**Artificial Redd Fine Sediment Accumulation Study**

**2012 Final ATR Summary**

**Introduction**

In collaboration with the USF&WS egg survival study, DWR installed artificial redds at five pool tailouts in upper Reach 1A on November 12, 2012. Each redd was dug to 1ft depth, installed with a piezometer and a collapsed, impermeable sediment bag, and covered with 6.35mm sieved gravel-cobbles. Each of these redds were proximal to the pits in which the egg tubes were installed. This round of the artificial redd study is designated as Experiment 4. The design of Experiment 4 follows that of Experiment 3. See details of the Pilot Study, Experiment 2, Experiment 3, and their designs in the previous 2012 Mid-Year Annual Technical Report and 2013 Monitoring and Analysis Plan for further details.

Since the previous ATR, the sediment retrieved in the sediment bags and from bedload samples from both Experiments 2 and 3 has been sieved and weighed. The data are presented as graphs (see Figures attached).

**Results**

Bedload transport was measured at each Redd Site at a point located immediately upstream of the artificial redd. Bedload monitored discharges ranged from 100 to 1000cfs. Redds 1 and 2 were not accessible during the 1000cfs flow and, as a result, their largest monitored discharge was 700cfs. Power functions provided the best fit to Redds 1 and 2’s bedload data while Redds 3, 4, and 5 are best fit by exponential functions (see Figure1). The power function relationship is provided for each Redd site because it makes physical sense (i.e. when discharge is zero bedload transport is also zero). Within the range of flows monitored, Redd 3 experiences the least transport above approximately >600cfs, which is the flow at which Redd 1 experiences the least transport. Redd 4 experienced the greatest amount of bedload transport. However, Redds 4 and 5 exhibit similar high levels of transport. Redds 1, 2 and 3, on the other hand, experience at least an order of magnitude less bedload transport at flows greater than about 300 to 400cfs. Also worth noting, the most upstream site, Redd 1, followed by Redd 2 show the least change in bedload transport with increasing discharge. This observation suggests upper Reach 1A, closest to Friant Dam, will be the least affected by fine sediment infiltrating into salmonid redds. Furthermore, managing discharge for fine sediment transport during incubation periods will be more important for redds located greater than 5 miles downstream of Friant Dam.

Very little fine sediment accumulated in the redds during the first phase (Exp2A) of Experiment 2 (i.e. up until December 12, 2011). This is a result of the low flow conditions (36 days <130cfs and 4 days between 250 and 390cfs) experienced during this period. During this period no more than 2% of the retrieved sample weight was <6.35mm. Later, the March 26, 2012 (Exp2B) retrieved samples contained between 1 and 6% <6.35mm. These samples were additionally subjected to another 35 days of flows less than 120cfs and 70 days of flows that averaged 336cfs with a maximum of 412cfs.

Experiment 3 lasted from March 29 until May 30, 2012. During this experiment the first phase (Exp3A) monitored 19 days at ~350cfs, and 14 days of a somewhat gradual ramp up to 690cfs. The second phase (Exp3B) monitored the peak of the pulse flow which held at just under 1,100cfs for roughly 23 days. Results show that Redd 4 accumulated the most sediment (~7% and 10% of sample weight for Exp3A and B, respectively). Surprisingly, when considering the measured transport rates, Redd 2 accumulated almost an equal amount by the end of Exp3B (~10%) suggesting a local source of fine sediment is available at flows greater than 700cfs.

The daily average discharge (USGS Friant gage) was used with the bedload transport rating curve power functions to calculate the mass of bedload transported across the 1ft diameter sediment bag rim at each site. The total accumulated sediment <6.35mm in each sediment bag was then compared to the transported amount to estimate the percent of bedload captured by the sieved redd gravel framework (see Figures for each experiment phase).

Future work will include collecting permeability measurements and sediment bag samples, sieving the sediment bag and bedload samples, and compiling the data as part of Experiment 4. Additional Experiments will depend on anticipated flow levels and collaborator interest. Any further experiments will provide supportive/confirmation data. A final technical memorandum presenting the fine sediment transport and accumulation findings will be prepared in collaboration with the USF&WS egg survival study’s results.