AB: Gravel augmentation is an increasingly common river restoration strategy for armored channels downstream of dams, however, few analytical tools are available to assist river managers in selecting the appropriate sediment volumes, grain sizes, and frequency of additions to achieve desired geomorphic and ecological outcomes. Coarse sediment additions are often intended to improve habitat for spawning salmonids by altering stream bed grain size distributions, and increasing the frequency of bed mobilization and the diversity of channel morphology. Here we report preliminary results of an ongoing laboratory investigation in which we simulate the gravel augmentation process and document the spatial and temporal evolution of the bed in response to pulses of elevated fine gravel supply. The experiments are conducted in a 30-m long, 0.86-m wide flume, with a calibrated sediment feed
and a tipping bucket type sediment trap that provides a continuous record of sediment flux at the downstream end of the flume. We created an initial armored bed by first achieving an active transport equilibrium slope and then shutting off the sediment feed and allowing the bed to coarsen and degrade until the transport rate became negligible. We then introduced gravel pulses of various volumes and grain sizes, and mapped the propagation of the wave of added sediment as it moved through the flume. The sediments comprising each pulse are painted distinct colors to aid in mapping and to quantify the extent of exchange with the armored bed. Mapping techniques include planform maps of zones of active transport and temporal contours of width-averaged concentrations of added gravel. We also documented the changes in bed grain size distribution using manual pebble counts before and after each run and analysis of high resolution photographs of the bed taken during the run. We also collected frequent bedload samples at regular locations along the flume length to document the movement of the gravel pulse and the extent of exchange with the initial bed. In our initial set of experiments we found that the mean velocity of the leading edge of the sediment pulse more than doubled when we increased the volume of added gravel by a factor of four. Likewise, holding gravel volume constant, the mean velocity of the gravel front increased by a factor of three when we decreased the grain size of the added gravel from 8 mm to 2 mm. In each case, the velocity of the leading edge decreased as the pulse moved downstream. As expected, the duration of elevated transport rates and temporary bed texture fining was inversely related to the rate of pulse propagation. These continuing experiments are intended to provide the basis for a methodology for determining the optimum combination of volume, grain size, and frequency of gravel addition to maximize both the spatial extent and temporal persistence of the beneficial changes in bed conditions.

DE: 1815 Erosion
DE: 1825 Geomorphology: fluvial (1625)
DE: 1856 River channels (0483, 0744)
DE: 1862 Sediment transport (4558)
SC: Hydrology [H]
MN: Fall Meeting 2005