

TR Stream Reach Summary

Study Reach: TR, Troublesome Creek - Immediately upstream of U.S Highway 40 downstream to Colorado River confluence.

Reach Description: Approximate channel length: 0.5 miles, approximate channel slope 0.4%.

Troublesome Creek is a 20 mile long tributary to the Colorado River, confluencing from the north in CR6 approximately 1 mile downstream of the bridge crossing on County Road 39 at the KB Ranch. Troublesome Creek flows north to south-southwest, paralleling County Road 2 for over 10 miles (road distance) immediately upstream of the U.S. Highway 40 crossing. Matheson Reservoir is located in the upper reaches of Troublesome and serves to release flows for the Pickering Ditch. Pickering Ditch is located approximately 12 to 13 miles upstream of U.S. Highway 40 and is the lower terminus for a reach with new instream flow recommendations recently proposed by BLM. The dominant land use on the lower reaches of the river is agriculture and the terrain is gently sloped with open meadows. The upper watershed is predominately public lands managed by BLM.



Troublesome Creek 1500 feet upstream of US Highway40



Troublesome Creek transect

Flow Recommendations:

Environmental Flow Methodology: CWCB instream flows are proposed for a 3 mile reach of Troublesome Creek beginning at the Pickering Ditch 12 miles upstream from U.S. Highway 40. A study site was also established by TetraTech in August 2008 on Troublesome Creek immediately upstream of U.S. Highway 40. Environmental flow targets were developed based upon a single riffle transect approach similar to that applied by CWCB. See Appendix A for methodology and Appendix E for survey information.

Water Users:

- Irrigators, municipalities and industry flow-related issues: none reported
- Recreation: None reported.

Summary of Flows:

Environmental, recommended target flow

- 13 cfs, summer
- 10 cfs, winter
- Flushing Flow – At least 130 cfs for a 3-day duration with a frequency of 1 in 2 years during the late May to late June period.

CWCB Flows (lower terminus approximately 10 miles upstream)

- 9.3 cfs summer (04/1 – 10/31)
- 5.9 cfs winter (11/1 – 03/31)

Water Users

- Irrigators, municipalities and industry: There are no local diversions between the study site, immediately upstream of U.S. Highway 9 and the confluence with the Colorado River. Upstream of the site, however, there are numerous diversions including the Pickering Ditch.
- Recreation: none reported.

Stream Assessments: In August 2008 Tetra Tech conducted two assessments in TR. These included the Stream Reach Inventory and Channel Stability Evaluation (SRI/CSE) and the EPA Habitat Quality Assessment (HQA). The SRI/CSE scored a 106, “fair” condition, while the HQA scored a 117, “suboptimal” condition. Relevant issues revealed in the stream assessments were marginal aquatic habitat structure and significant stream bank erosion. Results of the assessments are summarized in the following table. Details and methodology are presented in Appendix A.

Reach TR Stream Assessments					
Stream Reach Inventory/Channel Stability Evaluation			EPA Habitat Quality Assessment		
Attribute			Attribute		Score
Upper Banks			Channel		
1	Landform Slope	2	1	Aquatic Habitat Barriers/ Diversion	18
2	Mass wasting hazard	10	2	Aquatic Structure as Cover	6
3	Debris Jam Potential	2	3	Velocity/ Depth Regimes	11
4	Vegetation Cover	6	4	Channel Flow Status	13
Upper Bank Score:		20	5	Channel Alteration	11
Lower Banks			6	Frequency of Riffles	16
5	Channel Capacity	3	7	Channel Sinuosity	10
6	Bank Rock Content	8	Channel Score		85
7	Flow obstructors & Deflectors	6	Banks		
8	Cutting	12	8	Bank Stability	8
9	Deposition	12	9	Riparian Vegetation Cover and Disturbance	12
Lower Bank Score:		41	10	Riparian Vegetation zone width	12
Channel Bottom			Bank Score		32
10	Rock Angularity	3	Total Score		117
11	Brightness	3	Notes		
12	Consolidation/Particle Packing	6			
13	Bottom size distribution	12			
14	Bed Scour and Deposition	18			
15	Clinging Aquatic Veg	3			
Channel Bottom Score:		45			
Total Score:		106			

Spawning Observations: No trout spawning survey was conducted on Troublesome Creek.

Hydrologic Records: USGS Gage Station 09040500 was operated near the mouth of Troublesome Creek from 1905 to 1956. Inspection of the streamflow exceedence plots and the IHA analyses indicate the recommended target flows have been commonly available historically.

Water Temperature: TR is a Tier I stream reach as designated by CDPHE with a chronic temperature standard of 17°C MWAT and an acute temperature standard of 21.2°C DM. No water temperature data is available for this reach. However, given the elevation and environment of reach TR, water temperatures are likely supportive of a cold-water fishery.

Water Quality: No water quality data were reviewed for this reach.

Water Supply Issues (UPCO): No water supply issues are reported for this reach.

Summary of Results and Additional Remarks:

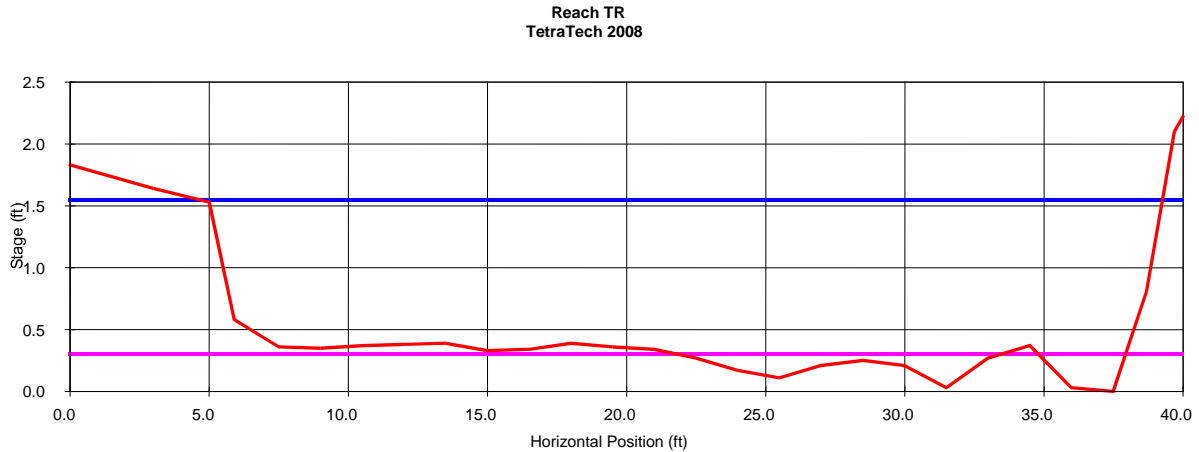
1. Recommended environmental target flows are relatively consistent with CWCB instream flows and appear to be commonly available, based on historic record.
2. Within the study reach the aquatic habitat structure is marginal and significant stream bank erosion has occurred.

Restoration Opportunities: Troublesome Creek could benefit from stream bank restoration and other habitat improvement measures, however, no specific recommendations are made at this time.

Monitoring: No recommendations are made at this time.

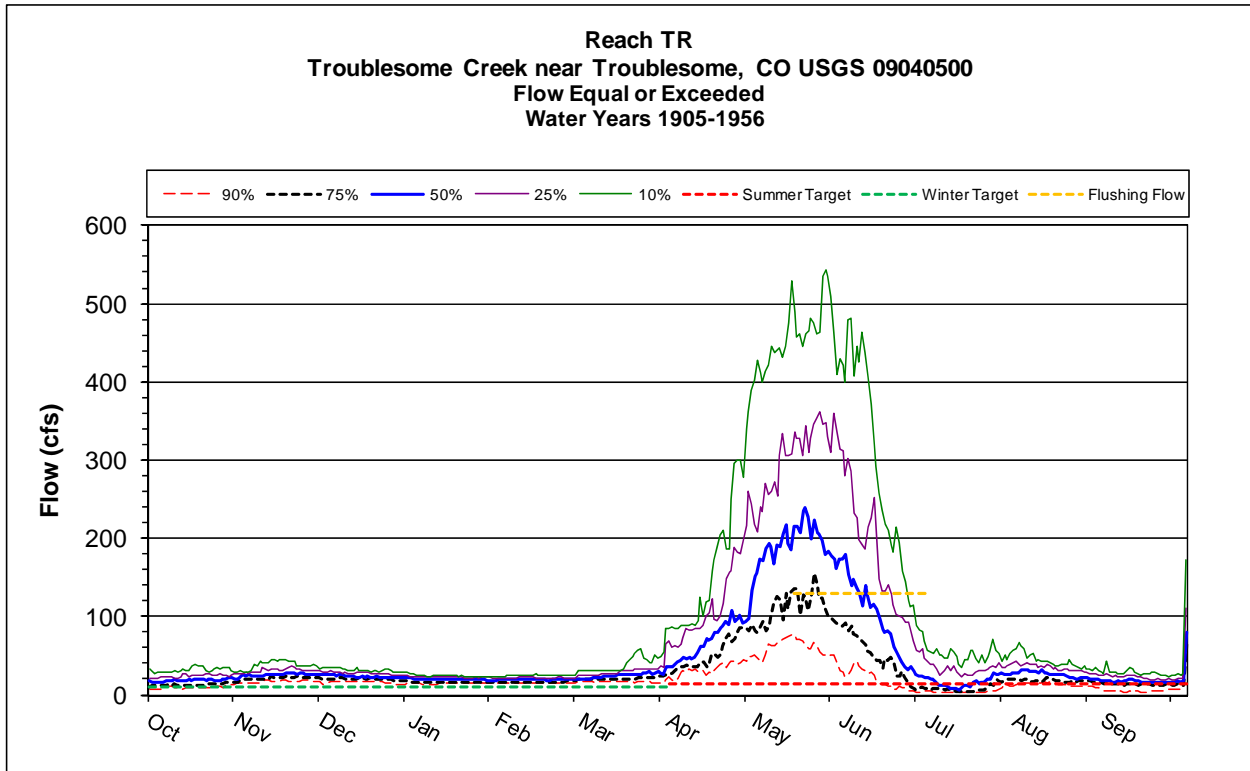
Support Data

Transect Hydraulics-Flow Relationships:



Reach TR										
TT2008 Site										
Resistance Method: Manning's n										
STAGE	AREA	PERIM	WIDTH	R	DHYD	SLOPE	n	VAVG	Q	SHEAR
(ft)	(sqft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)		(ft/s)	(cfs)	(psf)
0.3	2.0	14.9	14.7	0.13	0.13	0.005	0.060	0.45	0.9	0.04
0.4	4.1	31.1	30.9	0.13	0.13	0.005	0.057	0.49	2.0	0.04
0.5	7.2	32.0	31.8	0.23	0.23	0.006	0.055	0.76	5.5	0.08
0.6	10.5	32.8	32.5	0.32	0.32	0.006	0.052	1.03	10.7	0.12
0.7	13.7	33.1	32.7	0.41	0.42	0.006	0.050	1.32	18.1	0.16
0.8	17.0	33.4	33.0	0.51	0.52	0.007	0.047	1.63	27.8	0.21
0.9	20.3	33.7	33.2	0.60	0.61	0.007	0.045	1.98	40.2	0.26
1.0	23.6	34.0	33.3	0.70	0.71	0.007	0.042	2.37	55.9	0.31
1.1	27.0	34.2	33.5	0.79	0.80	0.008	0.040	2.8	75.4	0.37
1.2	30.3	34.5	33.7	0.88	0.90	0.008	0.037	3.28	99.6	0.43
1.3	33.7	34.8	33.9	0.97	1.00	0.008	0.034	3.84	129.5	0.5
1.4	37.1	35.0	34.0	1.06	1.09	0.009	0.032	4.49	166.5	0.56
1.5	40.5	35.3	34.2	1.15	1.18	0.009	0.029	5.25	212.5	0.63
1.6	42.2	35.8	34.6	1.18	1.22	0.009	0.028	5.64	238.2	0.66

Hydrographs and Exceedence Plots and Tables



IHA Results

Non-Parametric IHA Scorecard		
Troublesome Creek near Troublesome, Co		
USGS 09040500		
Period of Analysis: 1905-1956 (23 years)		
NormalizationFactor	1	
Mean annual flow	51.91	
Non-Normalized Mean Flow	51.91	
Annual C. V.	1.6	
Flow predictability	0.62	
Constancy/predictability	0.59	
% of floods in 60d period	0.39	
Flood-free season	96	
	Medians	Coeff. of Disp.
Parameter Group #1		
October (cfs)	18	0.6667
November (cfs)	25	0.38
December (cfs)	22	0.3182
January (cfs)	19	0.3684
February (cfs)	19.5	0.2564
March (cfs)	25	0.36
April (cfs)	73	0.726
May (cfs)	208	0.5337
June (cfs)	90.5	1.088
July (cfs)	16	1.563
August (cfs)	24	0.625
September (cfs)	17	0.3824
Parameter Group #2		
1-day minimum (cfs)	5	1.92
3-day minimum (cfs)	5.567	1.886
7-day minimum (cfs)	6.414	1.759
30-day minimum (cfs)	10.68	1.008
90-day minimum (cfs)	16.72	0.4217
1-day maximum (cfs)	420	0.6905
3-day maximum (cfs)	409.3	0.6922
7-day maximum (cfs)	374.1	0.7178
30-day maximum (cfs)	251.6	0.5095
90-day maximum (cfs)	152.3	0.509
Number of zero days (count)	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.1084	1.266
Parameter Group #3		
Date of minimum (Julian day)	201	0.224
Date of maximum (Julian day)	142	0.05191
Parameter Group #4		
Low pulse count (#)	7	1.143
Low pulse duration (days)	5.25	0.8571
High pulse count (#)	6	0.6667
High pulse duration (days)	3	0.8333
The low pulse threshold is (cfs)	18	
The high pulse threshold is (cfs)	38	
Parameter Group #5		
Rise rate (cfs difference between consecutive days)	3	1
Fall rate (cfs difference between consecutive days)	-3	-0.6667
Number of reversals	85	0.4471

IHA Percentile Data						
Troublesome Creek near Troublesome, Co						
USGS 09040500						
Period of Analysis: 1905-1956						
	10%	25%	50%	75%	90%	(75-25)/50
Parameter Group #1						
October (cfs)	10.1	12	18	24	28	0.6667
November (cfs)	16.9	21	25	30.5	35.2	0.38
December (cfs)	16.4	20	22	27	29.6	0.3182
January (cfs)	13.8	15	19	22	23.6	0.3684
February (cfs)	14.4	16	19.5	21	23.6	0.2564
March (cfs)	16.2	20	25	29	30	0.36
April (cfs)	34.7	43	73	96	119.3	0.726
May (cfs)	81.4	129	208	240	354.8	0.5337
June (cfs)	19.3	40.5	90.5	139	244.8	1.088
July (cfs)	4	6	16	31	41.2	1.563
August (cfs)	13.4	18	24	33	35.6	0.625
September (cfs)	4.3	14	17	20.5	26.2	0.3824
Parameter Group #2						
1-day minimum (cfs)	1.28	2.4	5	12	15.6	1.92
3-day minimum (cfs)	1.34	2.833	5.567	13.33	16	1.886
7-day minimum (cfs)	1.674	3	6.414	14.29	16.29	1.759
30-day minimum (cfs)	3.753	5.167	10.68	15.93	18.8	1.008
90-day minimum (cfs)	9.971	13.66	16.72	20.71	22.38	0.4217
1-day maximum (cfs)	162.4	260	420	550	667.2	0.6905
3-day maximum (cfs)	145.9	254.7	409.3	538	618.1	0.6922
7-day maximum (cfs)	134.5	225.7	374.1	494.3	545.6	0.7178
30-day maximum (cfs)	107	182.8	251.6	311	434.2	0.5095
90-day maximum (cfs)	67.61	94.51	152.3	172	243.1	0.509
Number of zero days (count)	0	0	0	0	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.04887	0.07719	0.1084	0.2144	0.2673	1.266
Parameter Group #3						
Date of minimum (Julian day)	176.2	193	201	275	290	0.224
Date of maximum (Julian day)	121.6	129	142	148	153.6	0.05191
Parameter Group #4						
Low pulse count (#)	2	3	7	11	13	1.143
Low pulse duration (days)	2	3	5.25	7.5	22.95	0.8571
High pulse count (#)	1.8	4	6	8	10.6	0.6667
High pulse duration (days)	1.2	2	3	4.5	47.6	0.8333
Parameter Group #5						
Rise rate (cfs difference between consecutive days)	1.22	2	3	5	7.3	1
Fall rate (cfs difference between consecutive days)	-5	-4	-3	-2	-1.64	-0.6667
Number of reversals	52	59	85	97	112.8	0.4471
EFC Monthly Low Flows						
October Low Flow (cfs)	14	15.75	20.5	24.25	29.05	0.4146
November Low Flow (cfs)	17.2	21	25	28	31.8	0.28
December Low Flow (cfs)	20	20	22.5	27	29.4	0.3111
January Low Flow (cfs)	15	15.75	19.5	22	23.7	0.3205
February Low Flow (cfs)	15	16.75	19.75	21.25	23.7	0.2278
March Low Flow (cfs)	16.2	20	24	27	30	0.2917
April Low Flow (cfs)	21.95	29	32	34.75	36	0.1797
May Low Flow (cfs)	28.5	28.5	32	33	33	0.1406
June Low Flow (cfs)	18.85	22.25	26	28.63	33.8	0.2452
July Low Flow (cfs)	18.65	20.38	23.5	30	32	0.4096
August Low Flow (cfs)	15.4	20	24.5	31	33.8	0.449
September Low Flow (cfs)	14.2	16.25	18	21.75	26.6	0.3056
EFC Parameters						
Extreme low peak (cfs)	6.28	8.8	9.45	11	12	0.2328
Extreme low duration (days)	1.9	3	5	13.75	21.15	2.15
Extreme low timing (Julian date)	195.9	200.8	221.3	271.3	293.5	0.1926
Extreme low freq. (#/year)	0	1	2	6	7.6	2.5
High flow peak (cfs)	41.2	42.75	47	53	80.7	0.2181
High flow duration (days)	1	1.25	2	3.5	6.5	1.125
High flow timing (Julian date)	111.3	158	204.5	224	311.4	0.1803
High flow frequency (#/year)	0.8	3	5	7	10	0.8
High flow rise rate (cfs difference between consecutive days)	4.1	5.667	7.768	9.875	14.53	0.5418
High flow fall rate (cfs difference between consecutive days)	-10.78	-7.569	-6.5	-5.25	-3.933	-0.3568
Small Flood peak (cfs)	421.4	438.5	519	604	654.4	0.3189
Small Flood duration (days)	60.8	71.75	80.5	86.5	92.5	0.1832
Small Flood timing (Julian date)	124	127.8	145	151.5	156.9	0.06489
Small Flood freq. (#/year)	0	0	0	1	1	0
Small Flood riserate (cfs difference between consecutive days)	6.675	10.96	12.19	13.88	17.52	0.2394
Small Flood fallrate (cfs difference between consecutive days)	-26.07	-19.72	-14.52	-8.758	-6.992	-0.755
Large flood peak (cfs)	672	672	781	890	890	0.2791
Large flood duration (days)	70	70	81	92	92	0.2716
Large flood timing (Julian date)	126	126	130.5	135	135	0.02459
Large flood freq. (#/year)	0	0	0	0	0.6	0
Large flood riserate (cfs difference between consecutive days)	22.75	22.75	26.06	29.38	29.38	0.2543
Large flood fallrate (cfs difference between consecutive days)	-14.84	-14.84	-14.07	-13.31	-13.31	-0.1083

