

Data Transmittal Report



To: Upper Clear Creek Watershed Association (UCCWA)

CC:

From: Mike Crouse

Date: 18-February-2022

Re: Stream Gaging Report Water Year 2021 – 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 annually since 2006. This report presents data collected at the gage from October 2020 to October 2021.

Data Collection and Evaluation

A continuous recording Campbell Scientific data logger was used to measure a submersible pressure transducer to develop the water 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 specific conductance data plot). An in-stream turbidity probe was used to monitor stream turbidity conditions related to suspended sediment loading (see attached turbidity 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 (see attached precipitation data plot).

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 (flow). 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).

Direct measurements of stream flow using a current meter are required each year to document this relationship at various seasonal flow rates. Three to six direct current meter discharge measurements are taken each season to maintain the discharge rating. Measurement results are available upon request. The discharge rating is evaluated annually to assess the accuracy of the rating in comparison to the direct measurements. The measurements are plotted on log-normal distribution using a computer program for comparison to the existing rating. If necessary, either shift adjustments are applied to the data before calculating discharge, or the rating is revised to maintain accuracy.

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 (300-2,000 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.

The discharge rating equations were applied to the corrected stage height data for the computation of discharge. A stream flow computation 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.

Stream flow results during the operation season are available in real-time on Clear Creek Consultants web site for rafters and other water users to obtain current stream flow conditions at clearcr.com/flow-pages.html.

The CC-40 mean daily discharge results for this reporting period are presented in the attached table, along with the flow hydrograph. The gage is not operated over the winter months (November-March) because the gage rating is not accurate during heavy 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 winter low-flow period.

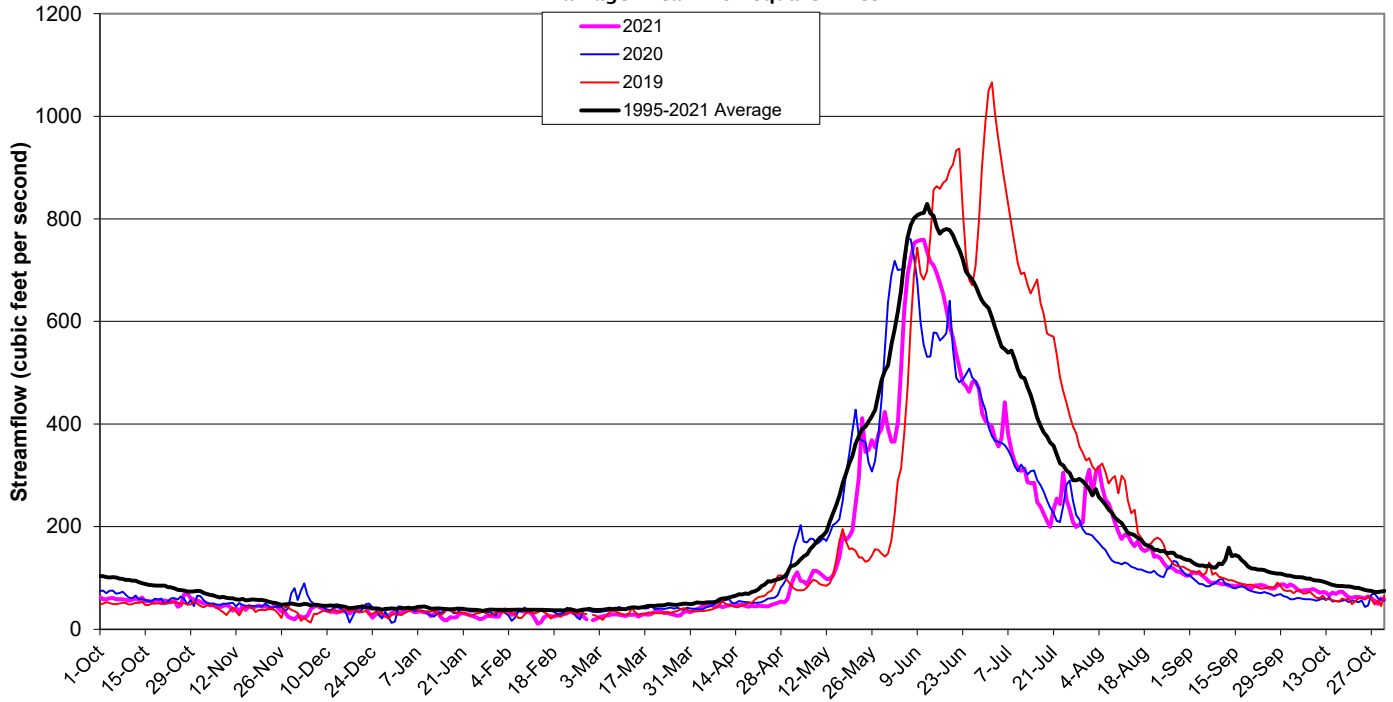
Minimum Clear Creek flows occur in winter, with maximum flows typically in June. Minimum flows typically range from 20 to 40 cfs at CC-40. Mean daily flows were near below average in 2021 and similar to year 2020. Peak snowmelt flow in 2021 was 838 cfs on 9-June similar to 2020.

Data graphs for specific conductance and temperature at CC-40 for this reporting period are also attached. Daily precipitation data for the seasonal monitoring periods are also tabulated.

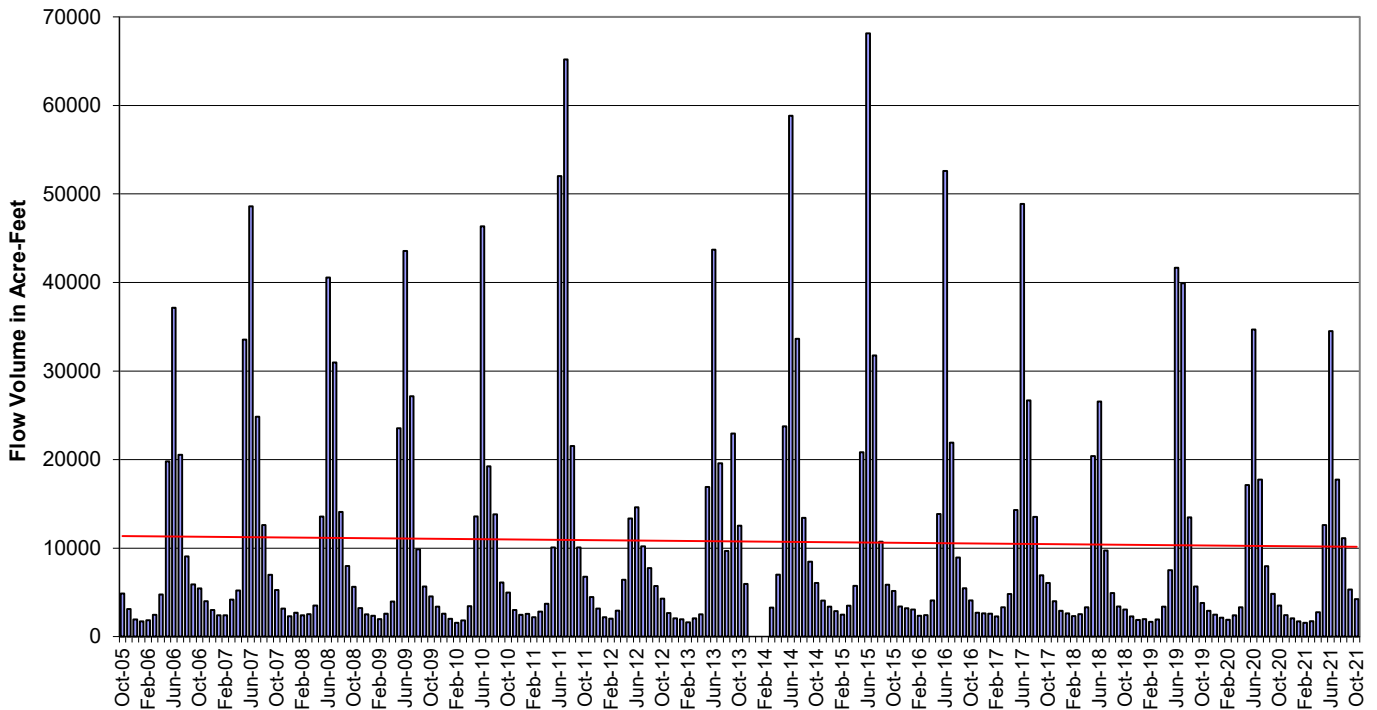
CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS													
WY 2021													
Provisional Data - Subject to Revision													
LOCATION -- 0.5 mi upstream Johnson Gulch				LATITUDE 39 44'47" LONGITUDE 105 26'08"									
GAGE DRAINAGE AREA -- 267 sq-mi				GAGE ELEVATION -- 7210 ft-msl									
PERIOD OF RECORD -- October 1994 to Current Year													
DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 2020 TO OCTOBER 2021													
MEAN DAILY VALUES													
DAY	2020 OCT	2020 NOV	2020 DEC	2021 JAN	2021 FEB	2021 MAR	2021 APR	2021 MAY	2021 JUN	2021 JUL	2021 AUG	2021 SEP	2021 OCT
1	63.0	53.1	26 e	30 e	24 e	18 e	35.5	83.2	365	400	311	105	82.6
2	58.3	50.4	24 e	33 e	36 e	20 e	39.4	101	366	395	260	111	87.4
3	58.4	49.7	22 e	37 e	39 e	23 e	41.5	111	403	370	305	109	84.4
4	60.5	46.0	26 e	38 e	36 e	25 e	45.3	94.4	506	356	316	109	78.9
5	60.7	46.8	39 e	36 e	27 e	26 e	47.2	92.4	619	372	277	103	74.3
6	58.6	43 e	44 e	33 e	29 e	27 e	49.9	86.5	690	443	253	99.1	75.7
7	58.5	42 e	45 e	34 e	38 e	29 e	45.0	101	724	381	245	92.1	76.0
8	58.4	45 e	42 e	35 e	35 e	29 e	43.5	114	753	348	227	89.7	76.0
9	57.2	47 e	40 e	33 e	34 e	28 e	45.1	113	757	327	206	90.6	78.2
10	55.6	44 e	37 e	33 e	33 e	27 e	42.8	109	758	315	189	89.7	75.7
11	57.1	36 e	34 e	25 e	32 e	25 e	44.9	103	759	309	176	87.6	70.9
12	60.2	40 e	34 e	29 e	22 e	28 e	46.0	97.4	736	313	184	87.9	72.3
13	56.8	35 e	32 e	37 e	11 e	28 e	48.2	98.2	717	287	182	84.9	71.4
14	61.7	46 e	35 e	24 e	13 e	29 e	46.8	105	709	285	169	85.0	65.3
15	54.2	37 e	35 e	18 e	23 e	25 e	47.5	119	694	285	162	83.1	71.2
16	54.8	46 e	35 e	17 e	26 e	28 e	47.4	141	676	247	172	85.2	68.8
17	53.9	42 e	31 e	23 e	25 e	29 e	45.0	183	654	239	158	85.3	72.2
18	55.3	44 e	36 e	23 e	24 e	28 e	43.9	174	622	225	152	86.0	73.4
19	57.1	46 e	34 e	23 e	27 e	29 e	45.7	180	590	210	155	81.2	67.0
20	52.7	43 e	39 e	31 e	29 e	34 e	44.4	192	569	199	162	79.4	62.2
21	56.1	45 e	45 e	31 e	30 e	35 e	45.4	242	537	234	141	85.2	61.1
22	54.3	40 e	42 e	29 e	30 e	34 e	45.2	296	510	254	143	85.7	62.5
23	52.4	42 e	32 e	28 e	36 e	31 e	44.5	411	480	243	138	86.3	62.5
24	55.8	47 e	22 e	25 e	31 e	32 e	44.4	346	474	305	129	84.8	61.5
25	43.6	41 e	28 e	23 e	29 e	29 e	47.2	349	463	252	120	81.6	60.4
26	46.3	34 e	34 e	20 e	26 e	28 e	49.3	368	482	233	121	79.1	63.9
27	67.5	34 e	27 e	20 e	25 e	26 e	51.4	354	482	209	118	79.2	60.1
28	69.3	24 e	26 e	25 e	19 e	27 e	53.9	380	470	199	112	85.0	55.7
29	59.9	22 e	26 e	26 e		34.2	52.1	391	421	204	112	86.9	49.2
30	57.9	19 e	32 e	25 e		34.5	58.2	424	406	207	107	87.5	60.0
31	56.1		35 e	24 e		33.2		390		286	104		57.5
TOTAL	1772	1231 e	1037 e	870 e	790 e	879 e	1387	6351	17390	8934	5605	2685	2138
MEAN	57.2	41 e	33 e	28 e	28 e	28 e	46.2	205	580	288	181	89.5	69.0
MAX	69.3	53 e	45 e	38 e	39 e	35 e	58.2	424	759	443	316	111	87.4
MIN	43.6	19 e	22 e	17 e	11 e	18 e	35.5	83.2	365	199	104	79.1	49.2
AC-FT	3,515	2,441 e	2,058 e	1,726 e	1,568 e	1,744 e	2,750	12,597	34,492	17,720	11,118	5,327	4,241
INSTANTANEOUS MEASUREMENTS													
MAX FLOW	86.9						73.3	476	838	524	364	115	90.7
DATE	28-Oct						1-May	23-May	9-Jun	6-Jul	1-Aug	2-Sep	2-Oct
MIN FLOW	38.5						31.9	73.3	341	186	102	76.3	38.6
DATE	26-Oct						1-Apr	1-May	2-Jun	30-Jul	31-Aug	26-Sep	29-Oct
e = estimated during ice affected period using average ratio of CC-60 flow													
p = partial data NA = not available													



**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: 2006-2021**



CLEAR CREEK NEAR KERMITTS (Station CC-40)	
PROVISIONAL STREAMFLOW RATING TABLE	
GAGE HEIGHT	STREAMFLOW
(feet)	(cubic feet per second)
3.3	33
3.4	41
3.5	50
3.6	61
3.7	78
3.8	93
3.9	109
4.0	128
4.1	150
4.2	175
4.3	203
4.4	235
4.5	271
4.6	312
4.7	304
4.8	327
4.9	352
5.0	379
5.1	406
5.2	435
5.3	466
5.4	498
5.5	532
5.6	567
5.7	604
5.8	643
5.9	683
6.0	726
6.1	770
6.2	816
6.3	864
6.4	914
6.5	966
6.6	1020
6.7	1076
6.8	1135
6.9	1195
7.0	1258
7.1	1324
7.2	1391
7.3	1462
7.4	1534
7.5	1610

Streamgauge sponsored by the Upper Clear Creek Watershed Association

Operated by:  Clear Creek Consultants

Based on Rating No. 11

