Appendix 3. Calibration Dataset and Model Results for Streamgage 04296280—Barton River Near Coventry—Suspended-Sediment Concentration

SITE NUMBER—04296280
SITE NAME—Barton River near Coventry, VT
DATE CREATED—2/4/2014
MODEL DEVELOPMENT DATA PERIOD—8/31/2010 – 5/31/2013
MODEL CALIBRATION DATA SET—Water samples were collected from the upstream side of the bridge over Coventry Station Road using a handheld DH-59 sampler, using USGS protocols and are stored in the NWIS database. The regression model is based on 45 concurrent measurements of suspended-sediment concentration (SSC), streamflow (Q), and acoustic backscatter for samples collected from 08-31-2010 through 05-31-2013. Sample collection targeted the range of continuously observed hydrologic conditions. Discharge over the sample period ranged from 28 to 6,070 cubic feet per second (ft^3/s) and instantaneous discharge during sample collection ranged from 39 to 4,550 ft^3/s. Summary statistics and complete model-calibration datasets are provided. None of the SSC samples were considered outliers.
The acoustic data were collected using a Sontek Argonaut SL 1.5 MHz (serial no. E3132) fixed on the right bank and configured with a blanking distance of 0.5 m and 5 cells of 1.22 m each.
MODEL DEVELOPMENT— Regression analysis was done using the USGS SAID (the Surrogate Analysis and Index Developer Tool, v. 20131101) computer program, which applied various OLS linear regression models to estimate SSC concentration from several different independent variables. Output from SAID included a variety of statistical and graphical tools that enabled the user to determine model validity and to make comparisons among regression models. Different combinations of untransformed and log_{10}-transformed data were evaluated. The regression model to estimate the log_{10} SSC concentration from the predictor variable sediment-corrected backscatter (SCB) was selected based on residual plots, RMSE, and R^2.
MODEL SUMMARY—Summary of the final regression analysis for SSC at site number 04296280.
Suspended sediment concentration-based model:

$$\log_{10}SSC = -2.28 + (0.05 \times SCB), \quad (3–1)$$

where

SSC = suspended sediment concentration, in mg/L
SCB = water- and sediment corrected backscatter, in decibels

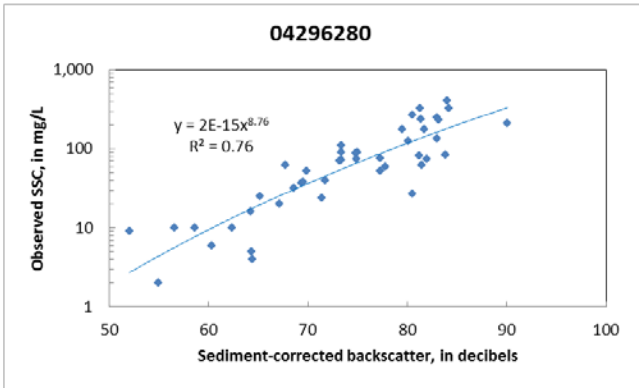
The use of SCB as an explanatory variable makes sense both physically and statistically. Physically because suspended sediment is strongly related to the property of acoustic backscatter in water and statistically as an explanatory variable because it resulted in a model with low RMSE and relatively high R^2 values.
SUSPENDED SEDIMENT CONCENTRATION RECORD— The record was computed using the Surrogate Analysis and Index Developer Tool (SAID; version 20131101). The ADP functioned well and collected continuous acoustic data during the study period except for the following. From 1/19/2011 to 2/8/2011 the ADP was influenced by the presence of shore ice at the sensor. From 12/26/2012 to 1/15/2013 and 4/11/2013 to 4/14/2013 there was a communication issue between the ADP and data logger. On April 15, 2013 a second solar panel was installed and is believed to be introducing a voltage spike during peak sunlight hours from approximately 9 to 11 am. The increase in voltage is believed to be causing a momentary spike in the water temperature being reported by the ADP. Water temperature spikes were within the maximum allowable limits for continuous water-quality monitoring sensors and were not removed.
Computed: Laura Medalie
Reviewed: Richard Kiah

Model Form: $\log_{10}SSC = -2.28 + (0.05 \times SCB)$

Model Calibration

Basic Data

Number of Measurements:	45
RMSE:	0.274
R^2:	0.766
Adj R^2:	0.761
Duan BCF:	1.182
PPCC:	0.976



Explanatory Variables

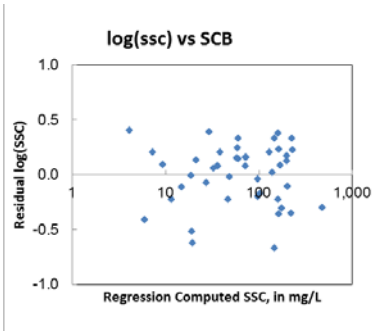
Variable	Value	Standard Error
Intercept	-2.276	0.3390
SCB	0.055	0.0046

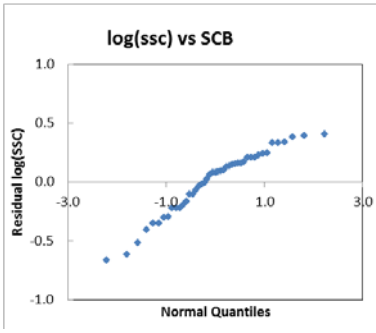
Test Criteria

Leverage	Cook's D	DFFITS
0.1333	2.2042	0.4216

Observations exceeding at least one test criterion

Observation	Observed log(SSC)	Predicted log(SSC)	Residuals	Leverage	Cook's D	DFFITS
3	0.30	0.71	-0.41	0.1186	0.172	-0.598
14	1.43	2.10	-0.67	0.0358	0.115	-0.512
17	0.95	0.55	0.40	0.1512	0.224	0.683
38	0.70	1.22	-0.52	0.0460	0.092	-0.443
39	0.60	1.23	-0.63	0.0454	0.130	-0.539





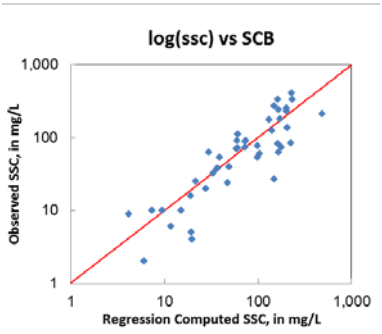


Table 3–1. Calibration dataset and computed values for suspended-sediment concentration at streamgage 04296280 in the Barton River near Coventry, Vermont, from August 2010 through May 2013.

[SSC, suspended-sediment concentration; mg/L, milligrams per liter; Q, discharge; ft3/s, cubic feet per second; MB, measured backscatter; dB, decibels; WCB, water-corrected backscatter; HystQ, marker to indicate position of sample on the hydrograph; AlphaF, fluid absorption coefficient; dB/m, decibels per meter; °F, degrees Fahrenheit; SCB, sediment-corrected backscatter; AlphaS, sediment-driven attenuation coefficient]

	Calibration dataset								Computed values				
Date and time	SSC, in mg/L	Q, in ft^3/s	MB, in dB	WCB, in dB	HystQ	AlphaF, in dB/m	Water temperature, in °F	log10SSC, in mg/L	SCB, in dB	AlphaS, in dB/m	Regression computed SSC, in mg/L	Residual log(SSC), in mg/L	Normal quantiles
8/31/2010 12:31	10	57	41.10	54.51	1	0.42	72	1.00	56.52	0.53	7	0.21	0.80
9/8/2010 13:05	16	46	50.28	63.88	1	0.49	66	1.20	64.19	0.24	19	-0.01	-0.22
9/22/2010 12:45	2	39	38.50	53.36	0	0.62	55.5	0.30	54.97	0.57	6	-0.41	-1.41
9/29/2010 14:35	6	90	44.90	59.50	1	0.54	61.4	0.78	60.32	0.39	12	-0.22	-0.72
10/1/2010 12:05	253	1,190	65.40	79.74	0	0.55	60.3	2.40	82.96	0.74	202	0.17	0.59
10/5/2010 13:25	20	512	52.40	67.03	1	0.62	55.52	1.30	67.17	0.29	28	-0.07	-0.40
12/2/2010 13:00	178	993	61.10	78.65	0	0.96	37.8	2.25	81.69	1.06	173	0.09	0.11
3/21/2011 18:40	53	932	51.60	70.69	1	1.12	32	1.72	69.86	0.60	39	0.20	0.72
4/5/2011 15:05	177	881	58.70	77.43	0	1.05	34.2	2.25	79.49	0.90	131	0.20	0.65
4/11/2011 13:30	209	3,210	64.30	83.59	0	1.06	34	2.32	90.03	1.42	489	-0.30	-0.96
4/12/2011 15:45	84	3,690	60.80	77.60	1	0.95	38.4	1.92	83.79	1.34	224	-0.35	-1.16
4/14/2011 13:30	24	2,000	51.80	69.69	1	1.00	36.5	1.38	71.42	0.66	48	-0.23	-0.88
4/18/2011 14:05	62	1,470	61.10	79.09	1	0.97	37.6	1.79	81.43	0.91	167	-0.36	-1.27
4/21/2011 16:15	27	1,580	58.30	76.64	1	0.95	38.7	1.43	80.49	1.07	148	-0.67	-2.22
4/28/2011 13:00	72	2,470	54.40	69.50	1	0.71	49.8	1.86	73.38	0.77	61	0.15	0.34
5/2/2011 13:50	60	925	60.40	76.38	1	0.74	48.1	1.78	77.76	0.70	105	-0.17	-0.59
8/5/2011 15:15	9	57	36.30	49.77	1	0.40	75	0.95	52.05	0.43	4	0.40	2.22
8/24/2011 13:20	10	68	43.20	57.24	1	0.48	66.4	1.00	58.57	0.44	10	0.09	0.17
8/29/2011 10:45	332	4,550	64.30	78.67	1	0.53	62.1	2.52	81.30	0.58	164	0.38	1.58
9/30/2011 14:30	241	1,060	63.60	78.13	0	0.57	59.2	2.38	81.40	0.87	166	0.23	0.96
10/25/2011 13:25	10	366	46.00	61.03	1	0.71	50	1.00	62.33	0.58	15	-0.11	-0.52
3/13/2012 11:10	110	467	54.30	72.01	0	1.05	34.3	2.04	73.36	0.75	61	0.33	1.27
3/15/2012 14:40	90	708	55.90	73.52	1	1.03	35	1.95	74.99	0.79	74	0.15	0.46
3/20/2012 16:10	125	996	61.40	77.95	1	0.89	40.7	2.10	80.08	0.88	141	0.02	-0.17
3/21/2012 18:45	53	888	59.30	75.36	1	0.82	44.1	1.72	77.24	0.79	99	-0.20	-0.65
3/27/2012 16:15	37	344	50.80	68.58	1	1.02	35.5	1.57	69.33	0.63	37	0.08	0.00
4/10/2012 16:00	90	437	56.30	73.03	1	0.91	40	1.95	73.33	0.52	60	0.25	1.05
4/18/2012 14:20	62	153	48.90	64.01	1	0.68	51.5	1.79	67.70	0.98	30	0.39	1.81
4/25/2012 10:45	38	435	53.40	69.40	1	0.81	44.5	1.58	69.49	0.42	37	0.08	0.06
5/31/2012 13:15	77	920	62.00	75.75	1	0.50	64.5	1.89	77.31	0.57	100	-0.04	-0.34
4/15/2013 10:15	74	652	56.22	73.33	1	0.97	37.6	1.87	74.87	0.76	73	0.08	-0.06
4/17/2013 13:40	271	844	60.84	77.68	0	0.93	39.1	2.43	80.51	1.00	149	0.33	1.41
4/18/2013 12:30	89	807	57.32	74.29	1	0.95	38.4	1.95	74.83	0.64	73	0.16	0.52
4/22/2013 17:15	71	813	56.78	73.00	1	0.84	42.9	1.85	73.14	0.51	59	0.15	0.40
4/26/2013 10:45	32	450	52.70	69.05	1	0.86	42.1	1.51	68.54	0.37	33	0.06	-0.11
5/2/2013 11:05	25	209	49.74	64.50	1	0.64	54	1.40	65.21	0.40	22	0.13	0.28
5/17/2013 16:45	5	96	49.76	64.17	1	0.60	57.2	0.70	64.30	0.30	20	-0.52	-1.58
5/21/2013 15:10	4	133	49.58	64.02	1	0.60	56.9	0.60	64.43	0.34	20	-0.62	-1.81
5/22/2013 13:12	332	643	64.76	79.45	0	0.63	54.6	2.52	84.15	1.07	235	0.22	0.88
5/23/2013 11:40	413	1,030	65.82	80.16	0	0.59	57.9	2.62	83.98	0.93	230	0.33	1.16
5/24/2013 10:30	231	2,519	63.74	78.07	0	0.60	58	2.36	83.12	1.07	206	0.12	0.22
5/24/2013 15:45	136	2,792	63.94	78.39	1	0.59	56.8	2.13	83.01	0.93	204	-0.10	-0.46
5/26/2013 10:40	74	3,198	62.60	78.30	1	0.77	46.5	1.87	81.95	0.88	178	-0.31	-1.05
5/28/2013 8:55	82	1,477	63.92	78.92	1	0.68	51.9	1.91	81.21	0.80	162	-0.22	-0.80
5/31/2013 10:50	40	715	57.22	71.52	1	0.58	58.3	1.60	71.73	0.34	49	-0.02	-0.28