Data Transmittal Report

CLEAR CREEK CONSULTANTS

To: Upper Clear Creek Watershed Association (UCCWA)

CC:

From: Mike Crouse

Date: 15-February-2023

Re: Stream Gaging Report Water Year 2022 – 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 2021 to October 2022.

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 operated at the CC-40 gage for water quality monitoring were discontinued in 2022.

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 evaluate this relationship at various seasonal flow rates. 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 to archive data.

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 fishermen, 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 in June and July 2022 were below average, and near average the remainder of 2022. Peak snowmelt flow in 2022 was 779 cfs on 11-June, similar to 2021.

CLEAR CREEK ABOVE JOHNSON GULCH NEAR KERMITTS
WY 2022
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 2021 TO OCTOBER 2022
MEAN DAILY VALUES

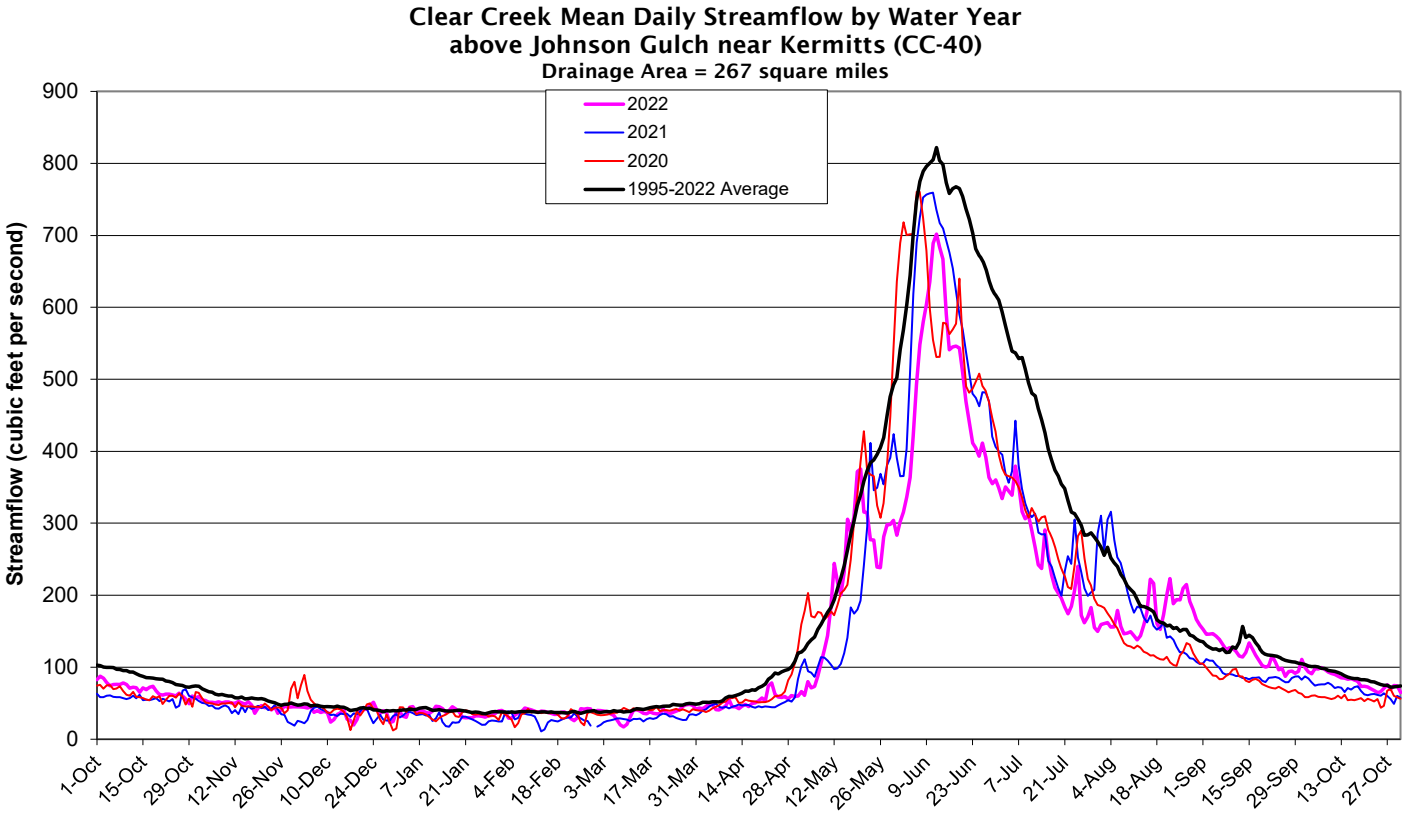
DAY	2021 OCT	2021 NOV	2021 DEC	2022 JAN	2022 FEB	2022 MAR	2022 APR	2022 MAY	2022 JUN	2022 JUL	2022 AUG	2022 SEP	2022 OCT
1	82.6	59.1	45 e	38 e	40 e	40 e	43.3	59.9	302	349	159	153	111
2	87.4	54.1	44 e	32 e	37 e	39 e	42.1	66.1	315	334	161	146	99.4
3	84.4	53.4	44 e	30 e	29 e	39 e	45.3	60.9	337	351	162	146	93.3
4	78.9	51.3	43 e	44 e	29 e	38 e	48.8	79.8	364	344	156	147	90.8
5	74.3	51.1	45 e	45 e	33 e	35 e	48.3	71.2	420	339	156	143	98.0
6	75.7	50.6	37 e	38 e	37 e	33 e	41.0	73.1	494	379	179	139	97.5
7	76.0	51.9	39 e	39 e	38 e	26 e	40.5	87.4	548	352	157	131	99.4
8	76.0	50.2	37 e	39 e	43 e	20 e	43.1	106 e	580	316	146	124	96.8
9	78.2	51.4	38 e	37 e	42 e	17 e	46.1	125 e	604	306	147	127	93.1
10	75.7	51.7	37 e	36 e	41 e	21 e	54.9	144	636	311	149	126	91.1
11	70.9	49.9	24 e	39 e	39 e	31 e	44.8	184	689	289	144	122	89.7
12	72.3	49.9	27 e	46 e	37 e	40 e	44.8	244	702	266	138	116	87.4
13	71.4	52.3	34 e	45 e	39 e	41 e	42.3	217	684	242	144	114	85.3
14	65.3	50.4	37 e	42 e	39 e	39 e	45.7	200	667	237	159	120	84.7
15	71.2	48.5 e	42 e	37 e	37 e	36 e	48.4	232	591	291	176	134	83.1
16	68.8	52 e	27 e	40 e	36 e	35 e	45.1	306	541	255	222	125	84.0
17	72.2	47 e	26 e	45 e	34 e	38 e	49.7	287	545	228	216	117	82.2
18	73.4	36 e	20 e	42 e	35 e	36 e	50.1	309	546	211	160	110	80.5
19	67.0	43 e	27 e	38 e	37 e	35 e	53.1	372	543	203	152	102	73.2
20	62.2	47 e	41 e	30 e	38 e	35 e	57.1	375	510	196	173	100	73.4
21	61.1	44 e	41 e	30 e	35 e	42 e	52.8	316	469	184	201	101	72.4
22	62.5	44 e	42 e	30 e	29 e	37 e	73.8	315	440	174	223	116	69.8
23	62.5	40 e	47 e	30 e	26 e	35 e	78.2	277	411	185	188	107	67.6
24	61.5	45 e	51 e	32 e	30 e	37 e	62.0	277	405	207	194	96.4	64.4
25	60.4	36 e	41 e	32 e	42 e	39 e	58.5	239	393	240	194	98.3	65.7
26	63.9	41 e	36 e	32 e	41 e	41 e	57.7	238	411	172	209	87.2	70.8
27	60.1	46 e	40 e	31 e	43 e	46 e	59.1	281	392	162	215	93.7	75.7
28	55.7	44 e	37 e	33 e	42 e	47.5 e	55.4	298	363	170	191	94.4	69.3
29	49.2	45 e	23 e	33 e		48.4	60.6	298	355	183	180	91.4	74.4
30	60.0	45 e	25 e	36 e		47.0	59.4	304	360	155	166	94.0	73.9
31	57.5		38 e	39 e		41.8		283		150	159		64.8
TOTAL	2138	1429 e	1137 e	1139 e	1026 e	1136 e	1552	6726	14618	7780	5377	3520	2562
MEAN	69.0	48 e	37 e	37 e	37 e	37 e	51.7	217	487	251	173	117	82.7
MAX	87.4	59 e	51 e	46 e	43 e	48 e	78.2	375	702	379	223	153	111
MIN	49.2	36 e	20 e	30 e	26 e	17 e	40.5	59.9	302	150	138	87.2	64.4
AC-FT	4,241	2,835 e	2,256 e	2,259 e	2,035 e	2,253 e	3,078	13,340	28,994	15,431	10,666	6,982	5,082

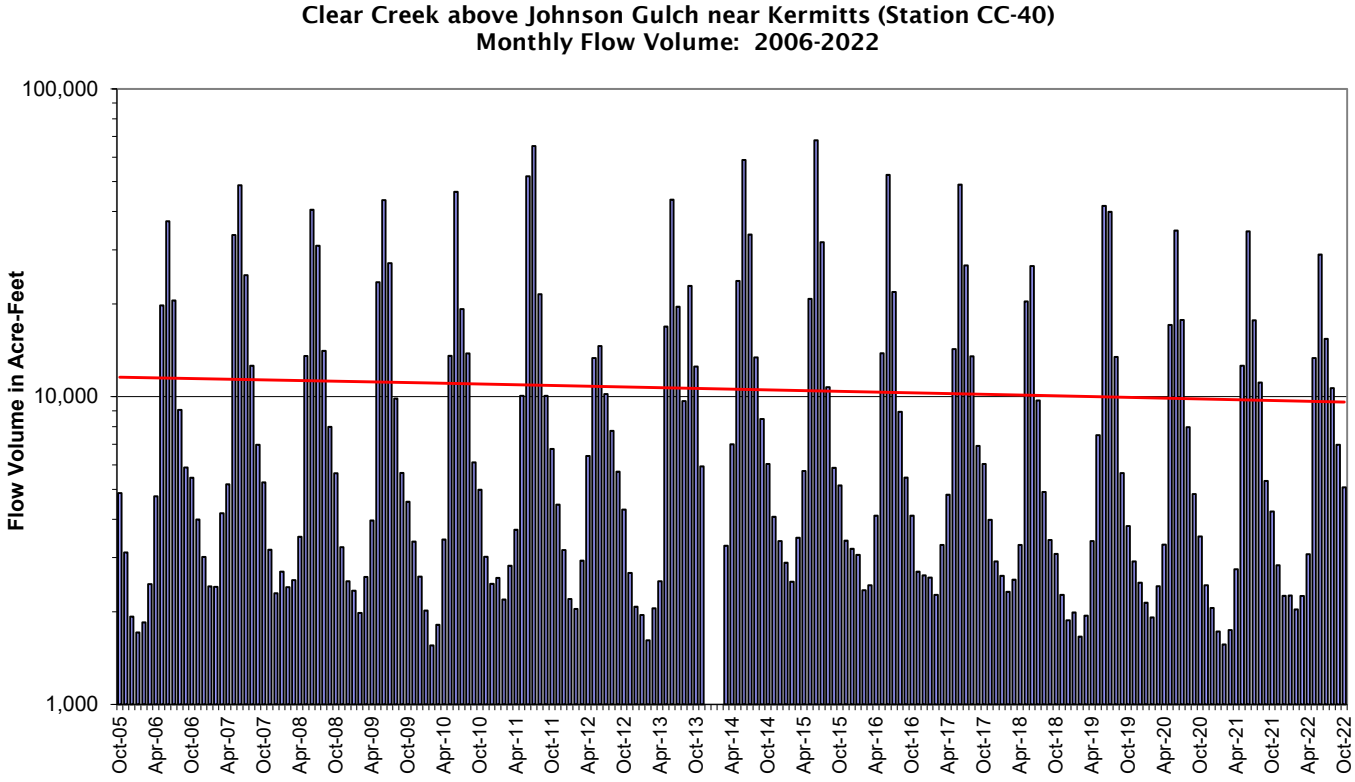
INSTANTANEOUS MEASUREMENTS

MAX FLOW	90.7						93.7	415	779	490	324	157	119
DATE	2-Oct						23-Apr	20-May	11-Jun	6-Jul	7-Aug	1-Sep	1-Oct
MIN FLOW	38.6						33.3	56.4	281	142	132	83.6	58.6
DATE	29-Oct						7-Apr	3-May	1-Jun	30-Jul	12-Aug	26-Sep	28-Oct

e = estimated during ice affected period using average ratio of CC-60 flow
p = partial data 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
2022
2021
2020
1995-2022 Average
Streamflow (cubic feet per second)
900
800
700
600
500
400
300
200
100
0
1-Oct
15-Oct
29-Oct
12-Nov
26-Nov
10-Dec
24-Dec
7-Jan
21-Jan
4-Feb
18-Feb
3-Mar
17-Mar
31-Mar
14-Apr
28-Apr
12-May
26-May
9-Jun
23-Jun
7-Jul
21-Jul
4-Aug
18-Aug
1-Sep
15-Sep
29-Sep
13-Oct
27-Oct


Clear Creek above Johnson Gulch near Kermitts (Station CC-40)
Monthly Flow Volume: 2006-2022
Flow Volume in Acre-Feet
100,000
10,000
1,000
Oct-05
Apr-06
Oct-06
Apr-07
Oct-07
Apr-08
Oct-08
Apr-09
Oct-09
Apr-10
Oct-10
Apr-11
Oct-11
Apr-12
Oct-12
Apr-13
Oct-13
Apr-14
Oct-14
Apr-15
Oct-15
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22

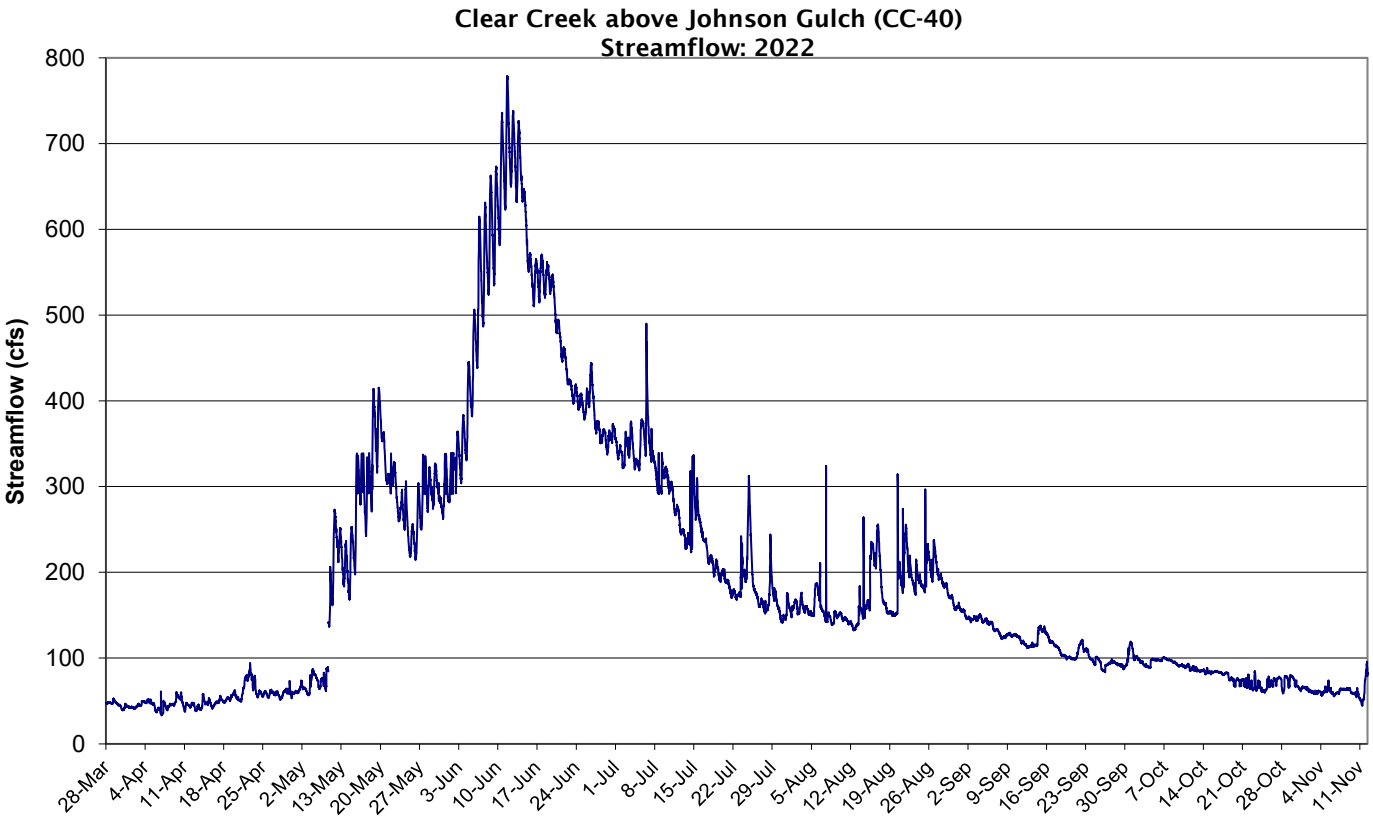
CLEAR CREEK NEAR KERMITTS (Station CC-40)
PROVISIONAL STREAMFLOW RATING TABLE

GAGE HEIGHT (feet)	STREAMFLOW (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

Streamgage sponsored by the Upper Clear Creek Watershed Association

Operated by: *Clear Creek Consultants*

Based on Rating No. 11


Clear Creek above Johnson Gulch (CC-40)
Streamflow: 2022
Streamflow (cfs)
800
700
600
500
400
300
200
100
0
28-Mar
4-Apr
11-Apr
18-Apr
25-Apr
2-May
13-May
20-May
27-May
3-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
11-Nov