

Data Transmittal Report

CLEAR CREEK CONSULTANTS



To: Upper Clear Creek Watershed Association (UCCWA)
CC:
From: Mike Crouse
Date: 6-April-2012
Re: Stream Gaging Report 2011 – Clear Creek at Kermitts (Station CC-40)

Clear Creek Consultants (CCC) has been retained by UCCWA to operate and maintain the stream flow gaging station on Clear Creek above Johnson Gulch near Kermitts (Station CC-40). The UCCWA and others utilize stream flow data from this gage to assess water quality conditions in Clear Creek. From October 1994 to October 2005, the gage was operated by the U.S. Geological Survey and records were published in annual reports. CCC has operated the CC-40 gage and published data since 2006. This report presents data collected at the gage from October 2010 to October 2011.

Data Collection Activities

Operation of the CC-40 streamgage requires the development and maintenance of a discharge rating to define the relationship between stream stage height and discharge. Direct measurements of streamflow using a current meter are required each year to document this relationship at various seasonal flow rates. These measurements are compared to the discharge rating and, if necessary, shift adjustments are applied to maintain accuracy. All data collection methods and procedures used at the CC-40 streamgage follow standard USGS guidelines and protocols (USGS, 1982 - Measurement and Computation of Streamflow, Volumes 1 and 2).

Seven direct current meter discharge measurements were taken in 2011 to support the discharge rating. Measurement results are available upon request. These measurements are plotted on log-normal distribution using a computer program for comparison to the existing rating. Each year the discharge rating is evaluated to assess the accuracy of the rating in comparison to the direct measurements. Shifts are applied when appropriate to maintain accuracy.

The low-flow and medium-flow ratings were refined for 2011 designated as Rating No. 6. Three separate rating curves were developed and utilized for the CC-40 gage representing low flow (20-70 cfs), medium flow (70-300 cfs), and high flow (300-3,000 cfs). The streamflow rating table for CC-40 is attached.

A continuous recording Campbell Scientific data logger was used to measure a submersible pressure transducer to develop the stage height record for CC-40. The 15-minute average stream stage height was recorded during ice-free periods extending from approximately March to November. The transducer was calibrated using an electronic tape gage referenced to the base of the gage enclosure box. An outside staff gage mounted in the stream is also utilized as a stream stage height reference.

The gage was audited approximately monthly to check calibration against the gage reference points and make any necessary adjustments to maintain accuracy. The gage reference and benchmark elevations were measured with a laser level on November 23, 2010 (to an accuracy of +/- 0.01-ft) to document any vertical movement in the gage and make any necessary adjustments. All gage reference elevations were within +/- 0.02-ft of the benchmark elevations.

Routine maintenance of the gage included removal of silt accumulated in the stilling well and painting of the entire gage. The rating table was also posted at the gage for rafters and other water users to obtain an estimate of the current stream flow.

Continuous recording water quality probes were also operated at the CC-40 gage. A combination conductivity/temperature probe recorded in-stream temperature and conductivity (dissolved solids) conditions related to salt loading in Clear Creek (see attached data plot). An in-stream turbidity probe was used to monitor stream turbidity conditions related to suspended sediment loading (see attached data plot). These water quality parameters are recorded by the data logger as 15-minute average and daily maximum values. A tipping bucket rainfall intensity gauge was also operated at the CC-40 gage.

Results

The stage height record was compiled for review, plotted, and any necessary corrections were made based on field calibration measurements. The final stage height record was then imported into an MSAccess database program for the computation of discharge and archiving. Water quality parameter data is also maintained in the MSAccess database for CC-40. This data is available upon request.

The updated 2011 discharge rating equations were applied to the corrected stage height data for the computation of discharge. A stream flow calculator program was used within the Access database framework to compute the 15-minute discharge. Statistical output summaries from the database program include mean daily flow; mean hourly flow; and maximum and minimum instantaneous flow by month.

The CC-40 mean daily discharge results for October 2010 to October 2011 are presented in the attached table, along with the flow hydrograph of these data. The gage is not operated over the winter months (December-February) because the rating is not accurate during ice-cover conditions which occur each year at CC-40. Therefore, winter flows were estimated based on Clear Creek flows at the Golden USGS gage (CC-60) adjusted using an average gage ratio ranging from 0.8 to 1.0.

Minimum Clear Creek flows occur in winter with maximum flows typically in June. Minimum flows ranged from 25 to 40 cfs at CC-40. Mean daily flows were below average in May 2011, followed by a rapid increase in June to above normal flows which persisted through summer and fall 2011.

Maximum mean daily July flows were well above the long-term average. The peak instantaneous flow was 1,663 cfs on July 8, 2011, compared to 1,335 cfs in June 2010. Mean daily flows remained well above average from July through October 2011.

Data graphs for 2011 specific conductance, temperature, and turbidity at CC-40 are attached. Daily precipitation data summary for the 2006-2011 monitoring period is also tabulated.

CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS

WY 2011

Provisional Data - Subject to Revision

LOCATION -- 0.5 mi upstream Johnson Gulch

LATITUDE 39 44'47" LONGITUDE 105 26'08"

GAGE DRAINAGE AREA -- 267 sq-mi

GAGE ELEVATION -- 7210 ft-msl

PERIOD OF RECORD -- October 1994 to Current Year

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

MEAN DAILY VALUES

DAY	2010 OCT	2010 NOV	2010 DEC	2011 JAN	2011 FEB	2011 MAR	2011 APR	2011 MAY	2011 JUN	2011 JUL	2011 AUG	2011 SEP
1	82.7	71.2	41 e	25 e	36 e	38.8	51.6	56.0	400	1310	566	206
2	80.5	68.4	41 e	41 e	37 e	40.3	53.6	58.6	478	1294	548	200
3	79.9	72.2	46 e	47 e	38 e	43.3	60.0	58.4	583	1284	662	194
4	80.3	71.1	43 e	41 e	49 e	43.5	49.7	63.2	606	1254	565	184
5	82.9	61.1	42 e	34 e	53 e	40.8	51.9	66.9	677	1203	526	185
6	87.5	58.4	40 e	43 e	49 e	42.3	53.7	75.9	759	1271	514	190
7	93.9	60.2	45 e	50 e	43 e	41.9	58.2	80.7	807	1301	473	280
8	93.4	56.8	44 e	44 e	37 e	40.9	59.5	106	804	1530	422	246
9	86.6	55.0	43 e	45 e	34 e	39.0	64.2	131	836	1447	381	186
10	83.4	43.3	44 e	39 e	30 e	41.3	63.6	137	859	1407	357	182
11	83.7	50.4	41 e	39 e	33 e	46.8	58.8	147	853	1447	338	169
12	93.0	37.5	46 e	46 e	36 e	45.8	60.7	132	847	1441	327	165
13	90.4	42.7	46 e	43 e	38 e	46.4	59.8	129	841	1325	320	156
14	71.8	46.1	43 e	48 e	40 e	43.9	72.0	141	862	1239	317	161
15	69.1	49.0	41 e	43 e	37 e	47.3	60.1	136	869	1137	327	190
16	80.4	51.1	39 e	41 e	43 e	47.8	64.6	153	918	1057	315	173
17	80.9	53 e	39 e	43 e	39 e	51.7	66.2	183	1002	1021	304	159
18	79.5	53 e	40 e	45 e	37 e	54.5	67.0	192	961	1015	281	161
19	81.7	51 e	43 e	50 e	39 e	54.0	73.4	198	926	1118	265	142
20	78.2	51 e	41 e	43 e	41 e	51.7	65.4	181	952	1008	282	155
21	76.6	51 e	45 e	42 e	35 e	52.9	71.4	180	873	925	252	161
22	84.6	49 e	40 e	43 e	40 e	53.1	74.1	178	838	837	256	149
23	84.3	38 e	44 e	42 e	43 e	48.4	60.6	193	873	775	240	141
24	80.4	43 e	42 e	43 e	39 e	45.9	63.4	193	954	730	242	144
25	87.5	36 e	40 e	42 e	39 e	45.6	67.7	185	1055	693	246	139
26	74.8	37 e	37 e	43 e	41 e	46.0	67.9	185	1116	668	297	138
27	71.8	40 e	35 e	41 e	40 e	45.7	61.4	209	1113	667	277	143
28	68.0	43 e	31 e	40 e	40 e	46.3	59.9	235	1135	660	262	127
29	74.2	44 e	27 e	40 e		45.0	64.4	324	1186	650	248	125
30	73.8	41 e	27 e	38 e		44.7	58.1	401	1249	587	227	133
31	74.6		28 e	35 e		47.2		368		564	218	
TOTAL	2510	1524 e	1242 e	1300 e	1107 e	1423	1863	5077	26231	32864	10855	5083
MEAN	81	51 e	40 e	42 e	40 e	46	62	164	874	1060	350	169
MAX	94	72 e	46 e	50 e	53 e	54	74	401	1249	1530	662	280
MIN	68	36 e	27 e	25 e	30 e	39	50	56	400	564	218	125
AC-FT	4,979	3,022 e	2,464 e	2,578 e	2,196 e	2,823	3,695	10,070	52,030	65,186	21,530	10,081

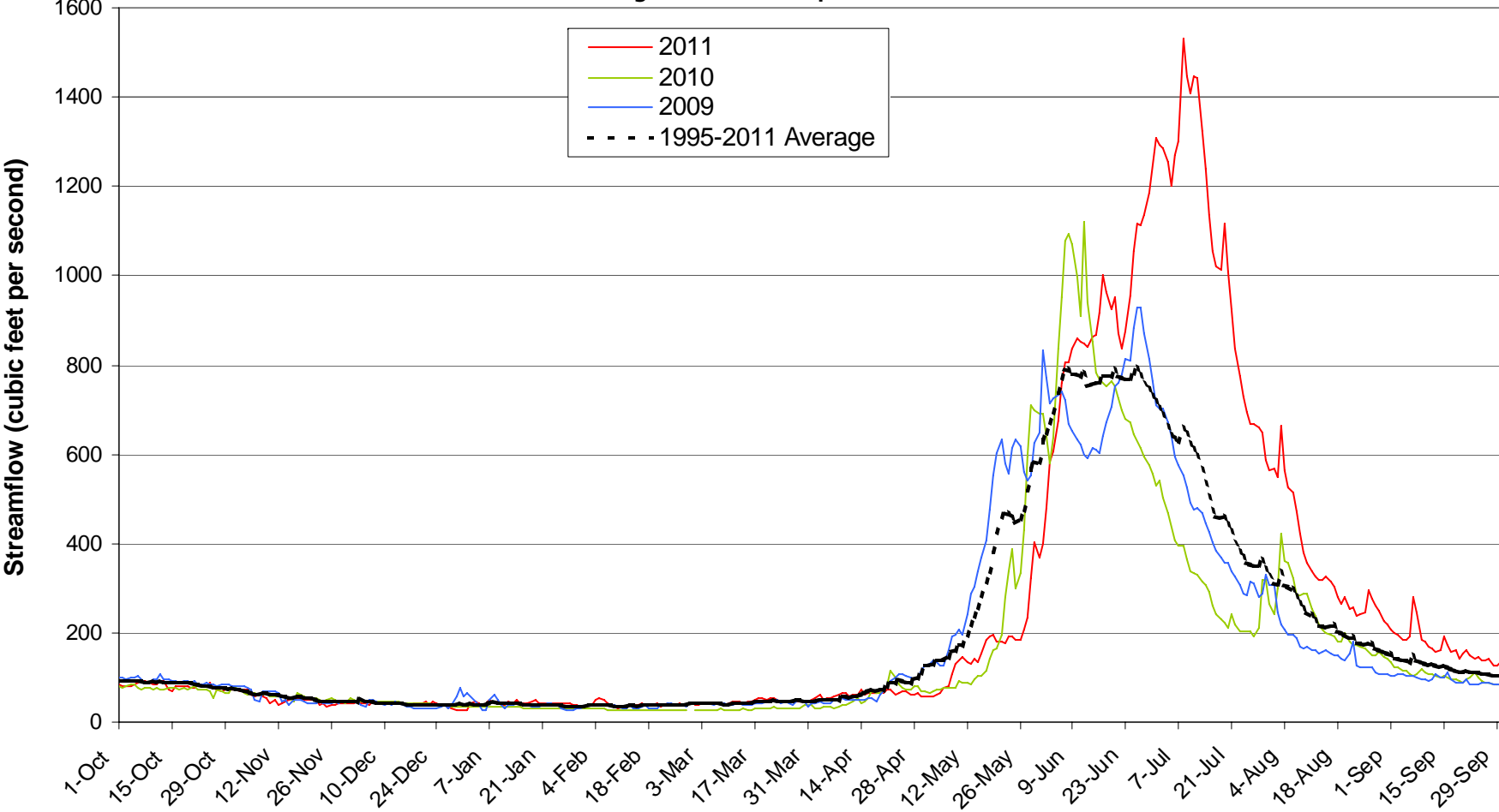
INSTANTANEOUS MEASUREMENTS

MAX FLOW	104					62.1	83.1	428	1380	1663	777	332
DATE	12-Oct					23-Mar	21-Apr	30-May	30-Jun	8-Jul	3-Aug	7-Sep
MIN FLOW	55.4					35.2	42.8	50.6	380	543	198	115
DATE	28-Oct					5-Mar	4-Apr	2-May	1-Jun	31-Jul	31-Aug	30-Sep

e = estimated during ice affected period using average ratio 0.8 of CC-60 flow

Clear Creek Mean Daily Streamflow by Water Year above Johnson Gulch near Kermitts (CC-40)

Drainage Area = 267 square miles



**CLEAR CREEK NEAR KERMITTS
PROVISIONAL STREAMFLOW RATING TABLE**

STAFF GAGE HEIGHT (feet)	STREAMFLOW (cubic feet per second)
3.4	24
3.5	32
3.6	43
3.7	57
3.8	74
3.9	88
4.0	104
4.1	122
4.2	143
4.3	168
4.4	195
4.5	227
4.6	262
4.7	303
4.8	326
4.9	351
5.0	377
5.1	405
5.2	434
5.3	465
5.4	497
5.5	530
5.6	565
5.7	602
5.8	641
5.9	681
6.0	723
6.1	767
6.2	813
6.3	861
6.4	911
6.5	962
6.6	1016
6.7	1072
6.8	1131
6.9	1191
7.0	1254
7.1	1319
7.2	1386
7.3	1456
7.4	1529

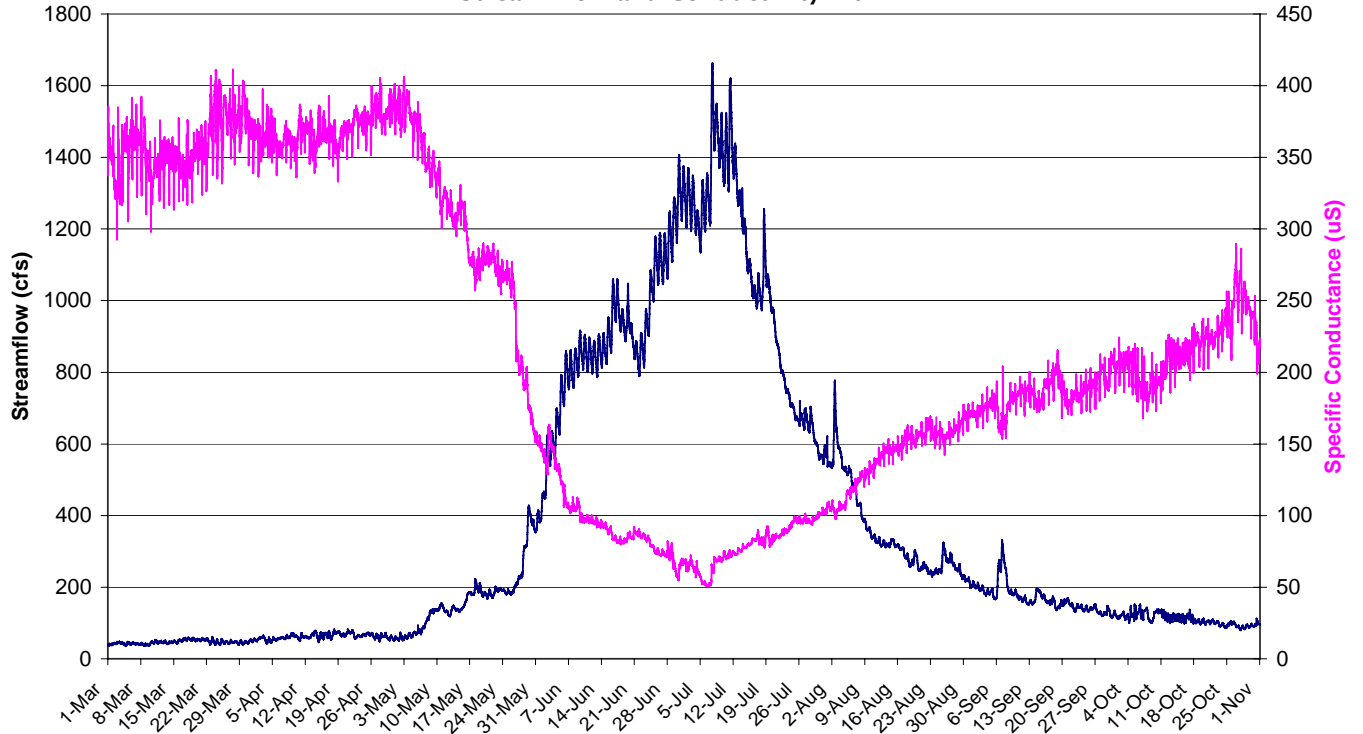
Streamgage sponsored by the Upper Clear Creek Watershed Association

Operated by:

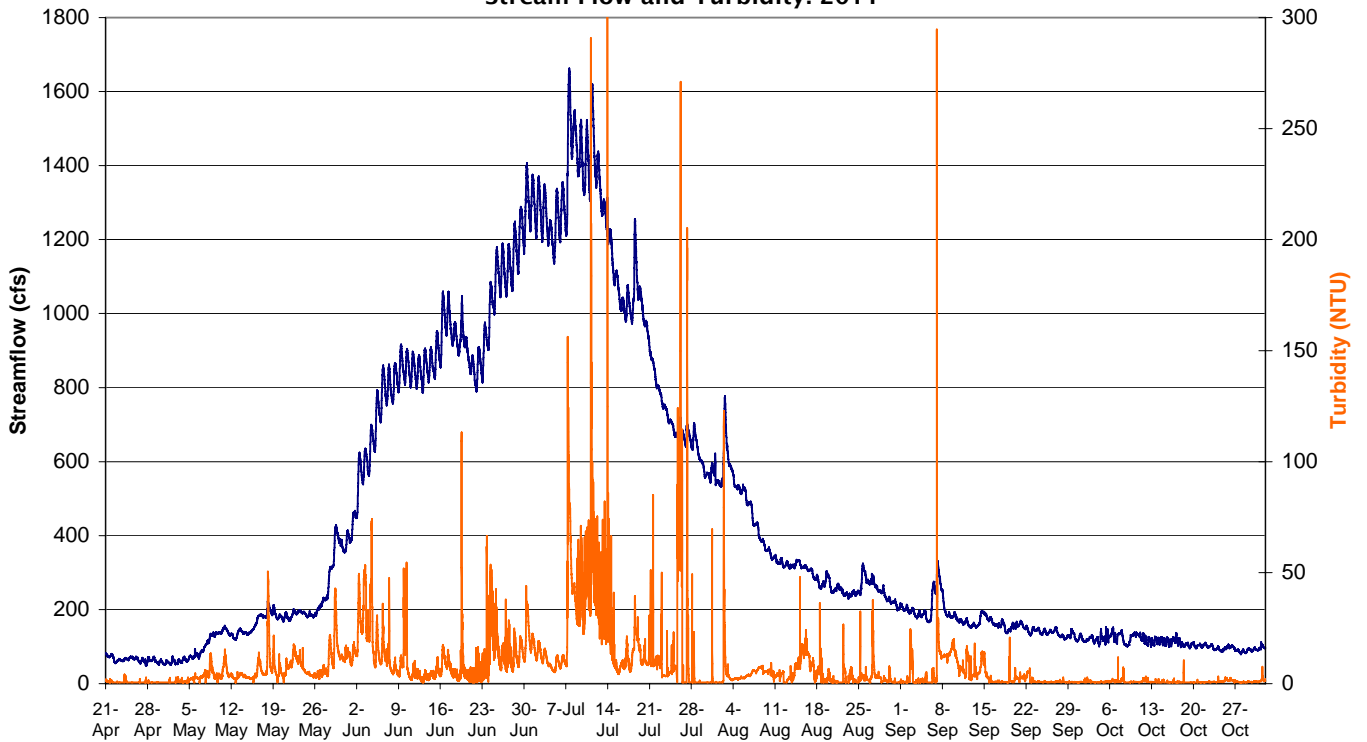


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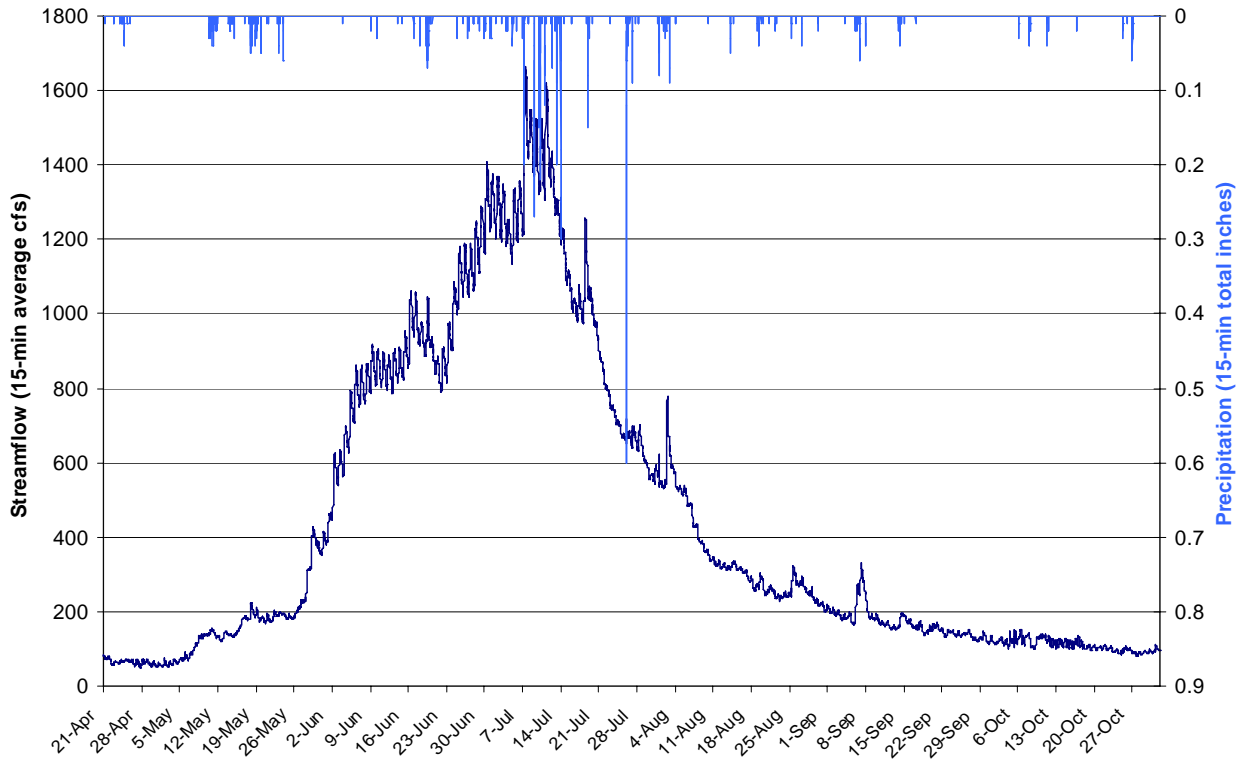
**Clear Creek at Kermitts (CC-40)
Stream Flow and Conductivity: 2011**



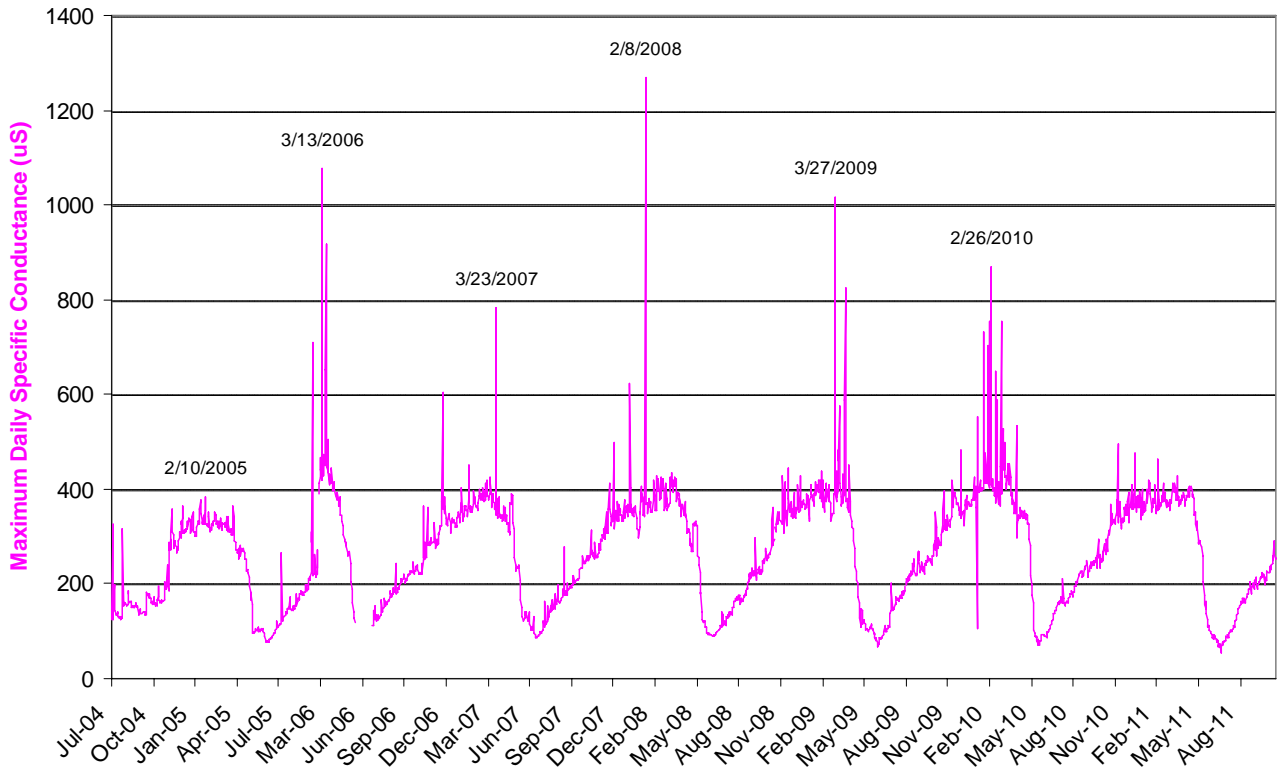
**Clear Creek at Kermitts (CC-40)
Stream Flow and Turbidity: 2011**



Clear Creek at Kermitts (CC-40)
Stream Flow and Precipitation: 2011



Clear Creek at Kermitts (CC-4) Maximum Specific Conductance
July 2004 to October 2011



DAILY RAINFALL RECORDS (inches)
CLEAR CREEK STATION CC-4 (above Johnson Gu)
 Lat 39 44' 46.27" N Long 105 26' 9.19" W Elev. 7220 ft-MSL
 YEARS: 2010, 2011, 2012

DATE	2010						2011						2012					
	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT
1	NA	0.00	0.07	0.28	0.00	0.00	0.00	0.00	0.12	0.14	0.00	0.00						
2	NA	0.00	0.07	0.32	0.00	0.00	0.00	0.00	0.01	0.18	0.00	0.00						
3	NA	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.01	0.17	0.00	0.00						
4	NA	0.00	0.26	0.00	0.00	0.00	0.00	0.01	0.06	0.02	0.01	0.00						
5	NA	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00						
6	NA	0.01	0.17	0.02	0.00	0.10	0.00	0.00	0.02	0.00	0.10	0.05						
7	NA	0.00	0.20	0.00	0.00	0.01	0.00	0.02	0.64	0.00	0.26	0.00						
8	0.16	0.00	0.12	0.24	0.30	0.01	0.00	0.00	0.02	0.00	0.06	0.35						
9	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.02	0.38	0.00	0.00	0.00						
10	0.00	0.01	0.00	0.00	0.00	0.10	0.00	0.03	0.55	0.01	0.00	0.00						
11	0.15	0.97	0.01	0.00	0.00	0.00	0.83	0.00	0.48	0.00	0.00	0.06						
12	0.25	0.35	0.00	0.00	0.00	0.46	0.00	0.00	0.04	0.00	0.00	0.02						
13	0.41	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00						
14	0.45	0.10	0.04	0.00	0.00	0.00	0.13	0.01	0.84	0.11	0.35	0.00						
15	0.01	0.00	0.00	0.00	0.00	0.00	0.12	0.01	0.01	0.01	0.02	0.00						
16	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00						
17	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.00	0.01	0.02						
18	0.03	0.00	0.01	0.00	0.00	0.05	0.67	0.04	0.00	0.00	0.00	0.00						
19	0.00	0.01	0.01	0.03	0.00	0.00	0.47	0.10	0.31	0.22	0.00	0.00						
20	0.00	0.01	0.23	0.00	0.00	0.00	0.07	0.90	0.01	0.02	0.00	0.00						
21	0.00	0.00	0.00	0.00	0.02	0.01	0.03	0.01	0.00	0.01	0.00	0.00						
22	0.00	0.00	0.00	0.00	0.05	0.61	0.00	0.00	0.00	0.04	0.00	0.00						
23	0.00	0.01	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.01	0.00	0.00						
24	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.02	0.00	0.00	0.00						
25	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.03	0.00	0.09	0.00	0.17						
26	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.94	0.01	0.00	0.01						
27	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.06	0.24	0.05	0.00	0.79						
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.00	0.00	0.00						
29	0.30	0.00	0.14	0.01	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00						
30	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.15	0.00	0.04	0.00	0.00						
31	0.01		0.01	0.00		0.01	0.00		0.00	0.00		0.00						
TOTAL	1.77	2.18	1.59	1.53	0.37	1.46	2.63	1.55	5.42	1.13	0.81	1.47	0.00	0.00	0.00	0.00	0.00	0.00
RainDays	16	10	15	11	3	10	10	17	23	16	7	8	0	0	0	0	0	1
MAX	0.45	0.97	0.26	0.46	0.30	0.61	0.83	0.90	0.94	0.22	0.35	0.79	0.00	0.00	0.00	0.00	0.00	0.00
X-2D	0.86	1.32	0.38	0.70	0.30	0.62	1.14	1.00	1.39	0.35	0.37	0.80	0.00	0.00	0.00	0.00	0.00	1.11
X-3D	1.11	1.95	0.49	0.70	0.30	0.62	1.21	1.04	1.43	0.49	0.42	0.97	0.00	0.00	0.00	0.00	0.00	31.00
DryDays	15	20	16	20	27	21	21	13	8	15	23	23	0	0	0	0	0	-1
NA No data collected at raingauge / Not available																		
* Rain gauge not present																		
0 No rainfall																		