Monitoring the effects of river realignment on the Upper Colorado River, Rocky Mountain National Park

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Abstract. A 2003 debris flow introduced 36,000 m3 of sediment into a high-elevation wetland on the Upper Colorado River in Rocky Mountain National Park. In September 2015 park staff built an earthen berm and realigned a 145 m reach of the Colorado River into its historic thalweg. Initial channel dimensions of the constructed segment were 1.6 m wide and 0.4 m deep with an averagebed slope of 1.9%. Pre- and post- realignment measurements are compared to assess the hydrogeomorphic response within the adjacent, 500 m long, wetland to the channel realignment. The earthen diversion berm constructed during the realignment has redistributed over 80% of river flow from a pre-realignment, west-side channel, to a central channel, resulting in altered surface watergroundwater interactions (hyporheic exchange) and sediment transport capacity. A sodium chloride tracer was injected during base flow and electrical resistivity was used to monitor changes in nearchannel hyporheic exchange across the realigned channel for 24 hours following the injection. Concurrent surface conductivity measurements throughout the wetland were used to complete a tracer mass balance. Pre- and post- restoration electrical resistivity analyses suggest that the wetland saw limited and spatially variable changes in hyporheic exchange. Tailing behaviors from conductivity tracer breakthrough curves indicate local changes in solute retention, which serves as a proxy for hyporheic exchange. The channel realignment appears to have increased solute retention within the bifurcated flow at the head of the wetland, where increased channel complexity has slowed river flow and increased floodplain inundation. These results suggest that the channel realignment has had short term effects on small scale hyporheic exchange flow paths. Such flow paths are essential in supporting flora and fauna on increasingly larger scales, ultimately influencing the biodiversity of the regional scale river-floodplain system. Furthermore, local incision over 0.5m, widening of 0.2 to 1 m, and upstream knickpoint migration within the constructed channel during 2016 runoff indicate increased sediment transport capacity. Long-term monitoring and increased instrumentation are required to predict how these changes may be amplified in a larger restoration attempt.