Supplemental Information for Warrick et al. publication in Geological Society of America, Bulletin, entitled, "*The effects of wildfire on the sediment yield of a coastal California watershed.*"

The supplemental information has been divided into three parts. Part 1 provides a table of the river suspended-sediment sampling results from water years 2009-2010. Part 2 provides the computations of a comparison of the USGS flow-integrated suspended-sediment samples and our near surface suspended-sediment samples. The purpose of this comparison is to evaluate the sediment grain sizes that should be vertically uniform in the Arroyo Seco. Concentrations of suspended-sediment from these grain sizes should not be significantly different for the two sampling methods. Part 3 provides a comparison of the suspended-sediment concentrations measured at the three sites sampled on the Arroyo Seco. The purpose of this comparison is to evaluate whether concentrations were significantly different from these sites.

Part 1 – Results of suspended sediment sampling of the Arroyo Seco during water years 2009-2010.

The suspended-sediment concentration sample results from our sampling of the Arroyo Seco are presented in Table DR1. Results have been organized by site and sample date.

Part 2 – Comparison of flow-integrated and near surface suspended-sediment samples.

Two suspended-sediment sampling methods (flow-integrated and water surface) were used in this study, and here we evaluate whether these results are directly comparable. Here we consider a comparison of the fine portion (< 0.063 mm) of the suspended-sediment concentrations using theoretical Rouse profiles (*after* van Rijn, 1984) and field measurements by the USGS. Flow-integrated concentrations for a specific sediment grain size were computed as the flow-normalized product of concentration and flow velocity across the sampled profile (Hicks and Duncan, 1997). Sediment concentration profiles were generated for 1-phi grain size increments from 0.002 to 0.063 mm using the modified Rouse profiles of van Rijn (1984). Velocity profiles were estimated using the von Karman-Prandtl equation (Dyer, 1986) assuming a range of roughness lengths representing the mixed sand and gravel bed conditions of the Arroyo Seco. Because we did not have velocity profiles, we assumed that the shear velocity (u_*) scaled with the mean channel velocity by a factor of 0.05 (*cf.* Hicks and Duncan, 1997). For these calculations the grain-size distribution of the fine suspended-sediment was assumed to be equivalent to the average of the grain-size distributions measured by the USGS for the Arroyo Seco following the Marble Cone wildfire (n=14). These samples had approximately equal fractions of mass (~20%) in the 5 phi-sized groups smaller than 0.063 mm (the final group included all particles less than 0.002 mm). Sediment fall velocities for each grain-size fraction were calculated conservatively by using the largest particle size in each group, using the Ferguson and Church (2006) equations. A reference concentration of 1000 mg/l was chosen for the reference height (z/d) of 0.05 (where z is the height and d is the total depth), although the results below were not sensitive to the range of concentrations expected for the Arroyo Seco (e.g., Figure 4C). Flow-integrated concentrations were calculated by integrating between 0.11 m above the bed (the approximate limit of suspended-sediment sampling; Hicks and Duncan, 1997) and the water surface, and water surface samples were calculated by the average concentration in the upper portion (z/d = 0.85 to 0.95) of the water column.

Our water surface samples were obtained for discharge rates between 2.3 and 200 m^3/s, and USGS measurements of the channel cross-section average discharge velocities for these discharges range between 0.3 and 3 m/s. Considering the lowest (and slowest) flow (2.3 m^3/s), which had an average flow depth of ~0.5 m, we computed that the surface fine sediment concentrations would be only 7% less than the flow-integrated concentrations. This level of underestimation was reduced to below 1% for the highest sampled discharges. This suggests that fine sediment concentrations in the Arroyo Seco during hydrologic events should be vertically uniform, and that negligible difference exists between the two fine sediment sampling techniques.

Part 3 – Comparison of suspended-sediment concentrations from the three Arroyo Seco sampling sites

During WY09 suspended-sediment samples were collected from the two USGS gaging stations in the Arroyo Seco (Sites 1A and 1B). These locations were sampled within 60 minutes of one another during both rising and falling limbs of event hydrographs. A plot of the fine suspended-sediment concentration with respect to river discharge from this sampling is shown in Figure DR1, and significant regressions were found for these data from both locations ($p<0.05$; r^2 = 0.55 and 0.78, respectively). The regression functions developed for each location appeared to be quite similar (Figure DR1), which is consistent with the finding that the slope and intercept of the best fit lines through log-transformed data were both not significantly different between the sample sites (p=0.77 and p=0.64, respectively). Similar results were found for the sand fraction of these samples, although these results are not discussed in this paper. We hypothesize that the majority of the fine sediment and water flux in the Arroyo Seco originates in the steep, mountainous region upstream of Site 1A, which would imply that the suspended-sediment concentration and water discharge patterns at Site 1B should mimic Site 1A somewhat closely during hydrologic events. These results support the use of Site 1B during WY10 as representative of suspended-sediment conditions at Site 1A.

References Cited

Dyer, K., 1986, Coastal and Estuarine Sediment Dynamics, John Wiley and Sons, Sussex, UK, 358 pp.

Ferguson, R.I. and M. Church, 2006, A simple universal equation for grain settling velocity, Journal of Sedimentary Research, v. 74, n. 6, p. 933-937.

Hicks, D.M. and M.J. Duncan, 1997, The effiency of depth-integrating samplers in sampling the suspended sand load in gravel bed rivers. Journal of Hydrology, v. 201, p. 138-160.

van Rijn, L.C. 1984, Sediment transport, Part II: Suspended load transport, Journal of Hydraulic Engineering, v. 110, n. 11, p. 1613-1641.

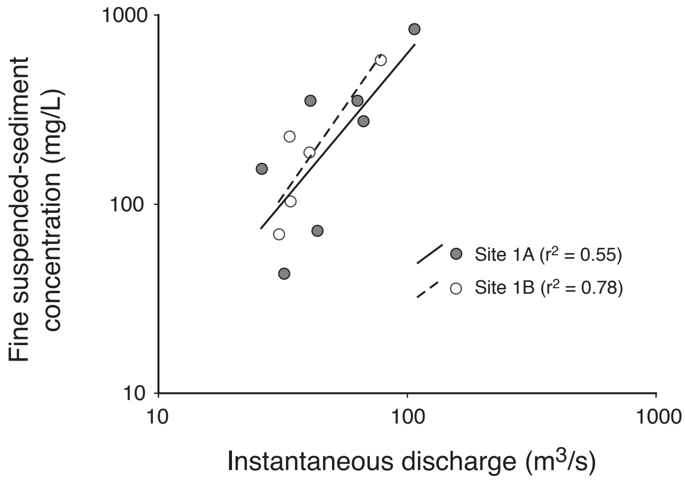

Figure DR1. Comparison of fine suspended-sediment concentrations obtained during water year 2009 from two USGS gaging stations in the Arroyo Seco. Samples were obtained within 60 minutes of one another during rising and falling limbs of two storm events. Power-law regressions and correlations are shown for both locations (lines).

Year	Month	Day	Time (Pacific Standard Time)	USGS Station	Drainage Area (km^2)	Discharge (m^3/s)	Fine (less than 63um) suspended-sediment concentration (mg/L)	Coarse (greater than 63um) suspended-sediment concentration (mg/L)	Non-settled particles during centrifuge (mg/L)	Total suspended-sediment concentration (mg/L)
2009	2	15	12:45	11151870	293	26.1	153.8	100.8	2.1	256.6
2009	2	15	15:45	11151870	293	40.8	352.6	217.9	2.6	573.1
2009	2	16	11:30	11151870	293	106	843.6	526.7	4.7	1375
2009	2	16	15:45	11151870	293	63.1	352.7	173.9	2.7	529.2
2009	2	17	9:30	11151870	293	43.6	72.1	50.8	1.5	124.4
2009	2	17	17:05	11151870	293	66.8	275	245.6	3.2	523.8
2009	2	18	9:45	11151870	293	32	42.9	25.4	1.5	69.9
2008	11	21	9:00	11152000	632	0	0.8	0.3	0	1.1
2009	2	15	13:45	11152000	632	4.33	2.4	0.2	1.7	4.2
2009	2	15	16:20	11152000	632	5.13	11.2	5.9	0.8	17.9
2009	2	16	12:10	11152000	632	87.2	316.9	126.5	2.8	446.2
2009	2	16	16:20	11152000	632	97.7	489.6	92.8	3.8	586.3
2009	2	17	9:00	11152000	632	41.9	115.9	18.5	2	136.4
2009	2	17	16:40	11152000	632	78.2	328.1	99.2	3.8	431.1
2009	2	18	9:20	11152000	632	31.1	46.9	11.8	0.9	59.6
2009	2	16	12:35	11152050	787	33.7	227.9	145	1.7	374.6
2009	2	16	16:50	11152050	787	78.4	577	213.5	3.6	794.1
2009	2	17	8:35	11152050	787	40.5	187.8	96.4	3.5	287.7
2009	2	17	16:15	11152050	787	34	103.3	18.5	3.6	125.3
2009	2	18	9:00	11152050	787	30.6	69.3	10.2	2.4	82
2009	10	14	18:30	11152050	787	30.6	145.3	59.66	0.28	212.38
2009	12	13	12:15	11152050	787	16.8	74.52	5.89	0.07	81.81
2010	1	13	21:50	11152050	787	2.41	18.06	13.73	0.42	32.66
2010	1	18	10:40	11152050	787	2.32	10.09	11.48	0.49	23.46
2010	1	18	21:00	11152050	787	95.6	821.77	139.29	0.14	966.66
2010	1	20	18:00	11152050	787	197	1310.78	208.04	0.14	1527.95
2010	1	23	16:15	11152050	787	42.2	83.26	48.52	0.35	136.94
2010	2	24	18:15	11152050	787	44.5	402.12	53.56	0.12	459.46
2010	2	27	9:15	11152050	787	46.7	206.22	36.57	0.15	247.55
2010	3	4	10:30	11152050	787	29.7	28.18	5.44	0.15	37.12
2010	4	5	8:30	11152050	787	29.4	218.09	150.06	0.4	372.25