

Data Transmittal Report

CLEAR CREEK CONSULTANTS



To: Upper Clear Creek Watershed Association (UCCWA)
CC:
From: Mike Crouse
Date: 7-March-2014
Re: Stream Gaging Report 2013 – 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 the flow data since 2006. This report presents data collected at the gage from October 2012 to October 2013.

Data Collection Activities

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.

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.

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 2013 to maintain 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 2013 designated as Rating No. 8. 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.

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 2013 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.

Results

The gage was audited approximately monthly to check calibration against the gage reference points and make any necessary adjustments to maintain accuracy. Routine maintenance of the gage included removal of silt accumulated in the stilling well and instrument maintenance. The flow results are posted in real-time on the Clear Creek Watershed Foundation Web Site for rafters and other water users to obtain current stream flow conditions.

The CC-40 mean daily discharge results for October 2012 to October 2013 are presented in the attached table, along with the flow hydrograph of these data. The gage is not operated over the winter months (November-March) because the rating is not accurate during ice-cover conditions which occur each year at CC-40. Significant channel ice accumulation renders the flow rating useless during the winter. Therefore, winter flows were estimated based on Clear Creek flows at the Golden USGS gage (CC-60) adjusted using the average flow ratio for the estimated period.

Minimum Clear Creek flows occur in winter with maximum flows typically in June. Minimum flows ranged from 25 to 30 cfs at CC-40. Mean daily flows were below average in April and near average in May 2013. Peak snowmelt flows were above average in June while flow was below average in July and August 2013. Precipitation in September increased flows above normal for the remainder of 2013.

Data graphs for 2013 specific conductance, temperature, and turbidity at CC-40 are attached. Daily precipitation data summary for the 2006-2013 monitoring period is also tabulated.

CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS

WY 2013

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 2012 TO SEPTEMBER 2013

MEAN DAILY VALUES

DAY	2012 OCT	2012 NOV	2012 DEC	2013 JAN	2013 FEB	2013 MAR	2013 APR	2013 MAY	2013 JUN	2013 JUL	2013 AUG	2013 SEP	2013 OCT
1	86.4	55.9	44 e	32 e	31 e	31 e	35.4	109	368	469	198	183	304
2	85.5	49.9	40 e	32 e	29 e	31 e	40.4	80.9	408	442	189	177	289
3	83.8	44.7	41 e	35 e	31 e	31 e	38.1	72.6	520	424	180	166	277
4	78.4	46 e	36 e	33 e	31 e	31 e	41.7	81.1	633	414	180	168	283
5	77.9	48 e	35 e	31 e	32 e	30 e	40.4	78.7	747	399	183	163	266
6	76.0	49 e	36 e	32 e	31 e	32 e	43.8	76.9	862	389	174	166	257
7	67.6	48 e	37 e	30 e	29 e	33 e	40.8	81.6	837	374	162	163	262
8	69.0	46 e	37 e	30 e	30 e	30 e	37.1	97.2	887	387	159	151	273
9	67.7	48 e	32 e	31 e	29 e	30 e	41.0	117	973	357	178	181	261
10	63.1	48 e	25 e	32 e	29 e	30 e	33.2	108	1048	337	168	316	250
11	69.6	41 e	27 e	31 e	28 e	30 e	35.2	105	1084	325	153	348	234
12	73.3	30 e	27 e	28 e	27 e	30 e	36.8	117	1103	344	150	473	234
13	77.9	41 e	31 e	29 e	28 e	32 e	38.1	159	1055	351	146	941	226
14	78.8	46 e	32 e	29 e	28 e	34 e	38.4	223	1027	391	162	720	211
15	77.7	54 e	34 e	30 e	29 e	36 e	40.0	269	986	356	131	731	206
16	73.1	51 e	34 e	29 e	30 e	38 e	35.1	311	901	322	121	719	193
17	77.8	52 e	34 e	30 e	28 e	35 e	41.8	379	812	306	119	636	180
18	69.3	53 e	35 e	31 e	28 e	33 e	33.6	414	754	321	117	568	188
19	71.0	51 e	33 e	36 e	28 e	28.2	33.6	357	759	317	115	507	171
20	75.9	42 e	32 e	37 e	27 e	26.8	33.4	318	725	289	118	455	174
21	69.6	39 e	33 e	37 e	26 e	31.2	36.4	295	681	259	116	415	177
22	72.1	41 e	31 e	35 e	26 e	30.1	40.9	290	657	235	127	395	164
23	67.3	39 e	36 e	34 e	27 e	36.7	39.2	325	610	224	164	410	155
24	63.8	41 e	32 e	33 e	29 e	45.8	37.8	411	552	227	164	385	148
25	58.9	40 e	32 e	34 e	29 e	48.8	37.7	493	516	256	164	369	146
26	52.1	34 e	34 e	34 e	30 e	38.0	41.2	548	522	250	168	349	146
27	47.5	36 e	36 e	33 e	31 e	35.0	44.8	587	521	211	182	340	133
28	50.5	46 e	33 e	30 e	31 e	34.2	57.1	604	509	250	161	330	132
29	55.7	48 e	35 e	31 e		34.8	74.9	561	499	222	165	325	127
30	65.6	43 e	34 e	28 e		35.2	98.0	458	472	220	191	309	129
31	64.2		34 e	28 e		34.1		399		207	175		125
TOTAL	2167	1349 e	1049 e	984 e	815 e	1036	1266	8527	22026	9874	4879	11558	6319
MEAN	70	45 e	34 e	32 e	29 e	33	42	275	734	319	157	385	204
MAX	86	56 e	44 e	37 e	32 e	49	98	604	1103	469	198	941	304
MIN	47	30 e	25 e	28 e	26 e	27	33	73	368	207	115	151	125
AC-FT	4,298	2,676 e	2,080 e	1,952 e	1,616 e	2,055	2,512	16,913	43,689	19,585	9,677	22,925	12,534

INSTANTANEOUS MEASUREMENTS

MAX FLOW	153					111	668	1297	496	307	1063	311
DATE	5-Oct					30-Apr	27-May	12-Jun	1-Jul	26-Aug	13-Sep	1-Oct
MIN FLOW	79.3					25.6	60.4	346	195	112	140	115
DATE	28-Oct					10-Apr	3-May	1-Jun	31-Jul	18-Aug	8-Sep	31-Oct

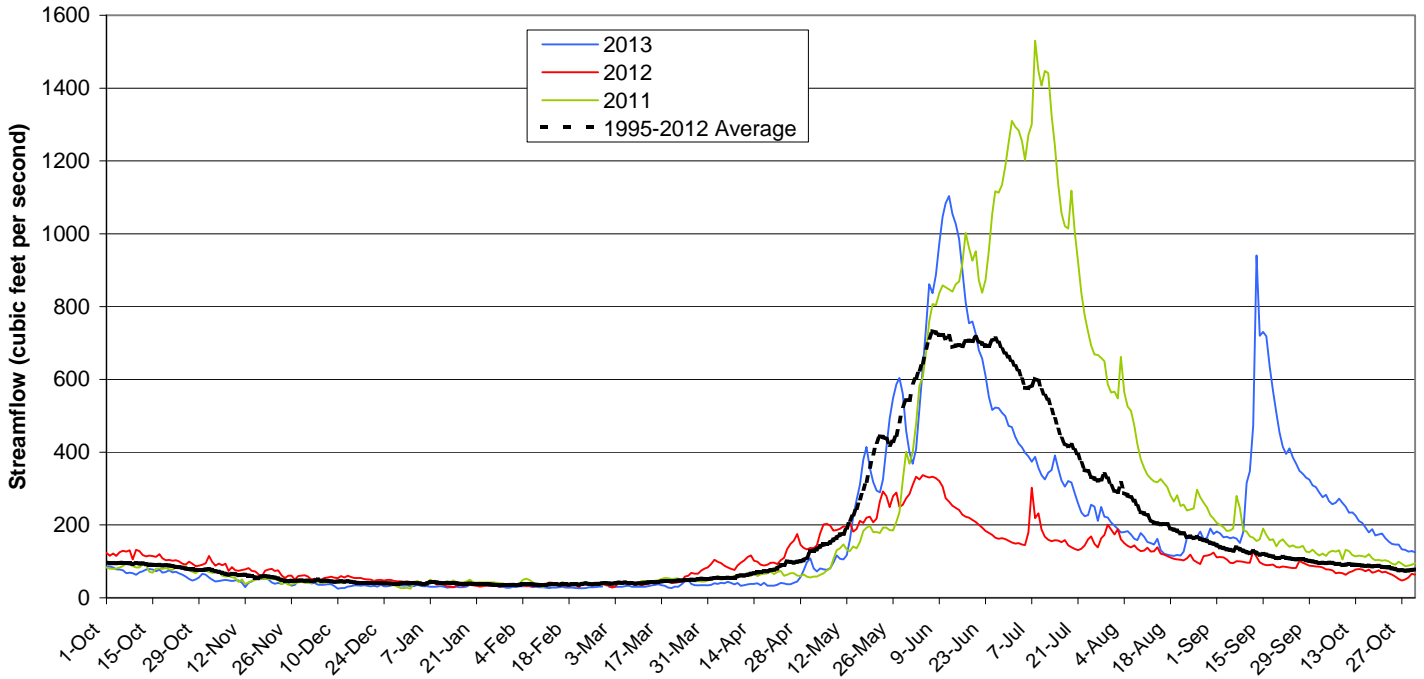
e = estimated during ice affected period using average ratio of CC-60 flow

P = provisional data subject to revision

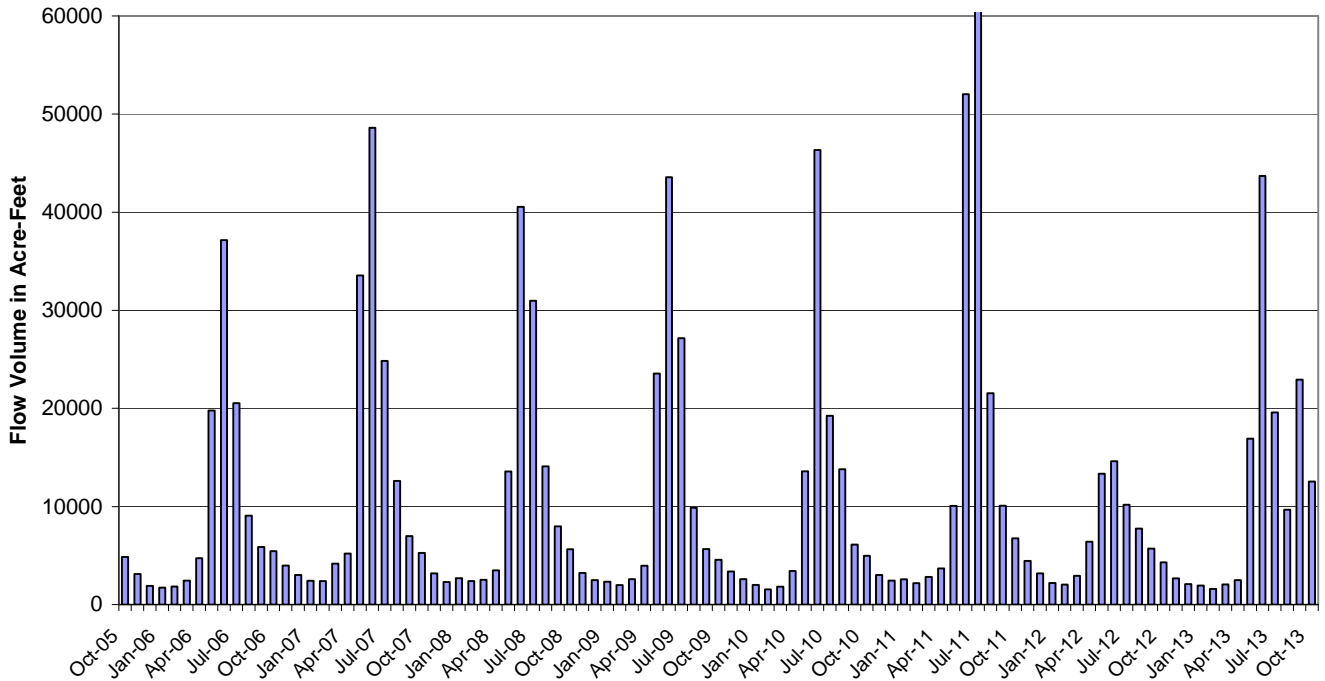


Clear Creek Consultants

**Clear Creek Mean Daily Streamflow by Water Year
above Johnson Gulch near Kermitts (CC-40)
Drainage Area = 267 square miles**



**Clear Creek above Johnson Gulch near Kermitts (Station CC-40)
Monthly Flow Volume: 2006-2013**



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

STAFF GAGE HEIGHT (feet)	STREAMFLOW (cubic feet per second)
3.3	24
3.4	33
3.5	43
3.6	57
3.7	77
3.8	90
3.9	105
4.0	121
4.1	140
4.2	161
4.3	184
4.4	210
4.5	239
4.6	271
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

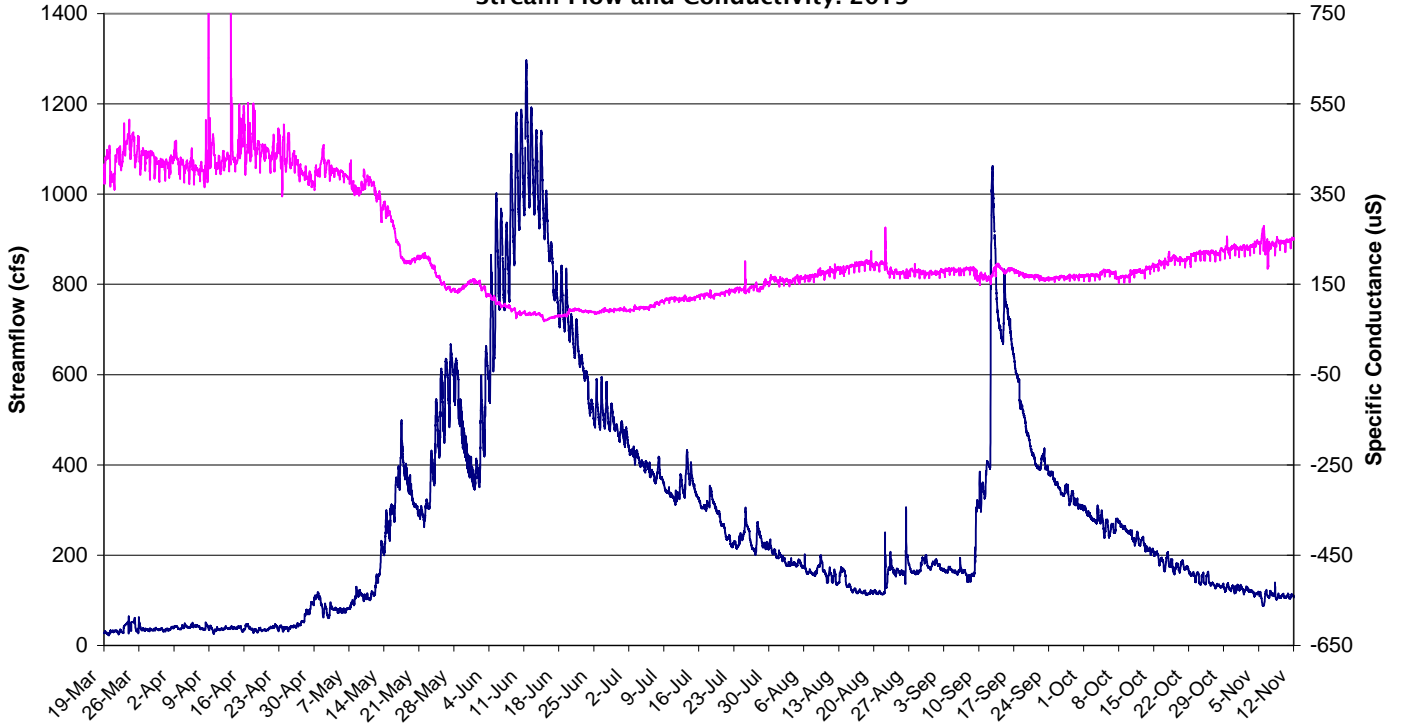
Streamgage sponsored by the Upper Clear Creek Watershed Association

Operated by:

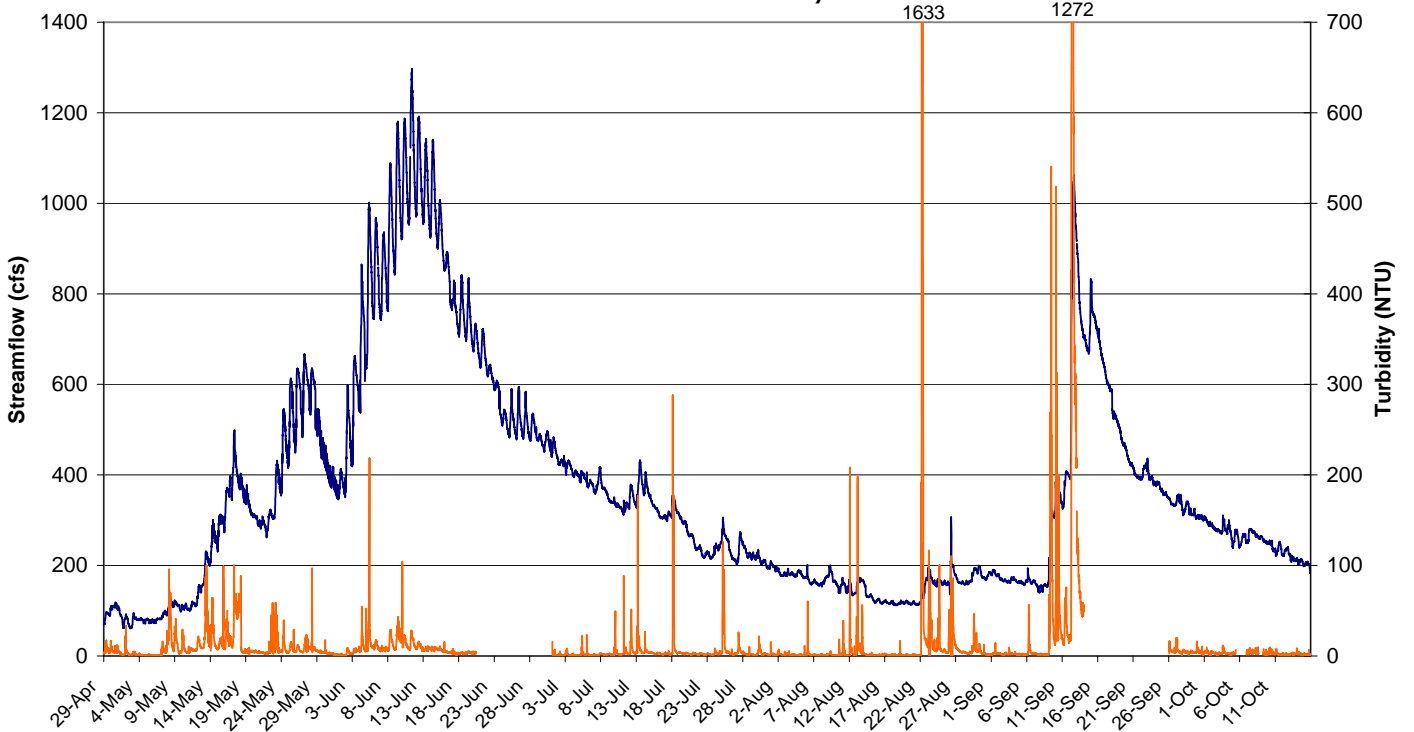


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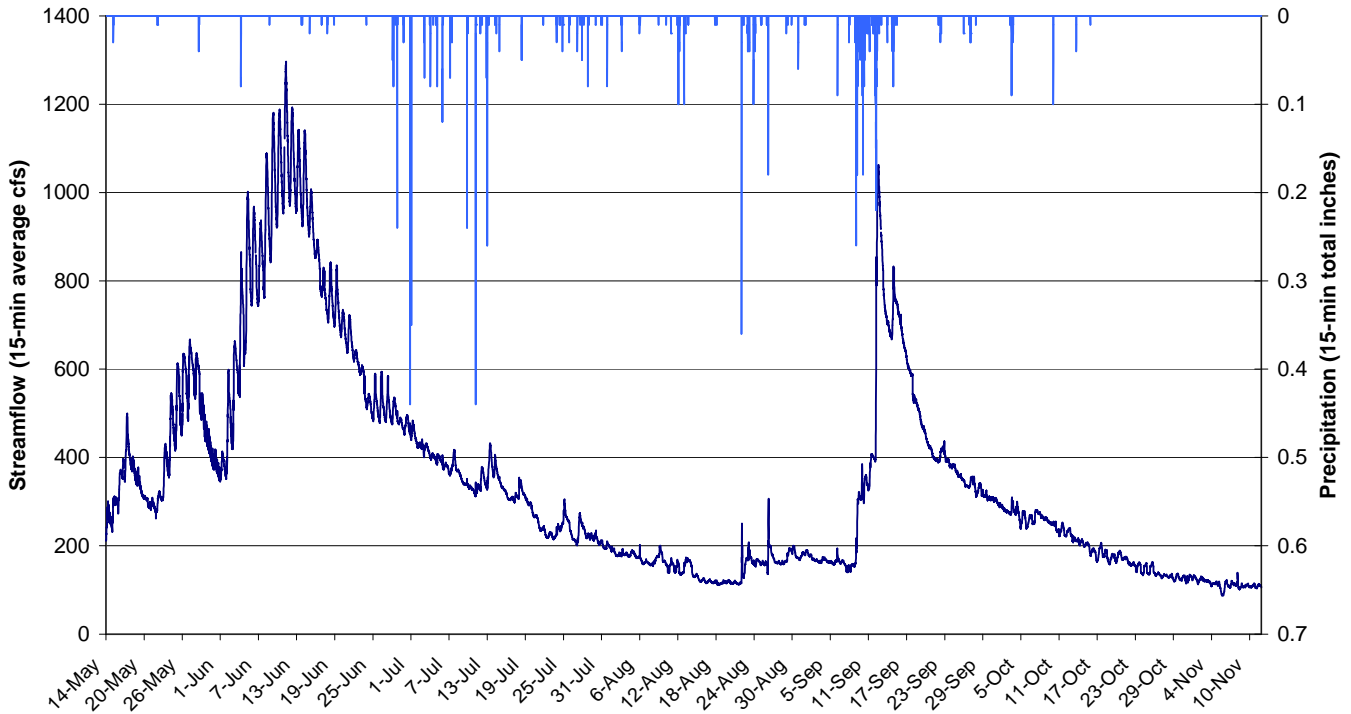
Clear Creek at Kermitts (CC-40)
Stream Flow and Conductivity: 2013



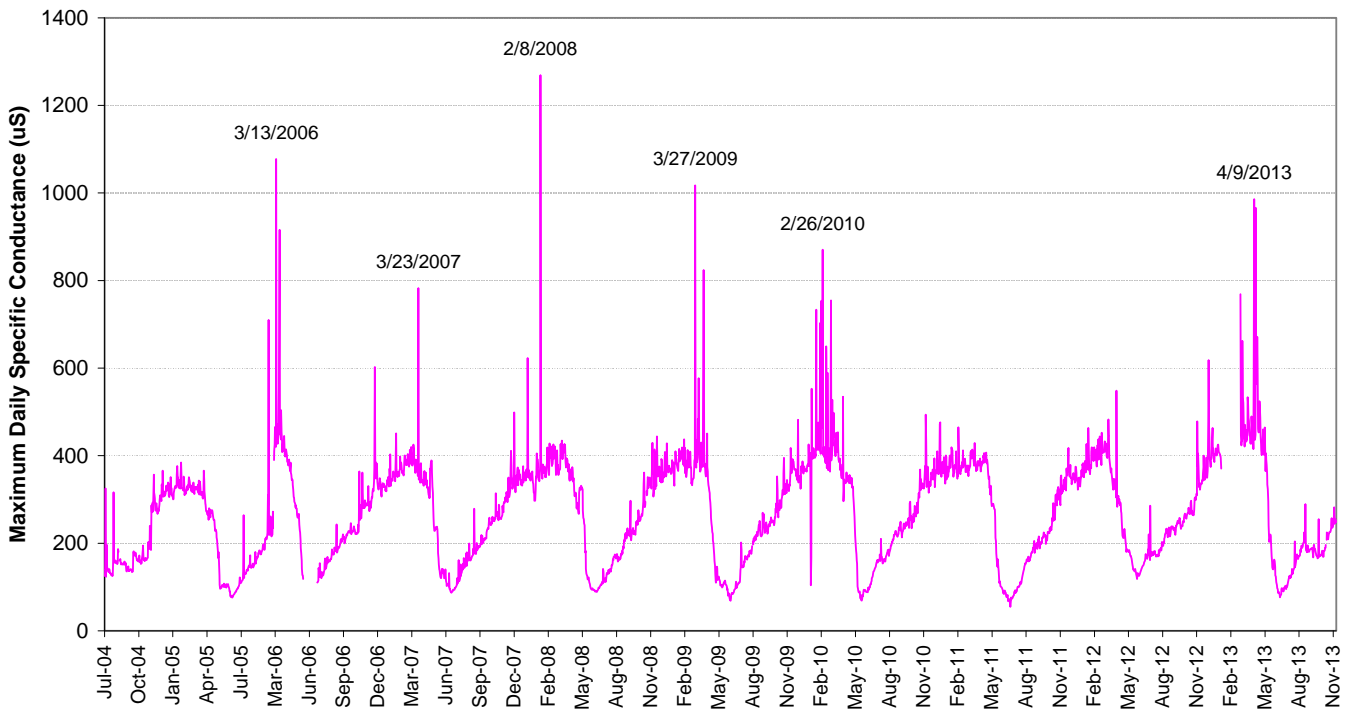
Clear Creek at Kermitts (CC-40)
Stream Flow and Turbidity: 2013



**Clear Creek at Kermitts (CC-40)
Stream Flow and Precipitation: 2013**



**Clear Creek at Kermitts (CC-4) Maximum Specific Conductance
July 2004 to November 2013**



DAILY RAINFALL RECORDS (inches)																		
CLEAR CREEK STATION CC-4 (above Johnson Gulch)																		
Lat 39 44' 46.27" N Long 105 26' 9.19" W Elev. 7220 ft-MSL																		
YEARS: 2013, 2014, 2015																		
DATE	2013						2014						2015					
	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT
1	NA	0.00	0.00	0.15	0.03	0.00												
2	NA	0.00	0.00	0.00	0.00	0.00												
3	NA	0.00	0.12	0.10	0.00	0.02												
4	NA	0.25	0.11	0.00	0.00	0.44												
5	NA	0.00	0.11	0.00	0.00	0.00												
6	NA	0.00	0.20	0.06	0.10	0.00												
7	NA	0.00	0.07	0.00	0.00	0.00												
8	NA	0.00	0.07	0.00	0.05	0.00												
9	NA	0.01	0.00	0.01	1.67	0.00												
10	NA	0.00	0.27	0.01	1.08	0.19												
11	NA	0.00	0.56	0.04	0.36	0.00												
12	NA	0.00	0.04	0.27	2.30	0.00												
13	NA	0.00	0.56	0.22	0.01	0.00												
14	0.00	0.02	0.02	0.01	0.06	0.08												
15	0.05	0.02	0.08	0.00	0.57	0.00												
16	0.00	0.00	0.00	0.00	0.00	0.03												
17	0.00	0.01	0.00	0.00	0.00	0.00												
18	0.00	0.03	0.00	0.03	0.00	0.00												
19	0.00	0.01	0.12	0.00	0.00	0.00												
20	0.00	0.00	0.00	0.00	0.00	0.00												
21	0.00	0.00	0.00	0.00	0.00	0.00												
22	0.03	0.00	0.01	0.52	0.12	0.00												
23	0.00	0.00	0.00	0.29	0.08	0.00												
24	0.00	0.01	0.08	0.27	0.00	0.00												
25	0.00	0.00	0.09	0.02	0.00	0.00												
26	0.00	0.00	0.04	0.33	0.04	0.00												
27	0.00	0.00	0.12	0.00	0.17	0.00												
28	0.02	0.17	0.09	0.00	0.01	0.00												
29	0.05	0.27	0.11	0.04	0.00	0.00												
30	0.00	0.04	0.03	0.01	0.00	0.00												
31	0.00		0.02	0.09		0.00												
TOTAL		0.84	2.92	2.47	6.65	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RainDays		11	22	18	15	5	0	0	0	0	0	0	0	0	0	0	0	0
MAX		0.27	0.56	0.52	2.30	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X-2D		0.44	0.83	0.81	2.75	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
X-3D		0.48	1.16	1.08	3.74	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.00
DryDays		19	9	13	15	26	0	0	0	0	0	0	0	0	0	0	0	0
NA No data collected at raingauge / Not available																		
* Rain gauge not present																		
0 No rainfall																		