**Elwha River response to dam removals through four years and a 30-year-flood:** *Lessons learned, channel response, and sediment effects from the world's largest engineered dam removal*

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The stepwise removal of two dams on the Elwha River beginning in September 2011 is the largest dam removal and managed sediment release ever conducted. Dam removal exposed ~21 million cubic meters of sediment to fluvial erosion and created an unprecedented opportunity to monitor reservoir sediment erosion and river response during base level adjustment and a pulsed sediment release. Observations from monitoring can inform future work and provide insight into important considerations for undertaking a project of this magnitude and complexity.

Suspended and bedload sediment behaved largely as predicted during drawdown, but sediment reworking diminished the value of some “fish windows”, depending on hydrology during hold periods.

A large sediment wave translated and dispersed downstream with little immediate effect on channel morphology, but increasing wood abundance and incision through the initial bedload deposit initiated widening of the active channel and increased meander amplitude, and the river is developing a planform more consistent with the upstream undammed “reference reach”

Organic material stored in both reservoirs interacted with sediment and water to both facilitate and diminish erosion in different contexts, and at different times. Interaction between sediment and fine organics complicated mitigation activities.

Following the completion of dam removal, the river profile remains elevated above the pre-dam bed elevation, for different reasons at each dam site. Ongoing monitoring and adaptive management highlight the importance of establishing an equilibrium profile through disturbance reaches, and the complexities in removing ageing infrastructure that in some cases was built with little documentation of pre-existing conditions.

At the end of summer 2015, about 58% of the total stored sediment has been eroded, or about 95% of the total volume predicted to erode before dam removal began. Work continues to understand the ongoing river response to this historic project.

