

John Holbrook[1]

[1]Texas Christian University, Fort Worth, TX

Abstract

Channel belts are the principle reservoirs in fluvial systems. The degree to which these belts are merged or separated is a critical determiner for reservoir volumes. The degree to which reservoirs within belts are connected is equally critical.

Predicting these variables is difficult in subsurface conditions where belts are neither clearly separated nor clearly merged and where materials within belts are not observable. Assessment of potential for draining channel-belt reservoirs depends upon an understanding of channel-belt processes.

Evaluation of over 300 driller's records and over 300 hand-augured boreholes along a 75 mile stretch of an active Mississippi River meander belt lends insights into this issue. Two trends are evident: 1) The variability of the basal scour surface of the belt mimics the variability of the modern channel thalweg depth through the studied belt, and 2) While the Mississippi River is the classic example of a mud dominated fluvial system with abundant abandoned meanders, much of the lower abandoned channel fill is not composed of passive-fill clays, but rather a grittier mix of active-fill mud and sand of variable permeability.

These results argue that the degree of connectivity at variable belt spacing can be quantified though projection of the variability of basal scour. For instance, channel belts vertically separated by the thickness equivalent to one-half the average belt thickness should be able to connect through the scour surface across 15% of the overlapping belt area. At one-belt separation, the likelihood of connectivity between potential channel-belt reservoirs decreases to less than 1%. Also, the processes that dictate filling of abandoned channels favors up to one-third sand fill depth in the lower portions which facilitates connectivity between point bar reservoirs within channel belts.