

Data Transmittal Report



To: Upper Clear Creek Watershed Association (UCCWA)

CC:

From: Mike Crouse

Date: 22-March-2021

Re: Stream Gaging Report Water Year 2020 – 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 2019 to October 2020.

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 30 to 40 cfs at CC-40. Mean daily flows were near average in April and May 2020 and below average from June through October. Peak snowmelt flow in 2020 was 836 cfs on 6-June and was lower than year 2019.

Data graphs for specific conductance, temperature, and turbidity 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 2020**

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 2019 TO OCTOBER 2020

MEAN DAILY VALUES

DAY	2019 OCT	2019 NOV	2019 DEC	2020 JAN	2020 FEB	2020 MAR	2020 APR	2020 MAY	2020 JUN	2020 JUL	2020 AUG	2020 SEP	2020 OCT
1	74.2	64.5	57 e	45 e	38 e	34 e	39.7	126	690	394	185	105	63.0
2	75.2	56.6	75 e	44 e	34 e	33 e	39.4	160	718	376	183	99.2	58.3
3	70.1	51.2	89 e	38 e	31 e	34 e	37.8	178	700	367	175	93.5	58.4
4	74.7	50.0	67 e	44 e	27 e	34 e	39.6	203	702	365	168	88.3	60.5
5	75.1	49.7	55 e	42 e	16 e	35 e	42.7	171	702	363	160	87.9	60.7
6	69.2	48 e	50 e	35 e	22 e	37 e	44.6	169	760	359	154	83.4	58.6
7	70.3	47 e	46 e	36 e	35 e	37 e	47.1	177	760	350	144	83.7	58.5
8	73.2	50 e	45 e	36 e	36 e	40 e	50.8	175	724	336	134	87.5	58.4
9	67.0	50 e	43 e	34 e	42 e	43 e	52.1	166	678	318	130	90.6	57.2
10	61.6	50 e	37 e	30 e	37 e	41 e	56.6	171	598	308	129	96.5	55.6
11	60.3	51 e	37 e	27 e	39 e	39 e	57.0	178	555	321	126	97.7	57.1
12	65.8	44 e	41 e	25 e	38 e	43 e	58.5	172	531	312	130	87.4	60.2
13	58.7	51 e	42 e	30 e	36 e	40 e	50.4	186	531	302	127	87.1	56.8
14	58.4	47 e	41 e	32 e	37 e	41 e	50.8	203	578	308	122	81.4	61.7
15	57.0	45 e	39 e	34 e	36 e	41 e	54.9	207	577	310	119	79.5	54.2
16	55.1	45 e	30 e	37 e	36 e	41 e	53.5	214	563	290	116	82.2	54.8
17	54.2	45 e	13 e	38 e	37 e	40 e	52.7	250	569	280	116	83.8	53.9
18	59.6	45 e	26 e	32 e	34 e	41 e	52.5	303	577	268	113	81.4	55.3
19	57.5	45 e	39 e	31 e	29 e	45 e	50.9	341	640	251	111	76.7	57.1
20	59.6	44 e	33 e	37 e	28 e	39 e	51.3	385	547	237	110	74.5	52.7
21	48.7	49 e	39 e	40 e	32 e	40 e	51.3	428	490	226	114	72.3	56.1
22	54.7	45 e	48 e	39 e	42 e	40 e	52.8	372	481	211	107	70.9	54.3
23	60.1	40 e	50 e	35 e	38 e	39 e	55.7	368	487	209	103	70.4	52.4
24	60.4	44 e	43 e	34 e	34 e	41 e	59.8	365	497	241	102	72.6	55.8
25	57.6	44 e	39 e	35 e	24 e	42 e	60.0	324	508	282	116	70.0	43.6
26	63.6	43 e	28 e	34 e	19 e	39.8	61.5	307	491	290	122	67.7	46.3
27	58.7	36 e	21 e	35 e	37 e	41.5	66.2	328	484	251	133	64.9	67.5
28	47.9	40 e	34 e	32 e	37 e	39.3	82.0	378	469	222	131	67.1	69.3
29	56.3	70 e	23 e	33 e	36 e	37.6	90.0	448	446	214	120	68.3	59.9
30	44.9	80 e	12 e	31 e		41.7	106	547	427	195	112	64.3	57.9
31	65.3		15 e	27 e		40.4		636		186	105		56.1
TOTAL	1915	1472 e	1254 e	1080 e	968 e	1221 e	1668	8636	17483	8944	4016	2436	1772
MEAN	61.8	49 e	40 e	35 e	33 e	39 e	55.6	279	583	289	130	81.2	57.2
MAX	75.2	80 e	89 e	45 e	42 e	45 e	106	636	760	394	185	105	69.3
MIN	44.9	36 e	12 e	25 e	16 e	33 e	37.8	126	427	186	102	64.3	43.6
AC-FT	3,798	2,919 e	2,488 e	2,142 e	1,919 e	2,421 e	3,308	17,130	34,677	17,740	7,966	4,832	3,515

INSTANTANEOUS MEASUREMENTS

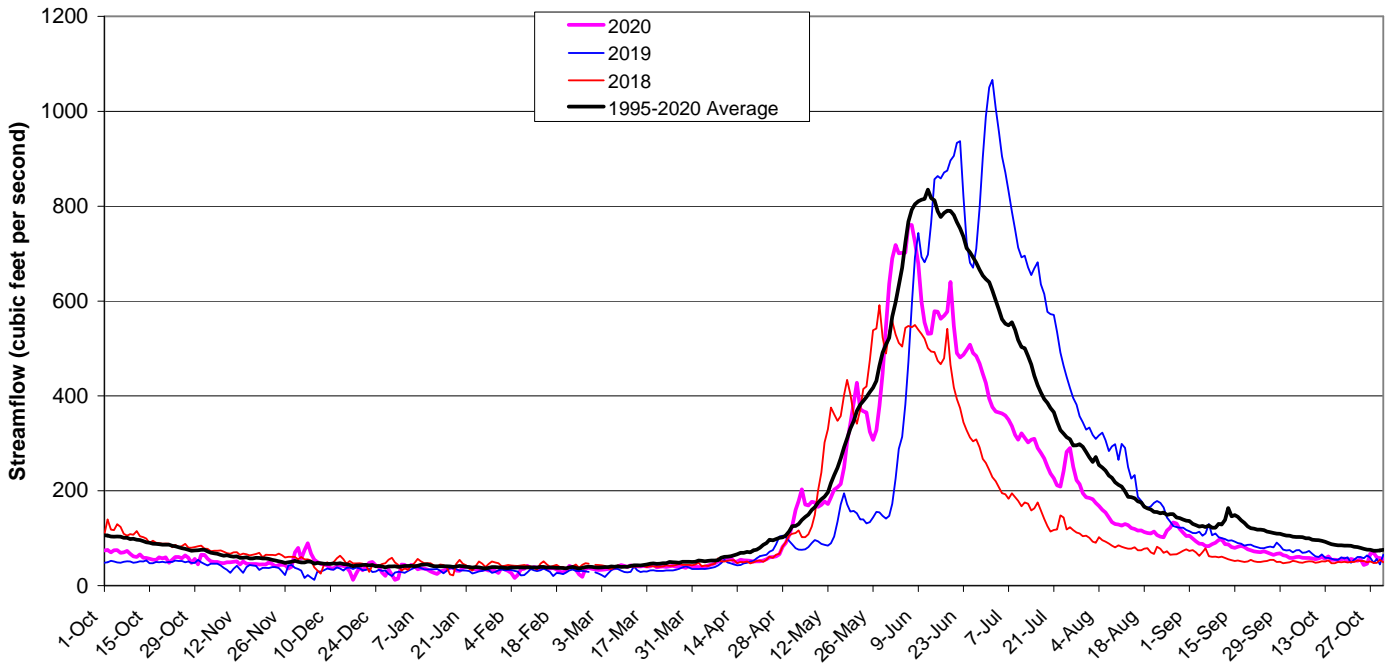
MAX FLOW	58.8					113	712	836	417	193	111	86.9
DATE	27-Oct					30-Apr	1-Jun	6-Jun	1-Jul	1-Aug	1-Sep	28-Oct
MIN FLOW	42.8					34.1	113	407	178	98.7	62.8	38.5
DATE	15-Oct					4-Apr	1-May	30-Jun	31-Jul	25-Aug	30-Sep	26-Oct

e = estimated during ice affected period using average ratio of CC-60 flow
p = partial data NA = not available

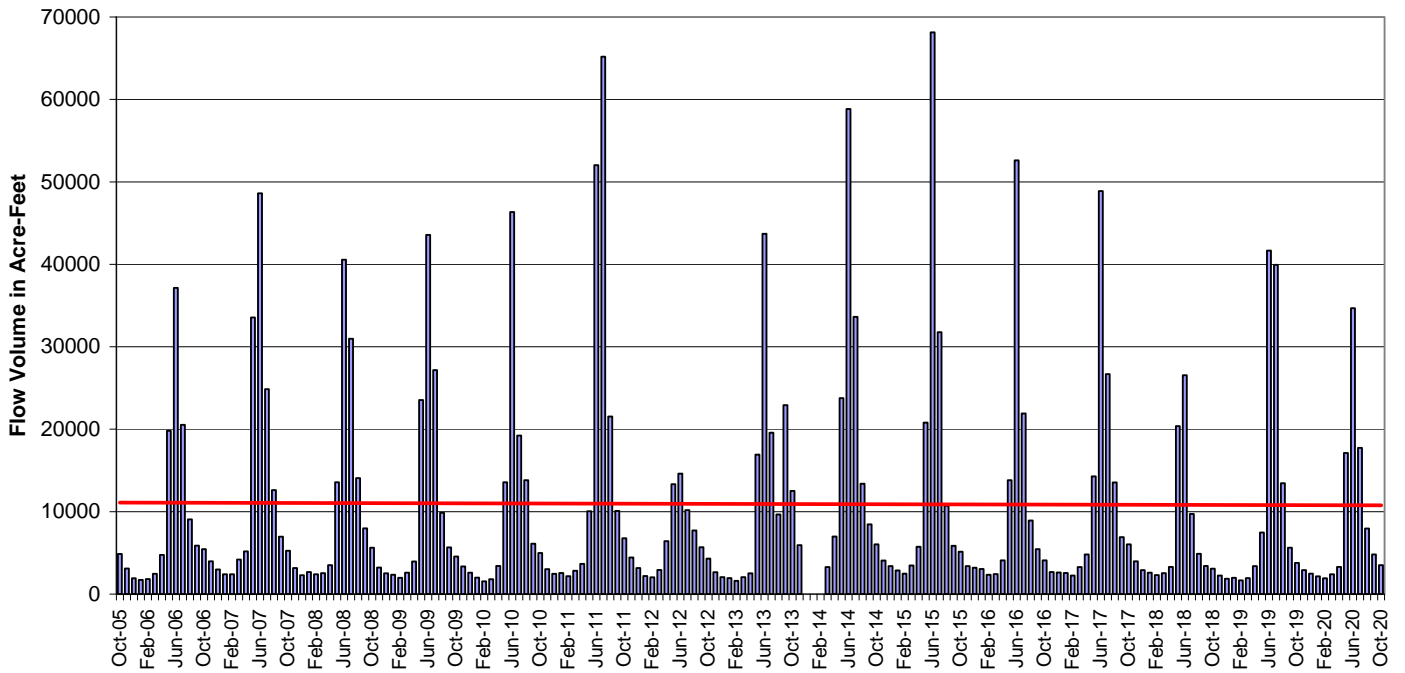


Clear Creek Consultants

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




**Clear Creek above Johnson Gulch near Kermitts (Station CC-40)
Monthly Flow Volume: 2006-2020**



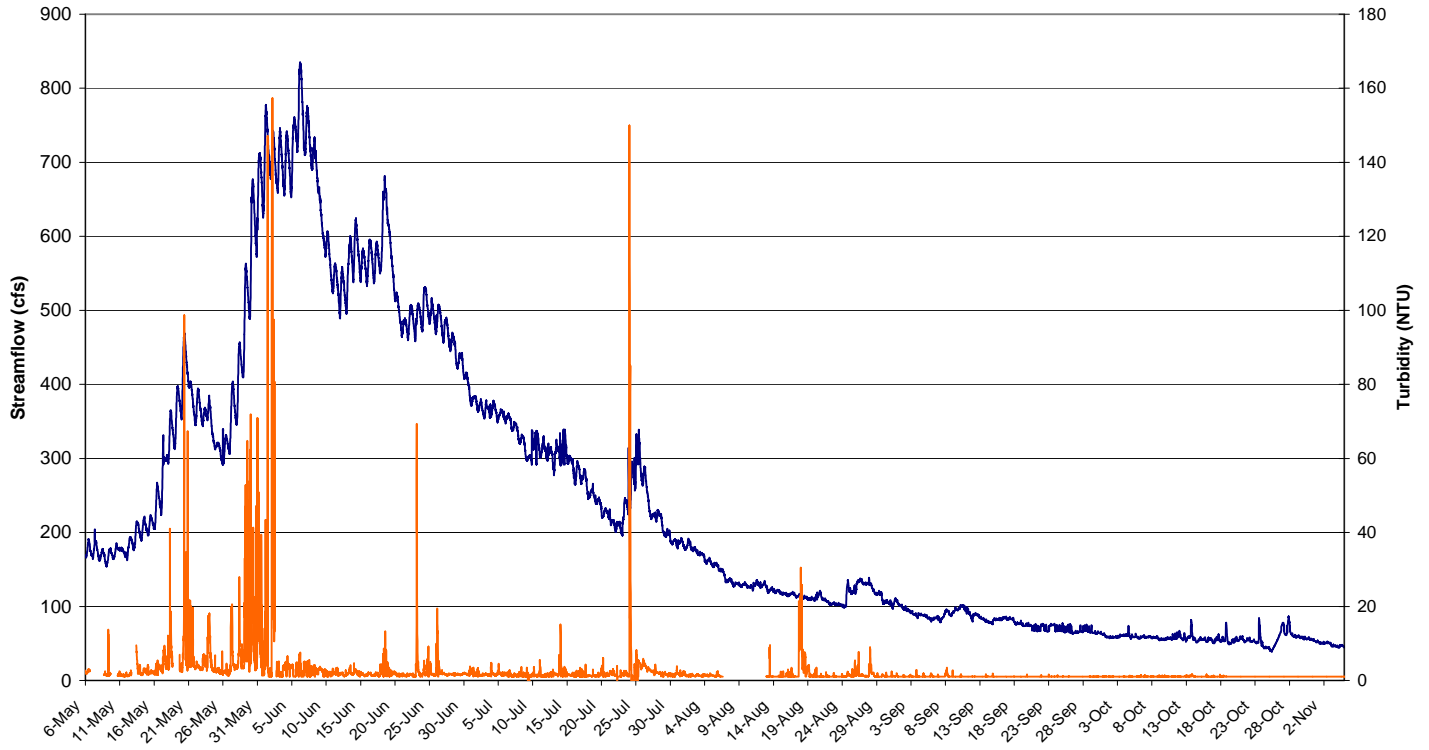
CLEAR CREEK NEAR KERMITTS (Station CC-40)	
PROVISIONAL STREAMFLOW RATING TABLE	
GAGE HEIGHT	STREAMFLOW
(feet)	(cubic feet per second)
3.3	33
3.4	41
3.5	50
3.6	61
3.7	78
3.8	93
3.9	109
4.0	128
4.1	150
4.2	175
4.3	203
4.4	235
4.5	271
4.6	312
4.7	304
4.8	327
4.9	352
5.0	379
5.1	406
5.2	435
5.3	466
5.4	498
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

Streamgage sponsored by the Upper Clear Creek Watershed Association

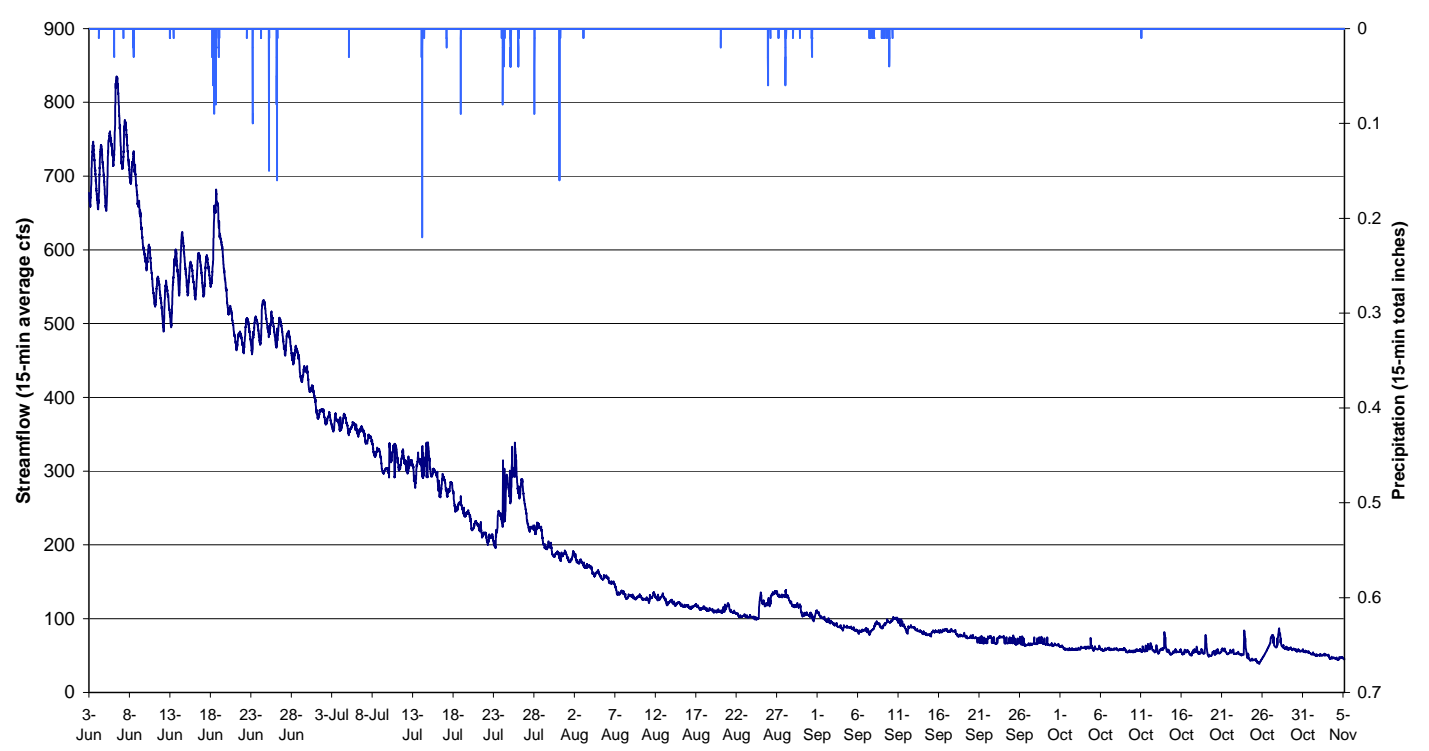
Operated by:  Clear Creek Consultants

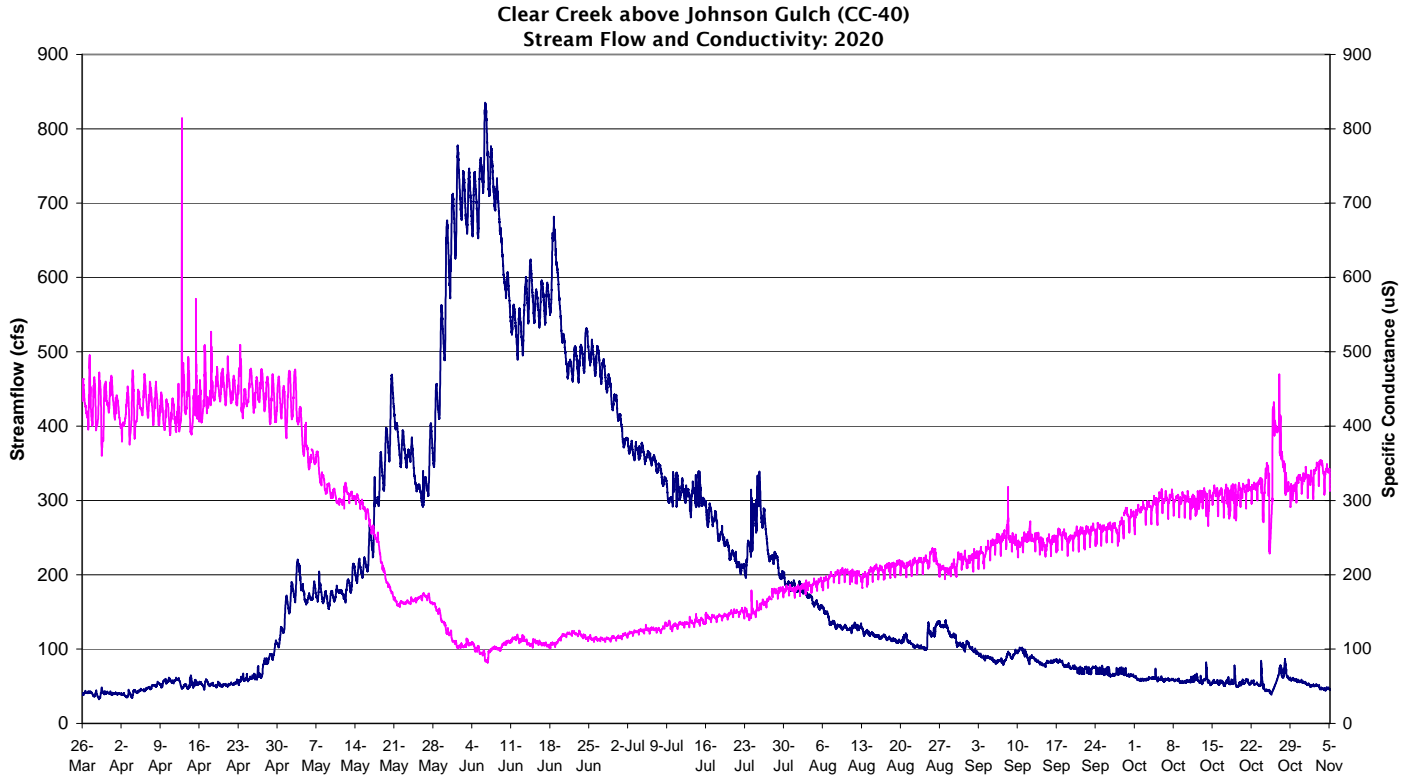
Based on Rating No. 11

Clear Creek above Johnson Gulch (CC-40)
Stream Flow and Turbidity: 2020

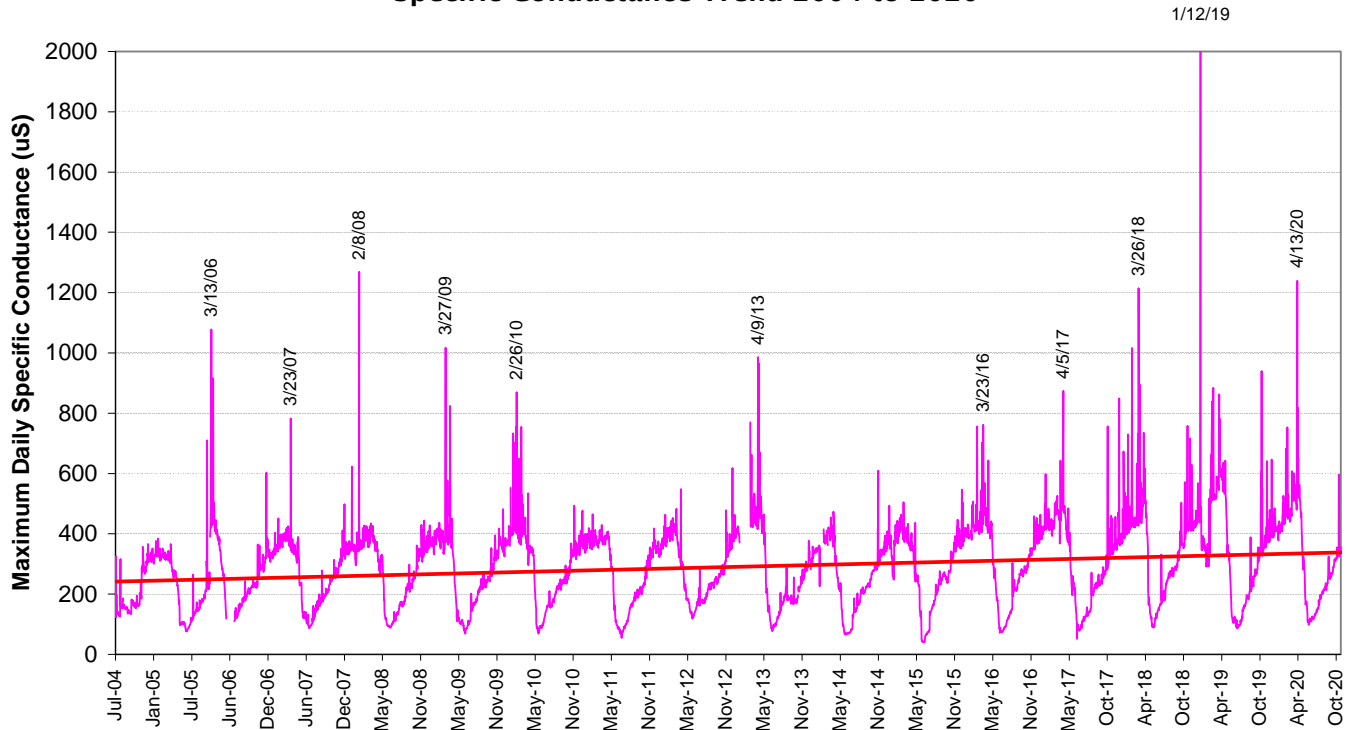


Clear Creek above Johnson Gulch (CC-40)
Stream Flow and Precipitation: 2020





Clear Creek above Johnson Gulch (CC-4) Specific Conductance Trend 2004 to 2020



DAILY RAINFALL RECORDS (inches)
CLEAR CREEK STATION CC-40 (above Johnson Gulch)
 Lat 39 44' 46.27" N Long 105 26' 9.19" W Elev. 7220 ft-MSL
 YEARS: 2019, 2020, 2021

DATE	2019						2020						2021					
	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG	SEP	OCT
1	0.01	0.02	0	0.17	0	0	NA	NA	0	0	0	0						
2	0	0.01	0.11	0.01	0	0	NA	NA	0	0	0	0						
3	0	0	0	0	0	0	NA	0	0	0.01	0	0						
4	0	0.01	0.05	0.15	0.08	0	NA	0.01	0	0	0	0						
5	0	0.31	0.09	0.01	0	0	NA	0	0.03	0	0	0						
6	0	0	0.01	0	2.59	0	NA	0.06	0	0	0	0						
7	0.2	0.03	0.07	0	0.04	0	NA	0.01	0	0	0	0						
8	0.22	0	0.03	0.26	0.34	0	NA	0.02	0	0	0.15	0						
9	0.16	0.02	0	0.09	0	0	NA	0.08	0	0	0.11	0						
10	0.18	0	0	0	0	0.04	NA	0	0	0	0.27	0						
11	0	0	0	0.09	0	0.09	NA	0	0	0	0	0.01						
12	0	0	0.02	0	0.11	0	NA	0	0	0	0	0						
13	0	0.01	0.05	0	0	0	NA	0.02	0	0	0	0						
14	0	0	0.08	0	0	0	NA	0	0.28	0	0	0						
15	0	0.03	0	0	0	0	NA	0	0	0	0	0						
16	0	0.19	0	0	0	0	NA	0	0	0	0	0						
17	0	0.34	0.01	0	0	0	NA	0	0.04	0	0	0						
18	0	0.19	0	0	0.01	0	NA	0.65	0	0	0	0						
19	0.12	0	0	0	0	0	NA	0.38	0.1	0	0	0						
20	0.19	0.01	0.54	0	0	0	NA	0	0	0.03	0	0						
21	0.52	0.5	0.04	0	0	0	NA	0	0	0	0	0						
22	0.17	0.37	0.02	0	0	0	NA	0	0	0	0	0						
23	0.4	0	0	0	0	0	NA	0.22	0	0	0	0						
24	0	0	0	0	0	0.58	NA	0.01	0.32	0	0	0						
25	0	0	0.02	0	0	0	NA	0.17	0.3	0	0	0						
26	0.01	0	0	0	0	0	NA	0.34	0.11	0.11	0	0						
27	0	0	0.09	0	0.01	0	NA	0	0	0.01	0	0						
28	0.06	0	0	0	0	0.22	NA	0	0.14	0.13	0	0						
29	0.02	0	0	0	0	0	NA	0	0	0.01	0	0						
30	0	0.02	0.08	0	0	0.03	NA	0	0	0.01	0	0						
31	0.02		0.02	0		0.01	NA		0.17	0.11		0						
TOTAL	2.28	2.06	1.33	0.78	3.18	0.97	NA	1.97	1.49	0.42	0.53	0.01	0.00	0.00	0.00	0.00	0.00	0.00
RainDays	14	15	17	7	7	6		14	9	8	3	1	0	0	0	0	0	0
MAX	0.52	0.50	0.54	0.26	2.59	0.58	NA	0.65	0.32	0.13	0.27	0.01	0.00	0.00	0.00	0.00	0.00	0.00
X-2D	0.71	0.87	0.58	0.35	2.63	0.58	NA	1.03	0.62	0.14	0.38	0.01	0.00	0.00	0.00	0.00	0.00	0.00
X-3D	1.09	0.88	0.60	0.35	2.97	0.58	NA	1.03	0.73	0.25	0.53	0.01	0.00	0.00	0.00	0.00	0.00	0.00
DryDays	17	15	14	24	23	25		16	22	23	27	30	0	0	0	0	0	0

NA No data collected at raingauge / Not available

* Rain gauge not present P partial data