Data Transmittal Report

CLEAR CREEK CONSULTANTS

To: Upper Clear Creek Watershed Association (UCCWA)

CC:

From: Mike Crouse

Date: 5-January-2015

Re: Stream Gaging Report 2014 – 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 streamflow 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 2013 to October 2014.

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. 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 2014 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 used in 2014 are 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 Access database program for the computation of discharge and archiving. Water quality parameter data is also maintained in the Access database for CC-40. This data is available upon request.

The 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 during ice-free periods 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 (www.clearcreekwater.org-flow.html).

The CC-40 mean daily discharge results for October 2013 to October 2014 are presented in the attached table, along with the flow hydrograph. 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. When possible, wintertime flows are 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 typically range from 25 to 40 cfs at CC-40. Mean daily flows were above average in April and near average in May 2014. Peak snowmelt flows were above average in June and flow remained above average in July 2014. Flow was near average from August to October 2014.

Data graphs for 2014 specific conductance, temperature, and turbidity at CC-40 are attached. Daily precipitation data summary for the 2006-2014 monitoring period is also tabulated.

CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS

WY 2014

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 2013 TO SEPTEMBER 2014

MEAN DAILY VALUES

DAY	2013 OCT	2013 NOV	2013 DEC	2014 JAN	2014 FEB	2014 MAR	2014 APR	2014 MAY	2014 JUN	2014 JUL	2014 AUG	2014 SEP	2014 OCT
1	304	129	79 e	NA	NA	47 e	63.1	149	1172	833	365	159	123
2	289	122	82 e	NA	NA	46 e	58.8	148	1230	802	325	149	122
3	277	122	74 e	NA	NA	45 e	64.6	150	1247	778	300	151	124
4	283	115	62 e	NA	NA	45 e	58.4	171	1296	797	286	144	118
5	266	114	NA	NA	NA	48 e	61.5	198	1254	788	310	191	114
6	257	100	NA	NA	NA	48 e	57.8	209	1172	737	291	172	112
7	262	112	NA	NA	NA	53 e	58.3	238	1148	704	271	153	101
8	273	113	NA	NA	NA	55 e	58.4	238	1158	717	249	146	100
9	261	107	NA	NA	NA	53 e	67.8	230	1015	689	235	157	109
10	250	109	NA	NA	NA	55 e	81.2	224	963	675	238	178	119
11	234	109	NA	NA	NA	58 e	94.6	245	967	668	232	162	108
12	234	110	NA	NA	NA	51 e	103	213 e	1012	648	209	155	102
13	226	99 e	NA	NA	NA	58 e	104	194	1048	619	200	148	102
14	211	100 e	NA	NA	NA	55 e	109	188	1084	581	234	143	95.5
15	206	95 e	NA	NA	NA	55 e	107	185	967	545	237	140	96.4
16	193	98 e	NA	NA	NA	53 e	98.4	184	891	537	204	137	90.6
17	180	92 e	NA	NA	NA	55 e	96.8	201	899	541	190	132	90.6
18	188	90 e	NA	NA	NA	53 e	98.3	237	923	483	179	132	88.8
19	171	95 e	NA	NA	NA	51.4	122	278	892	446	173	131	88.2
20	174	91 e	NA	NA	NA	50.3	144	307	881	419	170	129	88.1
21	177	93 e	NA	NA	NA	51.7	151	370	894	407	165	131	87.1
22	164	83 e	NA	NA	NA	51.9	168	441	855	377	168	144	90.6
23	155	94 e	NA	NA	NA	50.0	188	473	842	365	169	136	88.0
24	148	93 e	NA	NA	NA	52.3	196	599	846	345	160	128	90.0
25	146	93 e	NA	NA	49 e	52.0	191	716	848	333	155	122	89.2
26	146	87 e	NA	NA	48 e	55.5	204	654	850	333	170	115	87.6
27	133	83 e	NA	NA	48 e	60.0	207	681	834	336	220	112	87.1
28	132	83 e	NA	NA	47 e	61.1	183	794	842	318	170	112	80.2
29	127	84 e	NA	NA		59.0	173	925	805	313	170	124	84.6
30	129	81 e	NA	NA		60.3	161	1046	822	392	161	133	86.5
31	125		NA	NA		62.2		1098		433	157		84.7
TOTAL	6319	2997 e	NA	NA	NA	1652	3529	11982	29656	16961	6765	4268	3048
MEAN	204	100 e	NA	NA	NA	53	118	387	989	547	218	142	98
MAX	304	129 e	NA	NA	NA	62	207	1098	1296	833	365	191	124
MIN	125	81 e	NA	NA	NA	45	58	148	805	313	155	112	80
AC-FT	12,534	5,944 e	NA	NA	NA	3,276	7,001	23,766	58,822	33,642	13,418	8,466	6,046

INSTANTANEOUS MEASUREMENTS

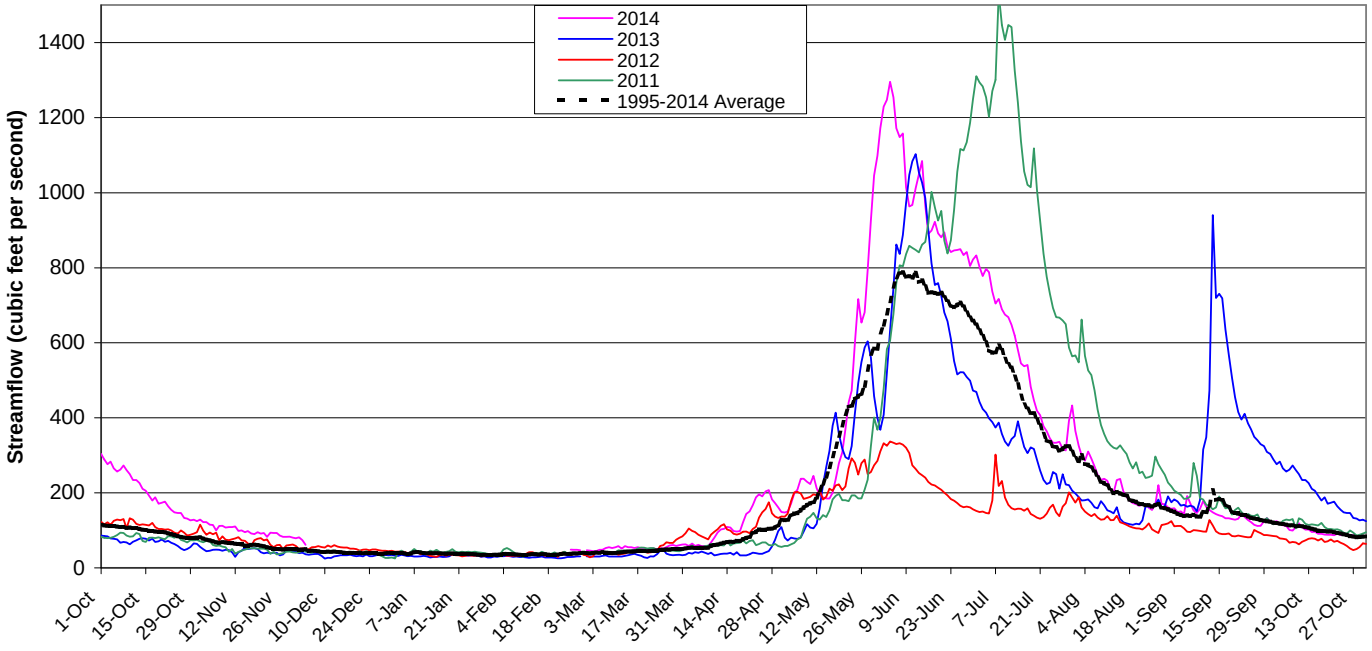
MAX FLOW	311	69.8	215	1227	1420	901	411	209	134
DATE	1-Oct	31-Mar	27-Apr	31-May	4-Jun	1-Jul	1-Aug	5-Sep	10-Oct
MIN FLOW	115	42.3	45.6	140	755	298	145	107	66.9
DATE	31-Oct	19-Mar	4-Apr	2-May	29-Jun	29-Jul	25-Aug	28-Sep	28-Oct

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

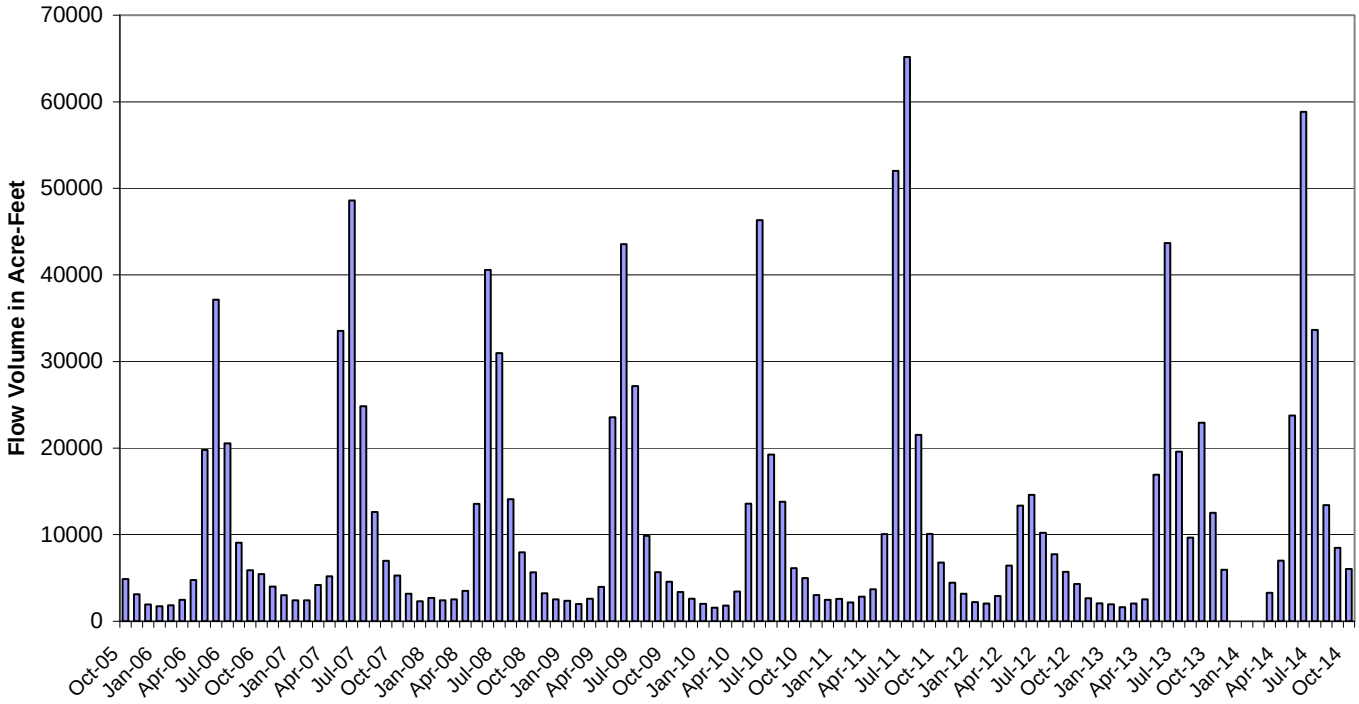
P = provisional data subject to revision NA = not available

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: 2006-2014

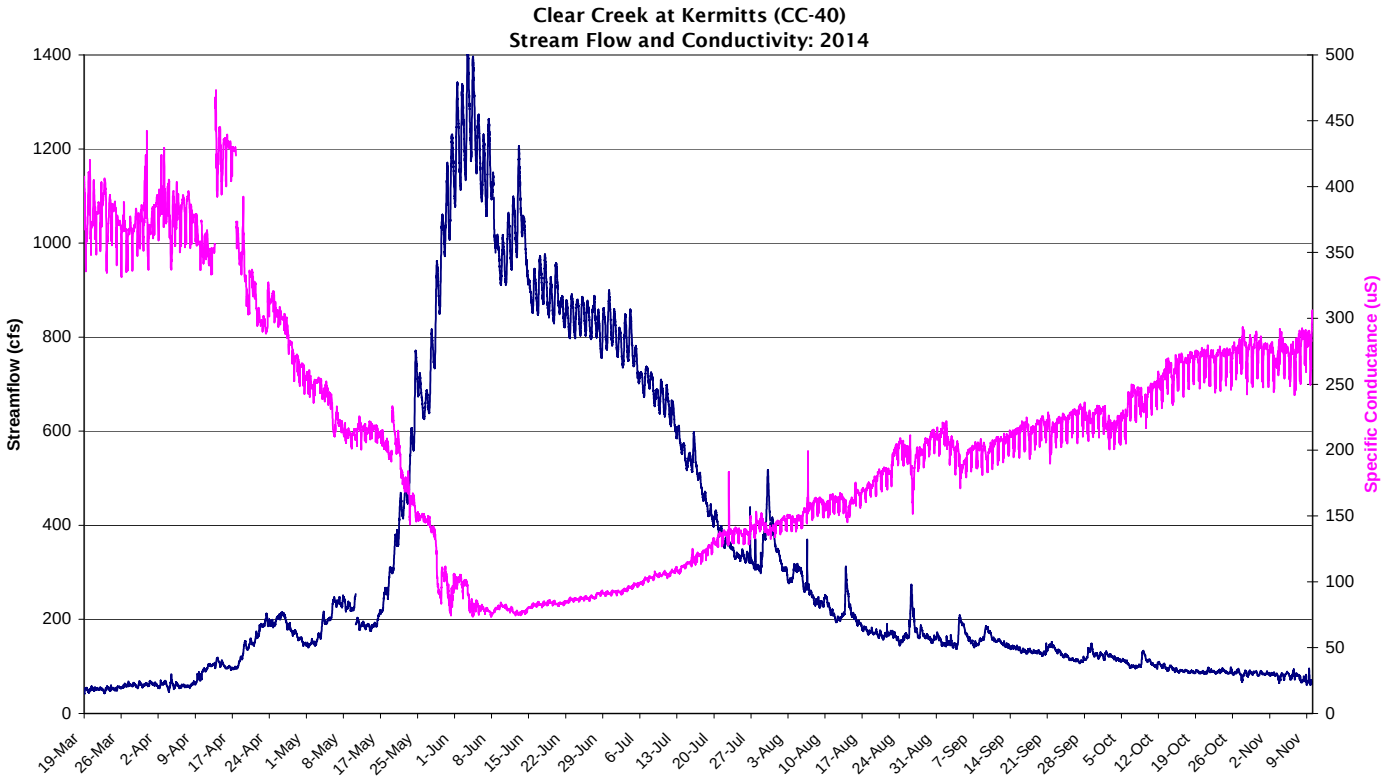


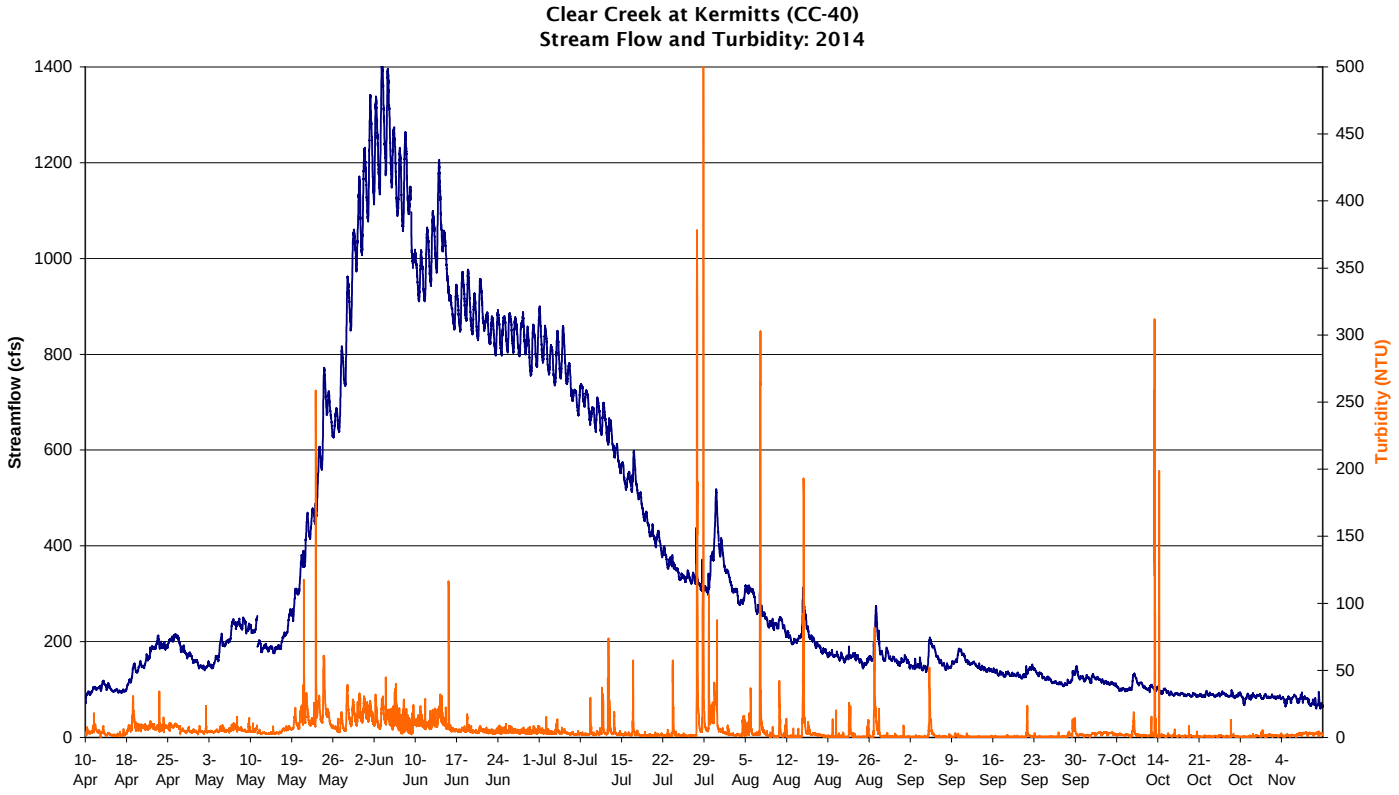
CLEAR CREEK NEAR KERMITTS
PROVISIONAL STREAMFLOW RATING TABLE

STAFF GAGE HEIGHT (feet)	STREAMFLOW (cubic feet per second)
3.3	24
3.4	32
3.5	42
3.6	56
3.7	78
3.8	91
3.9	106
4.0	123
4.1	141
4.2	163
4.3	186
4.4	213
4.5	242
4.6	275
4.7	326
4.8	351
4.9	377
5.0	405
5.1	434
5.2	465
5.3	497
5.4	530
5.5	565
5.6	602
5.7	641
5.8	681
5.9	723
6.0	767
6.1	813
6.2	861
6.3	911
6.4	962
6.5	1016
6.6	1072
6.7	1131
6.8	1191
6.9	1254
7.0	1319
7.1	1386
7.2	1456
7.3	1529
7.4	1604

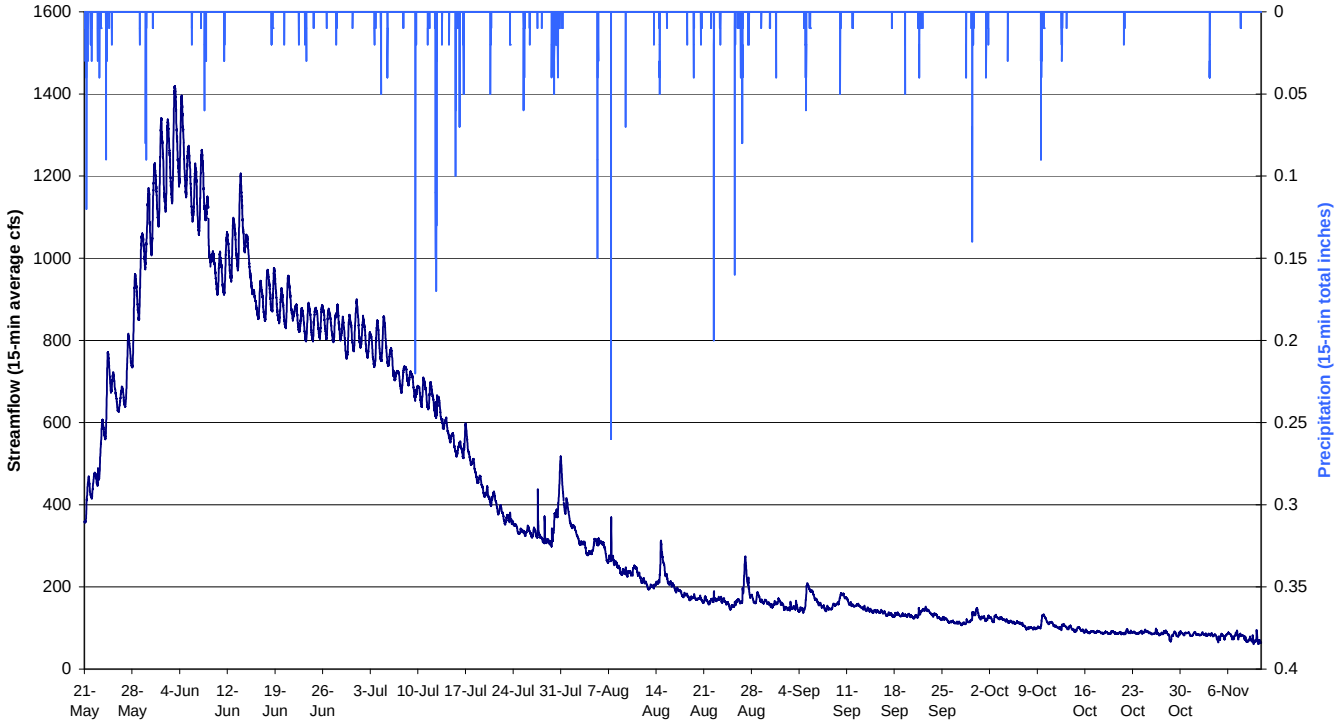
Streamgage sponsored by the Upper Clear Creek Watershed Association

Operated by: *Clear Creek Consultants*

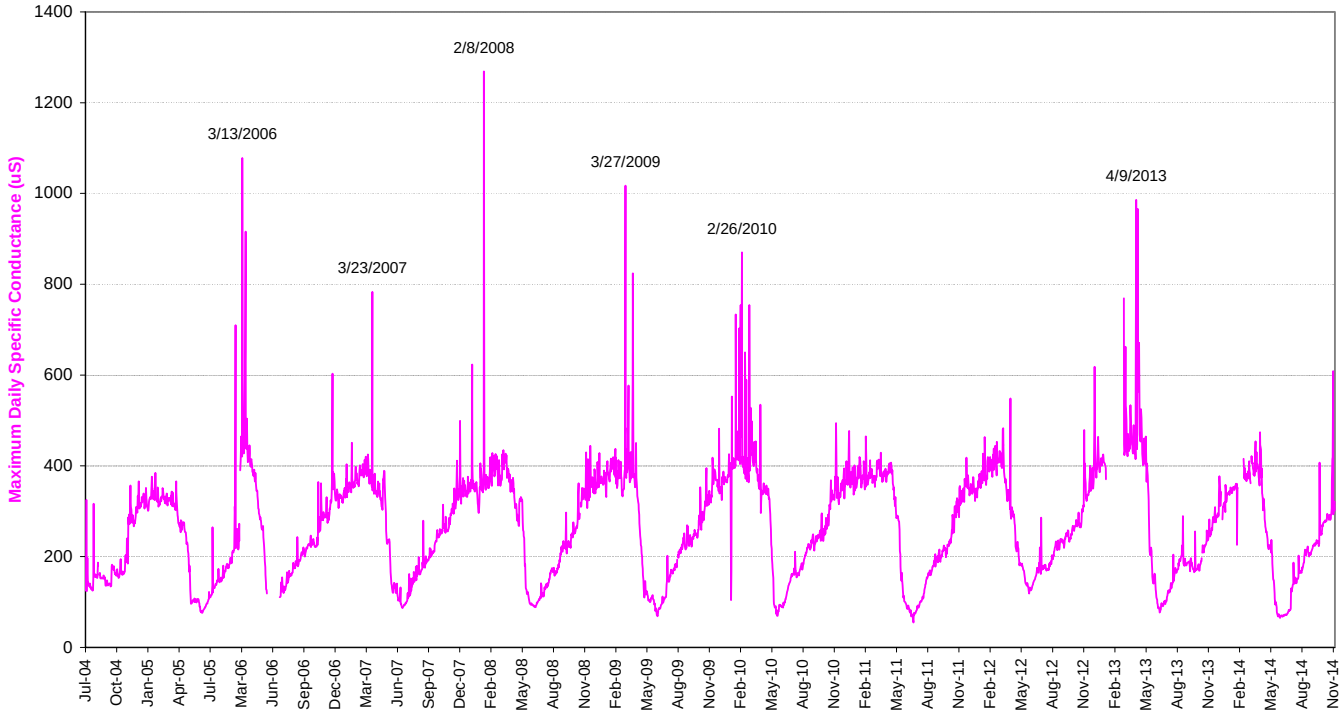

Clear Creek at Kermitts (CC-40)
Stream Flow and Conductivity: 2014
Streamflow (cfs)
Specific Conductance (uS)
0
200
400
600
800
1000
1200
1400
0
50
100
150
200
250
300
350
400
450
500
19-Mar
26-Mar
2-Apr
9-Apr
17-Apr
24-Apr
1-May
8-May
17-May
25-May
1-Jun
8-Jun
15-Jun
22-Jun
29-Jun
6-Jul
13-Jul
20-Jul
27-Jul
3-Aug
10-Aug
17-Aug
24-Aug
31-Aug
7-Sep
14-Sep
21-Sep
28-Sep
5-Oct
12-Oct
19-Oct
26-Oct
2-Nov
9-Nov


Clear Creek at Kermitts (CC-40)
Stream Flow and Turbidity: 2014
Streamflow (cfs)
Turbidity (NTU)
0
200
400
600
800
1000
1200
1400
0
50
100
150
200
250
300
350
400
450
500
10-Apr
18-Apr
25-Apr
3-May
10-May
19-May
26-May
2-Jun
10-Jun
17-Jun
24-Jun
1-Jul
8-Jul
15-Jul
22-Jul
29-Jul
5-Aug
12-Aug
19-Aug
26-Aug
2-Sep
9-Sep
16-Sep
23-Sep
30-Sep
7-Oct
14-Oct
21-Oct
28-Oct
4-Nov

Clear Creek at Kermitts (CC-40)
Stream Flow and Precipitation: 2014



Clear Creek at Kermitts (CC-4) Maximum Specific Conductance
July 2004 to November 2014



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	NA	0.00	0.00	0.00	0.00	0.12						
2	NA	0.00	0.00	0.00	0.00	0.00	NA	0.00	0.00	0.00	0.00	0.00						
3	NA	0.00	0.12	0.10	0.00	0.02	NA	0.00	0.04	0.00	0.00	0.00						
4	NA	0.25	0.11	0.00	0.00	0.44	NA	0.00	0.08	0.00	0.06	0.03						
5	NA	0.00	0.11	0.00	0.00	0.00	NA	0.00	0.09	0.34	0.48	0.00						
6	NA	0.00	0.20	0.06	0.10	0.00	NA	0.03	0.00	0.00	0.00	0.02						
7	NA	0.00	0.07	0.00	0.00	0.00	NA	0.01	0.01	0.26	0.00	0.00						
8	NA	0.00	0.07	0.00	0.05	0.00	NA	0.17	0.00	0.00	0.00	0.00						
9	NA	0.01	0.00	0.01	1.67	0.00	NA	0.00	0.30	0.12	0.00	0.43						
10	NA	0.00	0.27	0.01	1.08	0.19	NA	0.00	0.00	0.00	0.08	0.02						
11	NA	0.00	0.56	0.04	0.36	0.00	NA	0.05	0.08	0.00	0.02	0.00						
12	NA	0.00	0.04	0.27	2.30	0.00	NA	0.00	0.77	0.00	0.02	0.00						
13	NA	0.00	0.56	0.22	0.01	0.00	NA	0.00	0.03	0.03	0.00	0.01						
14	0.00	0.02	0.02	0.01	0.06	0.08	NA	0.00	0.02	0.24	0.00	0.00						
15	0.05	0.02	0.08	0.00	0.57	0.00	NA	0.00	0.24	0.01	0.00	0.00						
16	0.00	0.00	0.00	0.00	0.00	0.03	NA	0.00	0.26	0.00	0.00	0.00						
17	0.00	0.01	0.00	0.00	0.00	0.00	NA	0.00	0.00	0.00	0.01	0.00						
18	0.00	0.03	0.00	0.03	0.00	0.00	NA	0.06	0.00	0.02	0.00	0.00						
19	0.00	0.01	0.12	0.00	0.00	0.00	NA	0.00	0.00	0.07	0.07	0.00						
20	0.00	0.00	0.00	0.00	0.00	0.00	NA	0.02	0.10	0.04	0.00	0.00						
21	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.13	0.05						
22	0.03	0.00	0.01	0.52	0.12	0.00	0.17	0.04	0.00	0.25	0.02	0.00						
23	0.00	0.00	0.00	0.29	0.08	0.00	0.12	0.06	0.04	0.04	0.00	0.00						
24	0.00	0.01	0.08	0.27	0.00	0.00	0.32	0.01	0.00	0.00	0.00	0.00						
25	0.00	0.00	0.09	0.02	0.00	0.00	0.08	0.00	0.17	0.21	0.00	0.00						
26	0.00	0.00	0.04	0.33	0.04	0.00	0.00	0.01	0.03	0.33	0.00	0.00						
27	0.00	0.00	0.12	0.00	0.17	0.00	0.00	0.00	0.01	0.07	0.00	0.00						
28	0.02	0.17	0.09	0.00	0.01	0.00	0.00	0.04	0.01	0.00	0.07	0.00						
29	0.05	0.27	0.11	0.04	0.00	0.00	0.03	0.00	0.20	0.03	0.42	0.00						
30	0.00	0.04	0.03	0.01	0.00	0.00	0.19	0.01	0.62	0.02	0.00	0.00						
31	0.00		0.02	0.09		0.00	0.01		0.04	0.04		0.00						
TOTAL		**0.84**	**2.92**	**2.47**	**6.65**	**0.76**		**0.51**	**3.14**	**2.12**	**1.38**	**0.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
RainDays		11	22	18	15	5		12	20	17	11	7	0	0	0	0	0	0
MAX		0.27	0.56	0.52	2.30	0.44		0.17	0.77	0.34	0.48	0.43	0.00	0.00	0.00	0.00	0.00	0.00
X-2D		0.44	0.83	0.81	2.75	0.46		0.18	0.85	0.54	0.54	0.45	0.00	0.00	0.00	0.00	0.00	0.07
X-3D		0.48	1.16	1.08	3.74	0.46		0.21	0.88	0.61	0.54	0.45	0.00	0.00	0.00	0.00	0.00	31.00
DryDays		19	9	13	15	26		18	11	14	19	24	0	0	0	0	0	0

NA No data collected at raingauge / Not available
***** Rain gauge not present
0 No rainfall