

# Data Transmittal Report

CLEAR CREEK CONSULTANTS



**To:** Upper Clear Creek Watershed Association (UCCWA)  
**CC:**  
**From:** Mike Crouse  
**Date:** 14-February-2011  
**Re:** Stream Gaging Report 2010 – Clear Creek at Kermitts (Station CC-40)

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Clear Creek Consultants (CCC) has been retained by UCCWA to operate and maintain the stream 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 2009 to October 2010.

## 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).

Five direct current meter discharge measurements were taken in 2010 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 revised for 2010 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. A rating table was also posted at the gage for rafters and other water users to gain 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 CC-40.

## 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 2010 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 2009 to October 2010 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 30 to 40 cfs at CC-40. Mean daily flows were below average in May 2010, followed by a rapid increase in June to above normal flows. Maximum mean daily June flows were above the long-term average. The peak instantaneous flow was 1,335 cfs on June 12, 2010, compared to 1,013 cfs in June 2009. Flows were below normal in July 2010 with an increase to above normal flows on August 3 resulting from a series of storm-runoff events. Flows remained near normal from mid-August through October 2010.

Data graphs for 2010 specific conductance, temperature, and turbidity at CC-40 are attached. Daily precipitation data summary for the 2010 monitoring period is also tabulated.

**CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS**

**WY 2010**

**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 2009 TO SEPTEMBER 2010**

**MEAN DAILY VALUES**

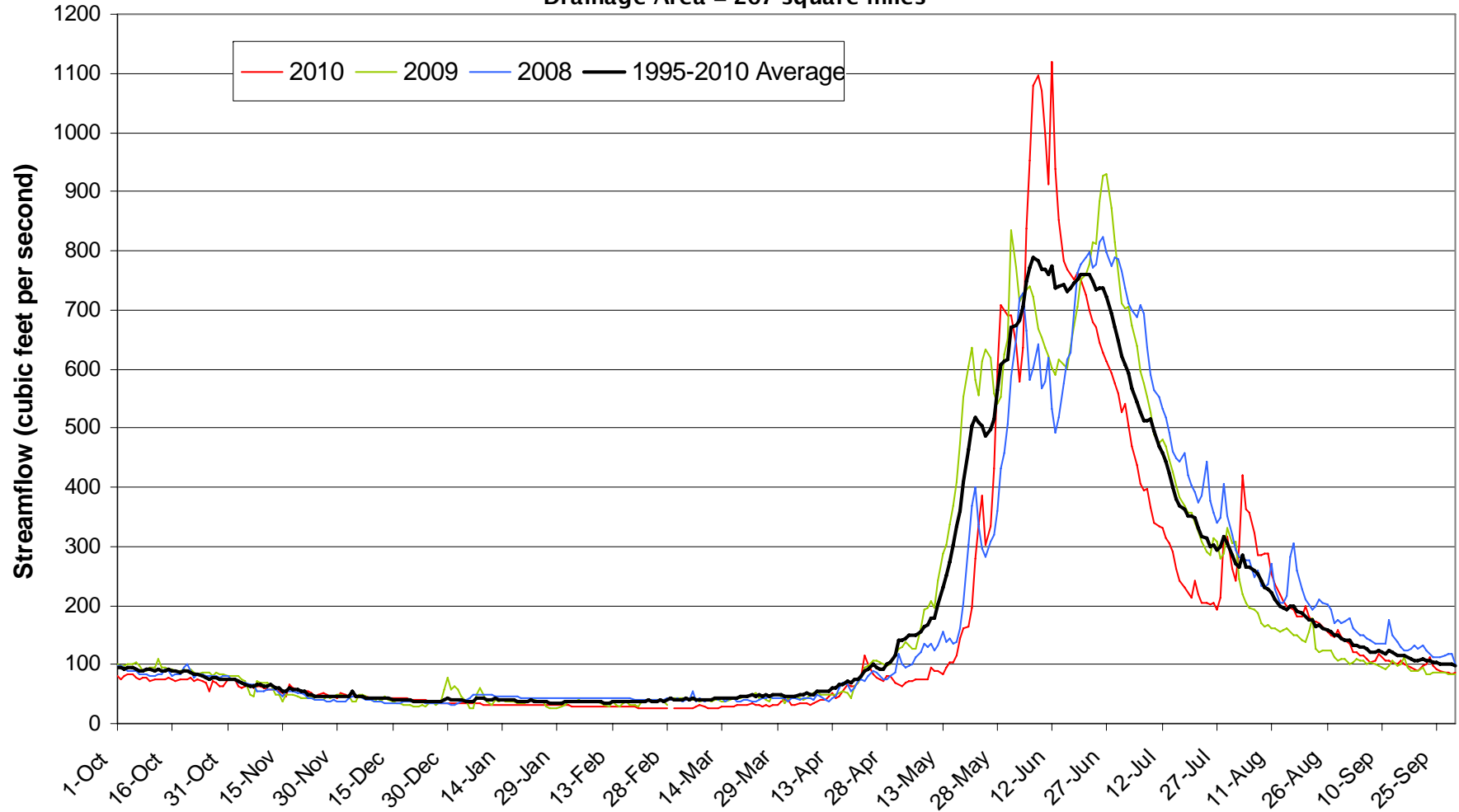
DAY	2009 OCT	2009 NOV	2009 DEC	2010 JAN	2010 FEB	2010 MAR	2010 APR	2010 MAY	2010 JUN	2010 JUL	2010 AUG	2010 SEP
1	79.4	75.3	52.0 e	35.4 e	30.8 e	25.0 e	39.0	67.3	692	528	241	135
2	76.0	74.1	48.0 e	35.3 e	29.9 e	25.8 e	31.2	64.3	641	540	299	121
3	80.2	64.7	47.0 e	35.3 e	29.8 e	25.7 e	30.9	70.1	578	503	420	121
4	83.2	61.8	46.9 e	35.2 e	29.8 e	25.7 e	33.6	71.5	637	470	361	116
5	84.7	64.2	46.8 e	35.1 e	29.7 e	25.6 e	34.2	72.6	838	439	356	114
6	77.1	64.9	46.7 e	35.1 e	29.7 e	27.2 e	35.4	75.8	952	407	323	109
7	74.5	61.4	44.7 e	35.0 e	28.7 e	28.0 e	32.2	75.7	1078	394	286	103
8	78.3	62.2	44.6 e	34.0 e	27.8 e	30.4 e	35.4	75.6	1095	396	284	108
9	77.7	63.4	44.6 e	33.0 e	27.8 e	27.9 e	38.7	76.1	1069	366	289	118
10	73.3	59.5	44.5 e	33.0 e	27.7 e	27.0 e	39.6	93.7	998	339	289	112
11	76.1	56.9	44.4 e	32.9 e	27.6 e	26.1 e	41.2	88.2	911	335	252	107
12	74.0	58.7	44.3 e	32.9 e	28.5 e	26.1 e	46.6	89.2	1121	330	236	106
13	74.3	57.3	44.3 e	32.8 e	28.4 e	26.8 e	51.9	84.1	938	314	220	102
14	75.2	55.9	44.2 e	32.8 e	28.3 e	29.2 e	42.5	94.6	853	306	206	100
15	77.6	52.1	44.1 e	32.7 e	28.3 e	27.5 e	46.8	104	782	291	199	105
16	75.1	46.7	44.0 e	31.7 e	28.2 e	27.5 e	54.3	103	769	262	195	99.4
17	73.3	66.0	44.0 e	31.7 e	28.2 e	29.8 e	67.3	115	761	242	193	97.3
18	75.2	59.8	42.9 e	31.6 e	28.1 e	32.2 e	64.0	144	750	231	181	94.7
19	74.8	56.5	41.9 e	31.6 e	28.1 e	31.3 e	64.2	161	762	221	182	91.3
20	75.4	53.0 e	40.9 e	32.4 e	27.2 e	31.3 e	69.1	165	750	212	199	89.4
21	79.1	53.9 e	40.8 e	32.3 e	27.1 e	31.2 e	80.7	196	725	241	180	96.9
22	72.6	53.8 e	40.7 e	32.3 e	27.1 e	35.4	116	279	700	218	174	99.4
23	74.3	51.7 e	39.7 e	31.3 e	27.0 e	32.6	99.4	337	680	205	171	111
24	71.9	44.7 e	39.7 e	31.3 e	27.0 e	31.8	83.8	387	670	205	168	99.3
25	69.2	48.6 e	37.7 e	31.2 e	26.1 e	28.9	76.7	301	644	202	163	93.4
26	54.6	52.5 e	37.6 e	31.2 e	26.0 e	30.8	74.5	333	628	205	156	89.0
27	71.6	49.4 e	36.6 e	31.1 e	26.0 e	30.1	73.3	431	614	191	150	86.6
28	68.1	46.4 e	34.7 e	31.9 e	25.9 e	30.4	80.4	596	593	212	148	85.2
29	63.9	46.3 e	34.6 e	31.9 e		32.3	80.8	708	576	318	158	84.8
30	64.0	42.3 e	34.6 e	32.7 e		37.0	69.2	698	557	317	146	86.3
31	75.7		34.5 e	31.8 e		39.4		690		263	140	
TOTAL	2300	1704	1312 e	1018 e	785 e	916	1733	6847	23363	9704	6967	3083
MEAN	74	57	42 e	33 e	28 e	30	58	221	779	313	225	103
MAX	85	75	52 e	35 e	31 e	39	116	708	1121	540	420	135
MIN	55	42	35 e	31 e	26 e	25	31	64	557	191	140	85
AC-FT	4,562	3,380	2,603 e	2,020 e	1,556 e	1,817	3,437	13,581	46,340	19,247	13,820	6,115

**INSTANTANEOUS MEASUREMENTS**

MAX FLOW	93.5					45.1	126	815	1,335	560	494	143
DATE	11-Oct					30-Mar	22-Apr	29-May	12-Jun	2-Jul	3-Aug	1-Sep
MIN FLOW	45.8					23.7	23.5	55.5	526	183	137	79.9
DATE	26-Oct					25-Mar	3-Apr	2-May	30-Jun	27-Jul	31-Aug	28-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-4)**  
Drainage Area = 267 square miles



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

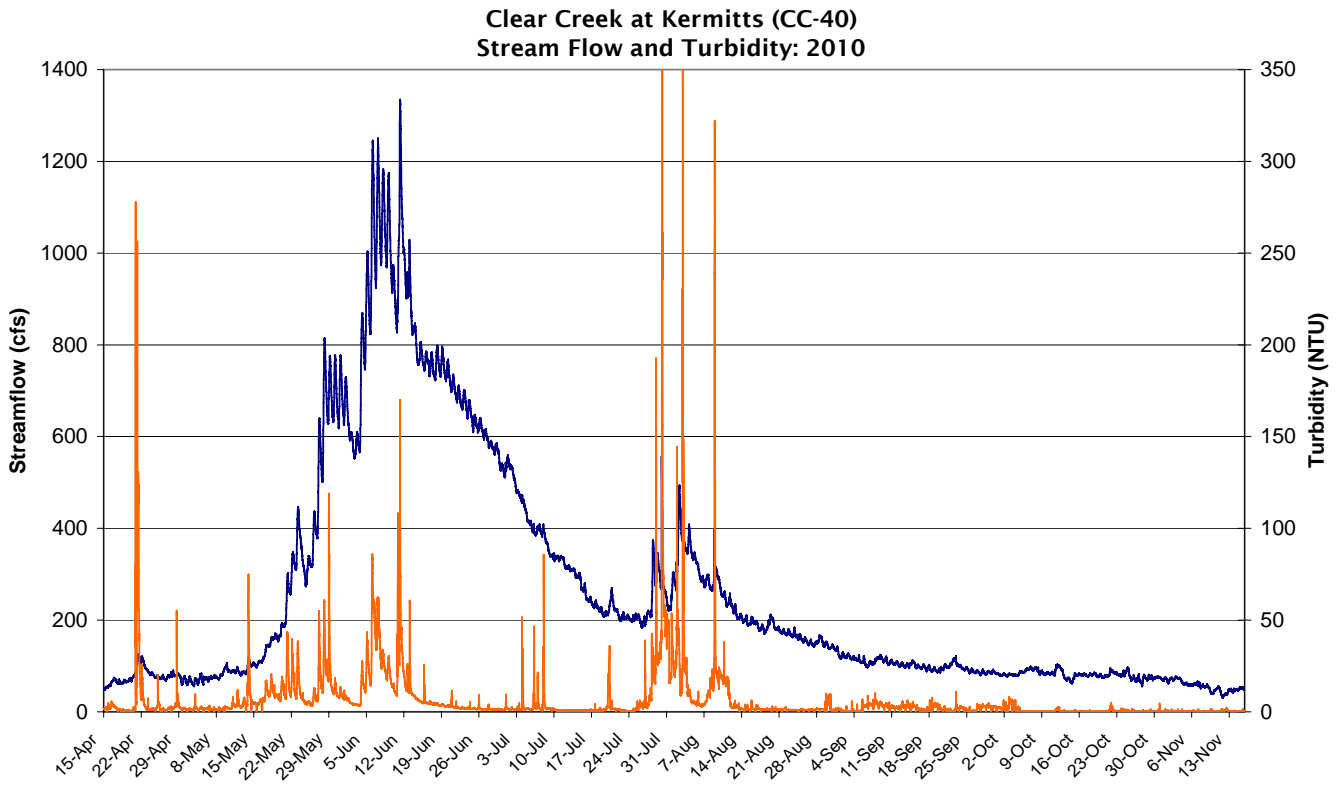
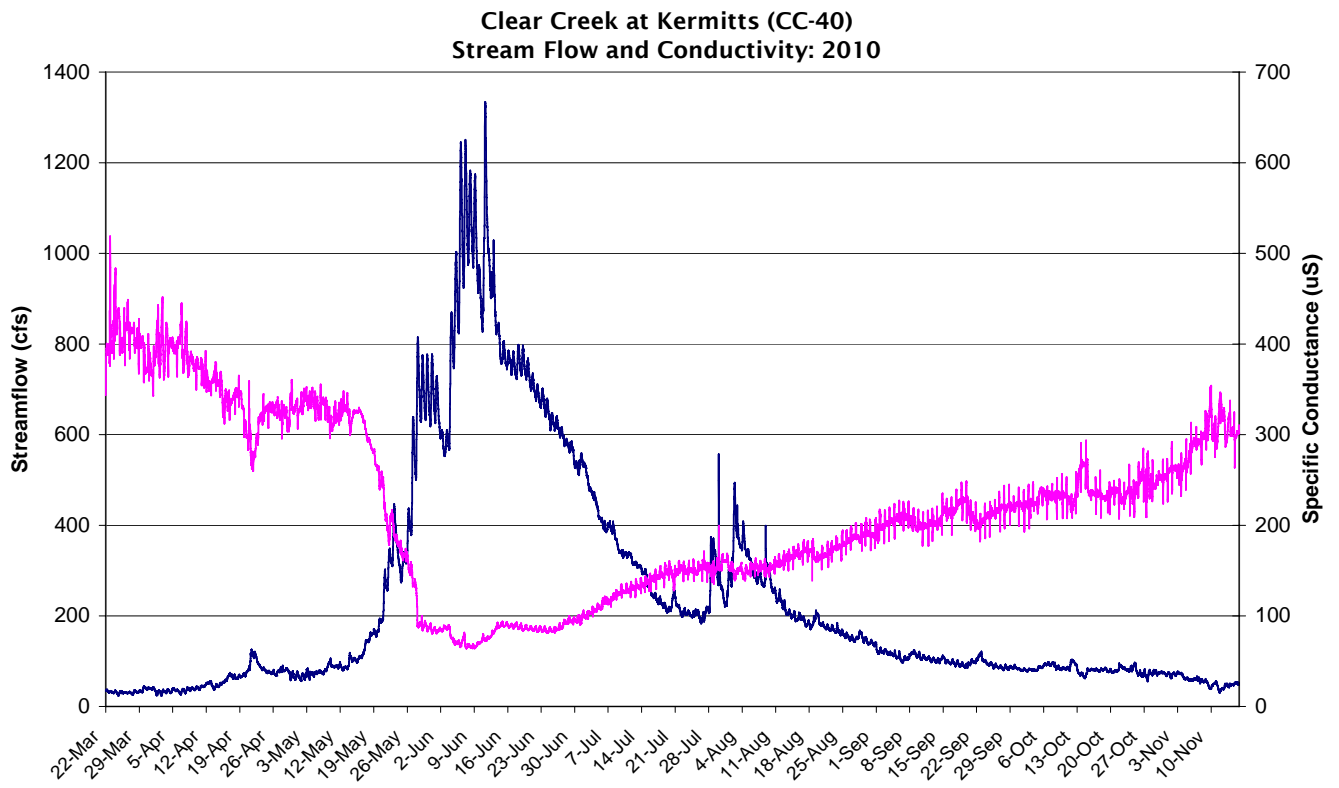
STAFF GAGE HEIGHT (feet)	STREAMFLOW (cubic feet per second)
3.4	24
3.5	32
3.6	43
3.7	57
3.8	74
3.9	88
4.0	104
4.1	122
4.2	143
4.3	168
4.4	195
4.5	227
4.6	262
4.7	303
4.8	326
4.9	351
5.0	377
5.1	405
5.2	434
5.3	465
5.4	497
5.5	530
5.6	565
5.7	602
5.8	641
5.9	681
6.0	723
6.1	767
6.2	813
6.3	861
6.4	911
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

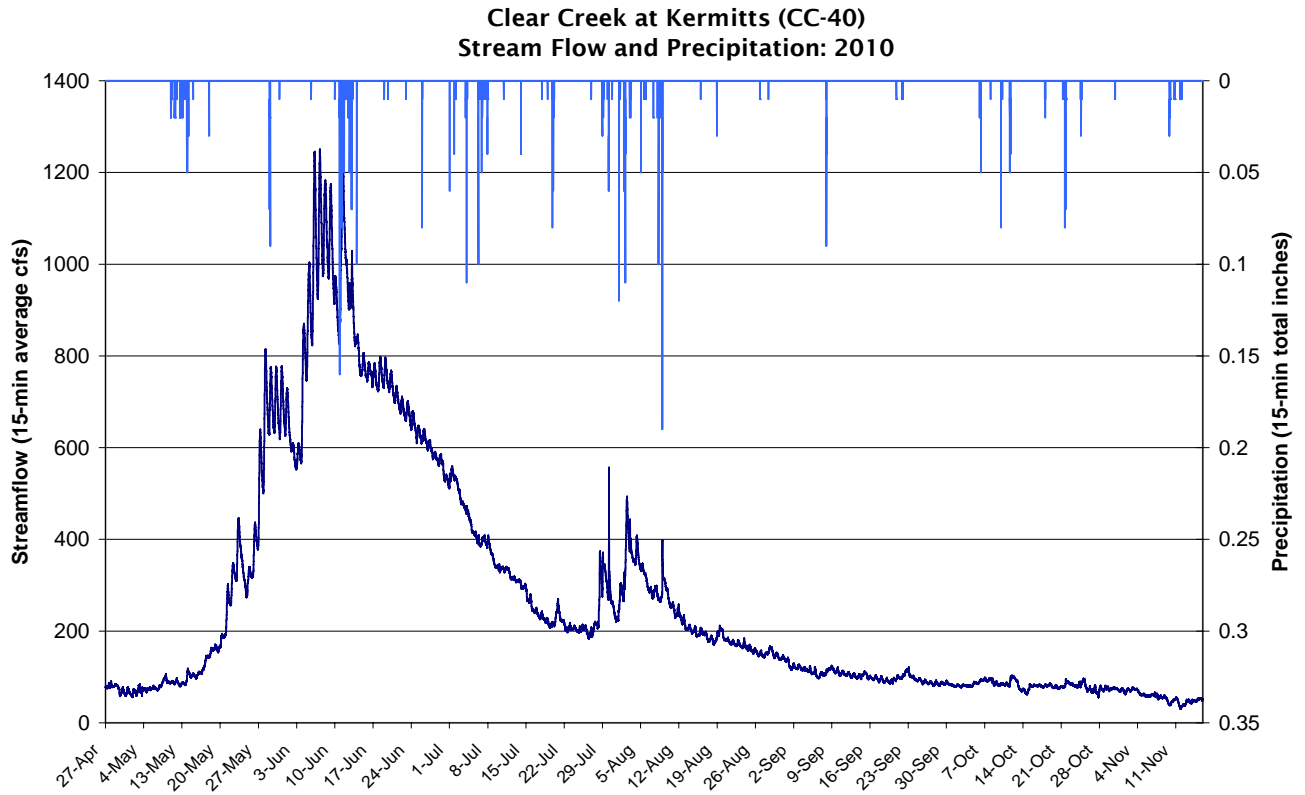
Streamgage sponsored by the Upper Clear Creek Watershed Association

Operated by:

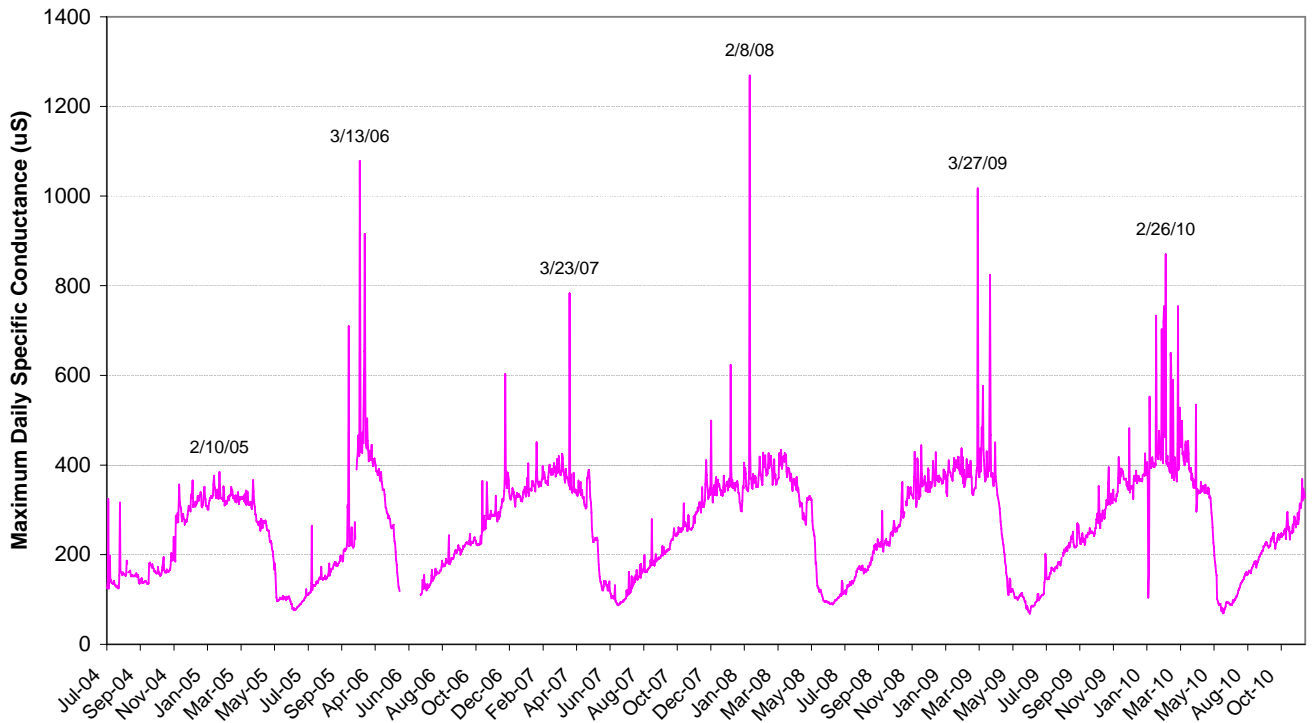


*Clear Creek Consultants*





### Clear Creek at Kermitts (CC-4) Maximum Specific Conductance July 2004 to November 2010



**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: 2007, 2008, 2009

DATE	2007					2008					2009				
	JUN	JUL	AUG	SEP	OCT	JUN	JUL	AUG	SEP	OCT	JUN	JUL	AUG	SEP	OCT
1	NA	NA	0.59	0.02	0.00	NA	0.00	0.01	0.00	0.00	0.13	0.01	0.00	0.00	0.00
2	NA	NA	0.03	0.03	0.00	NA	0.02	0.00	0.00	0.27	0.13	0.06	0.00	0.00	0.00
3	NA	NA	0.11	0.01	0.00	NA	0.00	0.02	0.00	0.00	0.02	0.02	0.00	0.01	0.00
4	NA	NA	0.01	0.00	0.00	NA	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04
5	NA	NA	0.00	0.00	0.00	NA	0.02	0.00	0.00	0.12	0.00	0.02	0.01	0.00	0.03
6	NA	NA	0.00	0.00	0.00	NA	0.26	0.04	0.00	0.00	0.00	0.00	0.02	0.01	0.00
7	NA	NA	0.02	0.02	0.00	NA	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.13	0.00
8	NA	NA	0.01	0.00	0.00	NA	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
9	NA	NA	0.14	0.00	0.01	NA	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.00	0.02
10	NA	NA	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.02	0.09	0.00	0.01	0.02	0.00
11	NA	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.62	0.09	0.24	0.01	0.00	0.00	0.00
12	NA	0.01	0.27	0.02	0.00	0.00	0.00	0.00	0.40	0.52	0.00	0.36	0.00	0.26	0.01
13	NA	0.03	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.07	0.01	0.28	0.00	0.20	0.00
14	NA	0.13	0.40	0.04	0.60	0.00	0.00	0.06	0.02	0.00	0.31	0.00	0.00	0.00	0.01
15	NA	0.02	0.06	0.00	0.01	0.00	0.00	0.57	0.00	0.00	0.01	0.00	0.00	0.00	0.01
16	NA	0.00	0.02	0.00	0.00	0.00	0.00	0.94	0.02	0.00	0.00	0.00	0.00	0.00	0.00
17	NA	0.01	0.00	0.00	0.00	0.00	0.06	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00
18	NA	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.06	0.00	0.00
19	NA	0.13	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.07	0.00	0.00	0.00
20	NA	0.00	0.02	0.00	0.05	0.00	0.00	0.00	0.04	0.13	0.12	0.02	0.00	0.00	0.03
21	NA	0.02	0.36	0.20	0.07	0.00	0.00	0.00	0.00	0.05	0.22	0.00	0.00	0.33	0.20
22	NA	0.00	0.00	0.00	0.13	0.00	0.18	0.00	0.00	0.12	0.00	0.00	0.00	0.27	0.00
23	NA	0.00	0.00	0.00	0.00	0.00	0.31	0.05	0.00	0.00	0.28	0.00	0.00	0.06	0.00
24	NA	0.00	0.22	0.20	0.00	0.12	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.00
25	NA	0.06	0.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.08	0.01	0.00	0.01	0.01
26	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.44	0.05	0.00	0.02
27	NA	0.01	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.03
28	NA	0.00	0.03	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.01
29	NA	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.01
30	NA	0.28	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.12	0.02	0.00	0.38
31		0.26	0.02		0.07		0.00	0.22		0.00		0.04	0.00		0.00
<b>TOTAL</b>	NA	<b>1.01</b>	<b>2.64</b>	<b>0.59</b>	<b>1.38</b>	<b>0.17</b>	<b>1.12</b>	<b>2.33</b>	<b>1.16</b>	<b>1.40</b>	<b>1.93</b>	<b>2.02</b>	<b>0.17</b>	<b>1.36</b>	<b>0.81</b>
<b>RainDays</b>	NA	NA	18	10	8	NA	11	15	8	10	16	16	6	11	14
<b>MAX</b>	NA	0.28	0.59	0.20	0.60	0.12	0.31	0.94	0.62	0.52	0.31	0.44	0.06	0.33	0.38
<b>X-2D</b>	NA	0.54	0.62	0.20	1.04	0.17	0.49	1.51	1.02	0.61	0.34	0.65	0.06	0.60	0.39
<b>X-3D</b>	NA	0.55	0.73	0.20	1.05	0.17	0.51	1.60	1.02	0.68	0.50	0.67	0.06	0.66	0.40
<b>DryDays</b>	NA	NA	13	20	23	NA	20	16	22	21	14	15	25	19	17

NA No data collected at raingauge / Not available

\* Rain gauge not present

0 No rainfall