



COLORADO

Parks and Wildlife

Department of Natural Resources

Aquatic Wildlife Section
6060 Broadway
Denver, CO 80216

January 7, 2026

Rob Viehl, Section Chief
Stream and Lake Protection Section
Colorado Water Conservation Board
1313 Sherman Street, 7th Floor
Denver, CO 80203

Re: Instream Flow Recommendations for Streams in Water Division 6, Garfield County;
Bear Creek, to be presented at the January 2026 CWCB Meeting

Dear Mr. Viehl:

The information contained within and referred to in this letter forms the scientific and biological basis for an instream flow (ISF) recommendation on Bear Creek in Water Division 6. Field investigations relating to this ISF recommendation were initiated by Colorado Parks and Wildlife (CPW) staff in 2018. Bear Creek is a first order stream that supports a recreational trout fishery. This ISF recommendation was first presented to interested parties at the ISF Workshop in January 2017. CPW and CWCB staff conducted outreach to the Garfield County Commissioners on numerous occasions, but most recently in 2025. It is CPW staff's opinion that the information contained in this letter is sufficient for the CWCB's staff to recommend an ISF appropriation to the Board on Bear Creek as it specifically addresses the findings required in Rule 5(i) of the Instream Flow Program Rules.

CPW participates in the ISF Program and develops ISF recommendations for the Board's consideration in an effort to address CPW's legislative directives "... that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" [§33-1-101 (1) C.R.S.], and "... that the natural,



Laura Clellan, Acting Director, Colorado Parks and Wildlife
Parks and Wildlife Commission: Richard Reading, Chair · James 'Jay' Tutchton, Vice-Chair · Eden Vardy, Secretary · Jessica Beaulieu Frances Silva
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scenic, scientific, and outdoor recreation areas ... be protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and (its) visitors ... and that, to carry out such program and policy, there shall be a continuous operation of acquisition, development, and management of ... lands, waters, and facilities.” [§33-10-101 (1) C.R.S.].

In addition to these broad statutory guidelines, CPW’s strategic planning document (CPW Strategic Plan, 2015) explains the agency’s current goals to, “[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems” in order to, “protect and enhance water resources for fish and wildlife populations,” by pursuing, “partnerships and agreements to enhance instream flows, protect reservoir levels, and influence water management activities,” and to, “[a]dvocate for water quality and quantities to conserve aquatic resources.” In addition to the CPW Strategic Plan, the agency’s fish and wildlife conservation activities are also informed by the State Wildlife Action Plan (2015, updated 2025). The aforementioned documents direct CPW to advocate for the preservation of the state’s fish and wildlife resources and natural environment, and therefore link CPW’s mission to the goals and priorities of CWCB’s Instream Flow and Natural Lake Level Program.

Recommended Segments & Land Status

CPW is proposing an ISF recommendation on Bear Creek from its headwaters (13T 307143 4438575) to the confluence with the North Fork White River (13T 307143 4438575). The reach is 3.1 miles in length. Approximately 90% of the proposed reach is on White River National Forest on lands managed as the Flat Tops Wilderness. Approximately 0.3 miles near the confluence of the North Fork White River is on private lands owned by the Rio Blanco Ranch.

Natural Environment and Biological Summary

Bear Creek is a tributary of the North Fork White River located east of the Town of Meeker. Its headwaters originate at over 10,600 feet in the Flat Tops Wilderness. Hydrology is influenced by snowmelt runoff with stable baseflows following spring runoff. Average annual precipitation in the basin is approximately 34 inches. The watershed is approximately 3.3 square miles of densely forested land cover containing stands of aspen, lodgepole pine, spruce, and conifer. Bear Creek supports a healthy riparian area with abundant plants and mosses. Upland and riparian communities support ample overhead cover and shading of the stream.

Bear Creek is a first to second order stream that is moderate to high gradient. The channel type is typical of a headwaters stream with an entrenched V-shaped channel and large substrate that ranges from coarse gravels to small boulders. Large substrate in the channel creates pocket pool habitat for fish. The channel is mainly single

thread with some side channel formation. There is considerable large wood in the creek, which supports habitat complexity, shading, and nutrient cycling. Much of the aquatic habitat observed by CPW staff includes high gradient riffles, cascades, and pool features that offer good holding habitat. Fish sampling conducted by CPW in 2015 indicates the stream supports a brook trout fishery.

R2Cross Background

Initial biological instream flow rates were developed using the R2Cross methodology (CWCB, 2024¹). R2Cross uses field data that has been collected in a riffle habitat type. Riffles are often the limiting habitat features in streams during low flow events, so maintaining specific hydraulic conditions across riffle habitat types will also maintain aquatic habitat in pools and runs for most life stages of fish and macroinvertebrates (Nehring, 1979²). The R2Cross model uses field data, including a survey of cross-sectional channel geometry, a longitudinal slope of the water surface, and a flow measurement as input to a single transect hydraulic model. R2Cross uses Ferguson’s Variable-Power Equation (Ferguson, 2007³) to model a stage-discharge relationship and compute corresponding hydraulic parameters of average depth, average velocity, and percent wetted perimeter over modeled stages. Maintaining these three hydraulic parameters at specified levels should ensure conditions that allow movement of fish longitudinally across riffles and adequate depths, velocities, and oxygenation for production of macroinvertebrates and development of trout eggs. Baseflow recommendations are typically developed based on the flows that meet two of three hydraulic criteria and summer flow recommendations are based on hydraulic criteria that meet three of three hydraulic criteria (as described in Nehring 1979 and CWCB 2024).

In 2018, CPW collected two cross-section data sets on Bear Creek. The results of the R2Cross analysis are summarized below.

	Bankful l Top Width	Date Surveyed	Flow measured	Flow Meeting Two Criteria	Flow Meeting Three Criteria
1	10.1’	8/1/2018	1.6 cfs	0.96 cfs	2.47 cfs
2	8.85’	8/1/2018	1.6 cfs	0.34 cfs	3.23 cfs

¹Colorado Water Conservation Board, 2024, R2Cross field manual. <https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf>

²Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

³ Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. <https://doi.org/10.1029/2006WR005422>

Recommended Biological Flow Rates	0.65 cfs	2.85 cfs
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Based on these cross-sections, the biological flow recommendation is 0.65 cfs during the baseflow period. This rate will support adequate wetted perimeter and depth necessary to overwinter fish. The biological flow recommendation during the high flow period is 2.9 cfs (rounded). This flow rate supports sufficient average velocity of 1.0 feet per second (fps), as well as average depth of 0.2 feet, and at least 50 percent wetted perimeter of the stream channel.

Water Availability

In order to make a preliminary determination whether water is available for the biological flow recommendations and to determine the appropriate seasonal transition dates, CPW examined basic hydrologic data and water rights information for the North Fork White River. Median hydrology was analyzed by CWCB staff using prorated gage data from the historic gage on the North Fork White River (USGS 09302420 “North Fork White River above Ripple Creek near Trappers Lake”). This gage operated between 1965 to 1973. Additionally, CPW is aware of the following water rights within the reach: Bear Creek Ditch (WDID: 4300534) decreed for 3.5 cfs (absolute). Diversions were accounted for by subtracting diversion records from the prorated gage data.

Final Flow Recommendations

CPW’s analysis indicates that the following flows are needed to protect the natural environment to a reasonable degree. Based on median hydrology results, there is sufficient water available to meet the biological flow recommendations with slight reductions during the late summer period of August through September. Therefore CPW’s flow recommendations are the following:

- **Summer Flow Recommendation (May 1 through July 31): 2.9 cfs**
 - This flow rate supports adequate depth, velocity, and wetted perimeter, which will support habitat availability in riffles, pools, glides, and runs. Ample habitat availability is beneficial to fish during the summer when they are active feeding and moving longitudinally throughout the channel.
- **Late Summer Flow Recommendation (August 1 through September 30): 2.4 cfs**
 - This flow rate will support sufficient depth and wetted perimeter, as well as moderate velocities (below 1.0 fps). Most trout growth occurs during summer, following peak runoff, when longer days and warmer water temperatures facilitate growth. Late summer is an important period for fish, so increased aquatic habitat availability for fish and

macroinvertebrates is beneficial from August through the end of September.

- Baseflow Recommendation (October 1 through April 30): **0.65 cfs**
 - This flow rate supports adequate wetted perimeter and depth in the channel to provide sufficient habitat availability and areas of holding habitat necessary to overwinter fish. Maintaining depth and wetted perimeter criteria will also support longitudinal movement of fish as they transition from overwintering habitat during the spring.

The purpose of this letter is to formally transmit this ISF recommendation to CWCB for the Board's consideration. Based on CPW's opinion, there is a flow-dependent natural environment in Bear Creek that can be preserved to a reasonable degree with an ISF water right in the recommended rates. Please refer to attachments which include; R2Cross field forms, R2Cross output, fish survey information, and photographs at each cross section location.

CPW personnel will be available at the January 2026 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Katie Birch Digitally signed by Katie Birch
Date: 2026.01.07 12:20:35
-07'00'

Katie Birch, CPW Instream Flow Program Coordinator



Bear Creek Fish Data

Water **25797** **Bear Creek**
Station **WR0232** **ABV Trappers Lake Rd**

Date **4/23/2015**

Drainage **White River** UtmX **303884** UtmY **4435325** Elevation **2652 m**
Length **70 m** Width **6.10 m** Area **0.04 Ha**
Surveyors **RCR, TH**
Gear **BPEF** Effort **2.00** Metric **PASS** Protocol **TWO-PASS REMOVAL**
Total catch **11**

Species	Count	Length (mm)	Weight (gm)	Status	Mark	Tag ID	Habitat
BRK	1	194		1			
BRK	1	103		1			
BRK	1	126		1			
BRK	1	195		1			
BRK	1	111		1			
BRK	1	62		1			
BRK	1	104		1			
BRK	1	120		2			
BRK	1	158		2			
BRK	1	123		2			
BRK	1	190		2			

Notes: Equipment test on BRK stream.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: _____				CROSS-SECTION NO.: _____				DATE: _____		SHEET ____ OF ____		
BEGINNING OF MEASUREMENT		EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)				LEFT / RIGHT		Gage Reading: _____ ft		TIME: _____		
Features	Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
① Upper		0.6		3.02								
	G	1.6		3.53								
	WL	2.3		4.80								
		3.0		5.03	0.10					0		
		3.5		5.07	0.20					1.27		
		4.0		5.22	0.30					1.43		
		4.5		5.51	0.60					0.69		
		5.0		5.50	0.60					0.78		
		5.5		5.33	0.30					0.80		
		6.0		5.21	0.30					0.68		
		6.5		4.95	0.05					—		
		7.0		5.22	0.3					1.33		
		7.5		5.25	0.25					0.62		
	R	8.0		5.06	0.15					—		
		8.5		5.13	0.2					0.77		
		9.0		5.08	0.1					1.01		
		9.5		5.04	0.1					0.79		
		10.0		5.22	0.3					0.64		
		10.5		5.20	0.3					0.37		
		11.0		4.95	0.05					—		
	WL	11.2		4.89	∅					—		
		11.4		3.96								Q=1.6
	G	11.7		3.61								
		12.7		3.21								
② Lower		∅		4.02								
	GL	1.5		6.9								
	WL	2.6		7.90	∅							
		3.0		8.06	0.15					10.0		7.51
		3.5		8.23	0.3					10.5		6.64
		4.0		8.22	0.3					11.5		5.59
		4.5		8.08	0.2					13.0		5.13
		5.0		8.15	0.25							
		5.5		8.40	0.5							
		6.0		8.49	0.35							
		6.5		8.28	0.35							
		7.0		8.31	0.45							
		7.5		8.47	0.10							
		8.0		8.45	0.55							
		8.5		8.24	0.35							
	WL	9.0		8.07	0.15							
	WL	9.0		7.94	∅							
TOTALS:												

End of Measurement

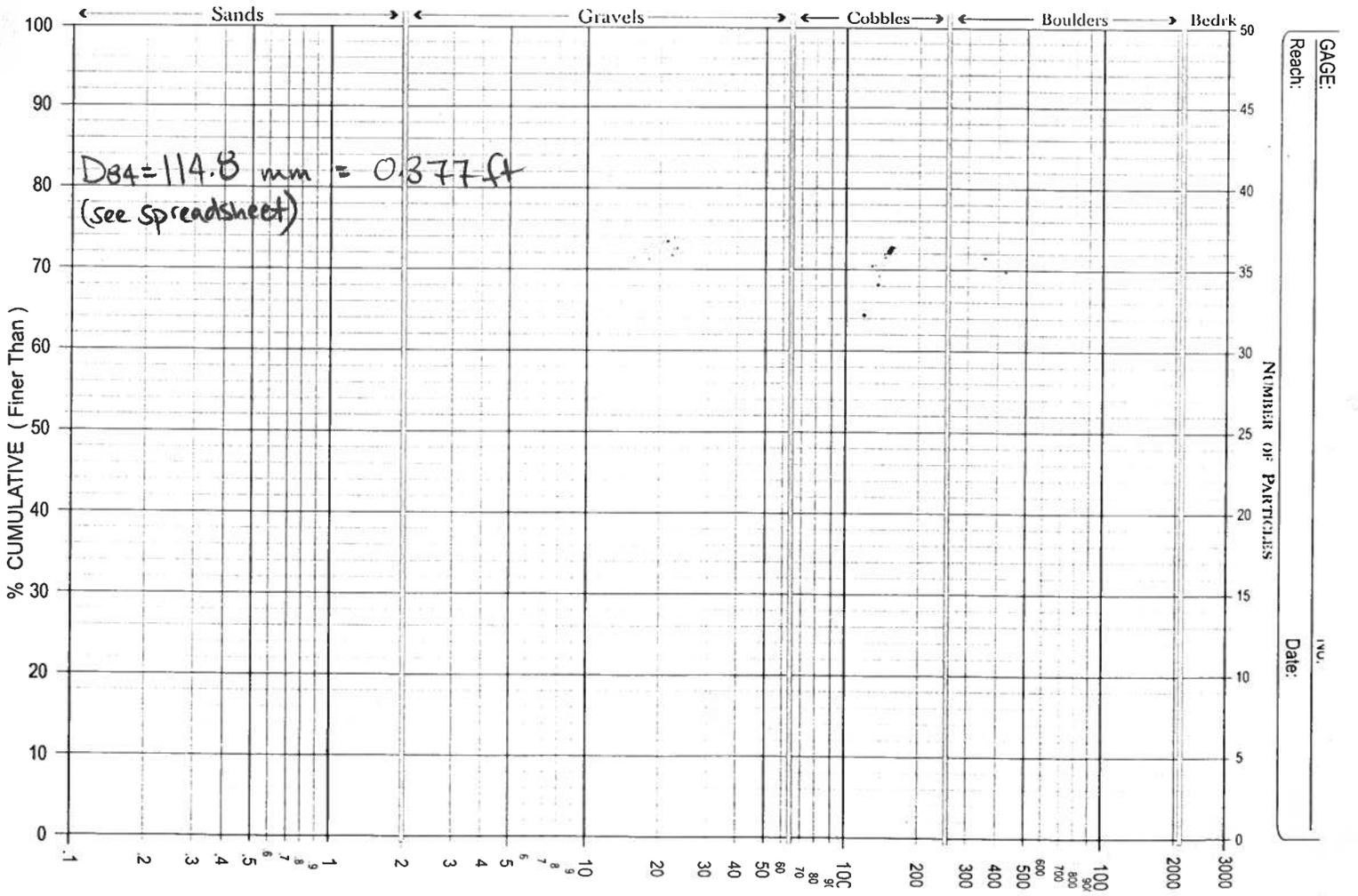
Time: _____

Gage Reading: _____ ft

CALCULATIONS PERFORMED BY: _____

CALCULATIONS CHECKED BY: _____

PEBBLE COUNT			PEBBLE COUNT			PEBBLE COUNT								
Site: Bear CK			Reach:			Reach:			Reach:					
Party:			Date: 8/1/18			Date:			Date:					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			1	2	3									
	Silt / Clay	< .062												
	Very Fine	.062 - .125												
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4												
.16 - .22	Fine	4 - 5.7												
.22 - .31	Fine	5.7 - 8												
.31 - .44	Medium	8 - 11.3												
.44 - .63	Medium	11.3 - 16												
.63 - .89	Coarse	16 - 22.6												
.89 - 1.26	Coarse	22.6 - 32												
1.26 - 1.77	Very Coarse	32 - 45												
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90												
3.5 - 5.0	Small	90 - 128												
5.0 - 7.1	Large	128 - 180												
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →														

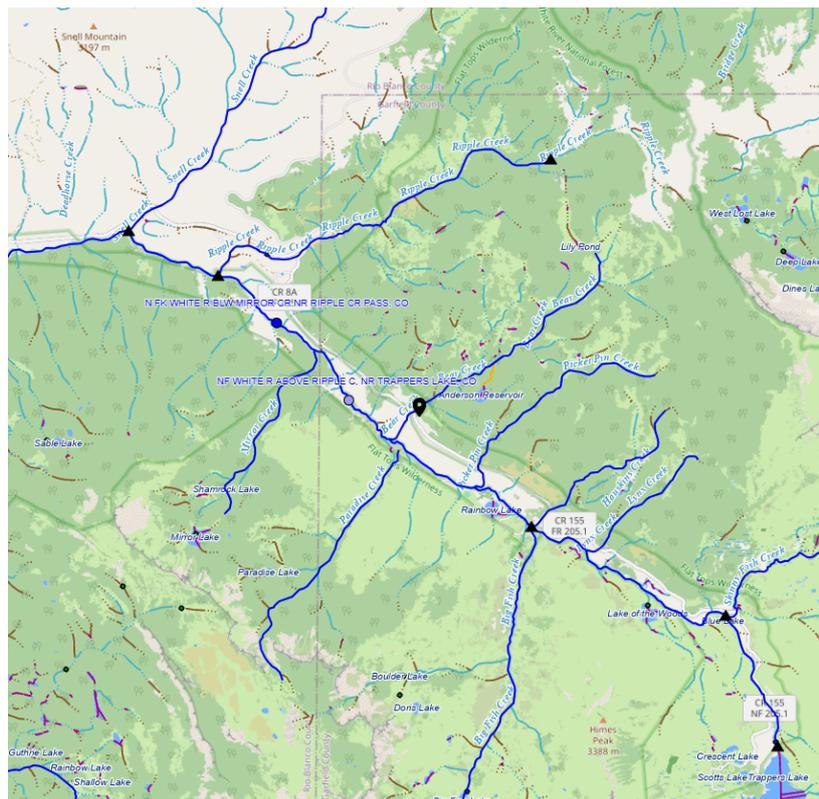


GAGE: _____
 Reach: _____
 Date: _____
 No. _____

R2Cross RESULTS

Stream Name: Bear Creek
Stream Locations: Above FS Road
Fieldwork Date: 08/01/2018
Cross-section: 1
Observers: Birch May Antonelli
Coordinate System: UTM Zone 13
X (easting): 303960
Y (northing): 4435361
Date Processed: 07/11/2025
Slope: 0.089
Discharge: R2Cross data file: 1.6 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: R2CrossData_Bear1-8-1-2018 - checked upper.xlsx
R2Cross version: 2.0.4

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 10.06

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.96
Percent Wetted Perimeter (%)	50.0	0.38
Mean Velocity (ft/s)	1.0	2.47

STAGING TABLE

Feature	Distance to Water (ft)	Top Width (ft)	Mean Depth (ft)	Maximum Depth (ft)	Area (sq ft)	Wetted Perimeter (ft)	Percent Wetted Perimeter	Hydraulic Radius (ft)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	3.6	10.06	1.44	1.91	14.49	12.15	100.0	1.19	0.06	7.75	112.26
	3.63	10.03	1.42	1.88	14.23	12.08	99.48	1.18	0.06	7.63	108.56
	3.68	9.96	1.38	1.83	13.73	11.96	98.48	1.15	0.07	7.39	101.49
	3.73	9.89	1.34	1.78	13.24	11.84	97.47	1.12	0.07	7.15	94.65
	3.78	9.82	1.3	1.73	12.74	11.72	96.47	1.09	0.07	6.91	88.04
	3.83	9.75	1.26	1.68	12.26	11.6	95.46	1.06	0.07	6.66	81.67
	3.88	9.68	1.22	1.63	11.77	11.47	94.46	1.03	0.07	6.42	75.52
	3.93	9.61	1.17	1.58	11.29	11.35	93.45	0.99	0.07	6.17	69.61
	3.98	9.55	1.13	1.53	10.81	11.23	92.48	0.96	0.07	5.91	63.89
	4.03	9.51	1.09	1.48	10.33	11.13	91.59	0.93	0.07	5.65	58.34
	4.08	9.47	1.04	1.43	9.86	11.02	90.7	0.89	0.08	5.38	53.03
	4.13	9.44	0.99	1.38	9.38	10.91	89.81	0.86	0.08	5.11	47.95
	4.18	9.4	0.95	1.33	8.91	10.8	88.92	0.83	0.08	4.84	43.11
	4.23	9.36	0.9	1.28	8.45	10.69	88.02	0.79	0.08	4.56	38.52
	4.28	9.32	0.86	1.23	7.98	10.58	87.13	0.75	0.09	4.28	34.18
	4.33	9.28	0.81	1.18	7.51	10.48	86.24	0.72	0.09	4.01	30.1
	4.38	9.24	0.76	1.13	7.05	10.37	85.35	0.68	0.09	3.73	26.27
	4.43	9.21	0.72	1.08	6.59	10.26	84.46	0.64	0.1	3.44	22.7
	4.48	9.17	0.67	1.03	6.13	10.15	83.57	0.6	0.1	3.16	19.39
	4.53	9.13	0.62	0.98	5.67	10.04	82.68	0.56	0.11	2.88	16.35
	4.58	9.09	0.57	0.93	5.22	9.93	81.79	0.53	0.11	2.6	13.57
	4.63	9.05	0.53	0.88	4.76	9.83	80.9	0.48	0.12	2.32	11.07
	4.68	9.01	0.48	0.83	4.31	9.72	80.01	0.44	0.13	2.05	8.83
	4.73	8.98	0.43	0.78	3.86	9.61	79.11	0.4	0.14	1.78	6.86
	4.78	8.94	0.38	0.73	3.41	9.5	78.22	0.36	0.15	1.51	5.16

	4.83	8.84	0.34	0.68	2.97	9.34	76.9	0.32	0.16	1.27	3.76
	4.88	8.67	0.29	0.63	2.53	9.13	75.16	0.28	0.18	1.04	2.62
Waterline	4.93	8.4	0.25	0.58	2.1	8.83	72.7	0.24	0.21	0.83	1.74
	4.98	8.02	0.21	0.53	1.69	8.42	69.31	0.2	0.24	0.65	1.09
	5.03	7.58	0.17	0.48	1.3	7.93	65.31	0.16	0.28	0.48	0.62
	5.08	6.06	0.16	0.43	0.95	6.36	52.4	0.15	0.3	0.42	0.4
	5.13	4.47	0.15	0.38	0.69	4.7	38.72	0.15	0.3	0.41	0.28
	5.18	3.66	0.13	0.33	0.49	3.84	31.61	0.13	0.34	0.33	0.16
	5.23	2.4	0.14	0.28	0.33	2.52	20.73	0.13	0.33	0.35	0.12
	5.28	1.63	0.15	0.23	0.24	1.73	14.23	0.14	0.32	0.37	0.09
	5.33	1.34	0.12	0.18	0.16	1.41	11.65	0.12	0.37	0.28	0.05
	5.38	1.1	0.09	0.13	0.1	1.15	9.5	0.09	0.46	0.19	0.02
	5.43	0.86	0.06	0.08	0.05	0.9	7.4	0.06	0.64	0.11	0.01
	5.48	0.63	0.03	0.03	0.02	0.64	5.31	0.03	1.29	0.03	0.0
	5.5	0.54	0.01	0.01	0.01	0.55	4.49	0.01	2.94	0.01	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	1.6	(cfs)
Calculated Flow (Qc) =	1.66	(cfs)
$(Qm-Qc)/Qm * 100 =$	-3.96%	
Measured Waterline (WLM) =	4.84	(ft)
Calculated Waterline (WLC) =	4.93	(ft)
$(WLM-WLC)/WLM * 100 =$	-1.66%	
Max Measured Depth (Dm) =	0.6	(ft)
Max Calculated Depth (Dc) =	0.58	(ft)
$(Dm-Dc)/Dm * 100 =$	2.60%	
Mean Velocity =	0.79	(ft/s)
Manning's n =	0.215	
$0.4 * Qm =$	0.64	(cfs)
$2.5 * Qm =$	4	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0.6	3.02		
Bankfull	1.6	3.53		
Waterline	2.3	4.8	0	0
	3	5.03	0.1	0
	3.5	5.07	0.2	1.27
	4	5.22	0.3	1.43
	4.5	5.51	0.6	0.69
	5	5.5	0.6	0.78
	5.5	5.33	0.3	0.8
	6	5.21	0.3	0.68
	6.5	4.95	0.05	0
	7	5.22	0.3	1.33
	7.5	5.25	0.25	0.62
	8	5.06	0.15	0
	8.5	5.13	0.2	0.77
	9	5.08	0.1	1.01
	9.5	5.04	0.1	0.79
	10	5.22	0.3	0.64
	10.5	5.2	0.3	0.37
	11	4.95	0.05	0
Waterline	11.2	4.89	0	0
	11.4	3.96		
Bankfull	11.7	3.6		
	12.7	3.21		

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (ft ²)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.74	0.1	0.06	0	0
0.5	0.2	0.1	0.13	7.94
0.52	0.3	0.15	0.21	13.41
0.58	0.6	0.3	0.21	12.94
0.5	0.6	0.3	0.23	14.62
0.53	0.3	0.15	0.12	7.5
0.51	0.3	0.15	0.1	6.38
0.56	0.05	0.03	0	0
0.57	0.3	0.15	0.2	12.47
0.5	0.25	0.12	0.08	4.84
0.53	0.15	0.07	0	0
0.5	0.2	0.1	0.08	4.81
0.5	0.1	0.05	0.05	3.16
0.5	0.1	0.05	0.04	2.47
0.53	0.3	0.15	0.1	6
0.5	0.3	0.15	0.06	3.47
0.56	0.05	0.02	0	0
0.21	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

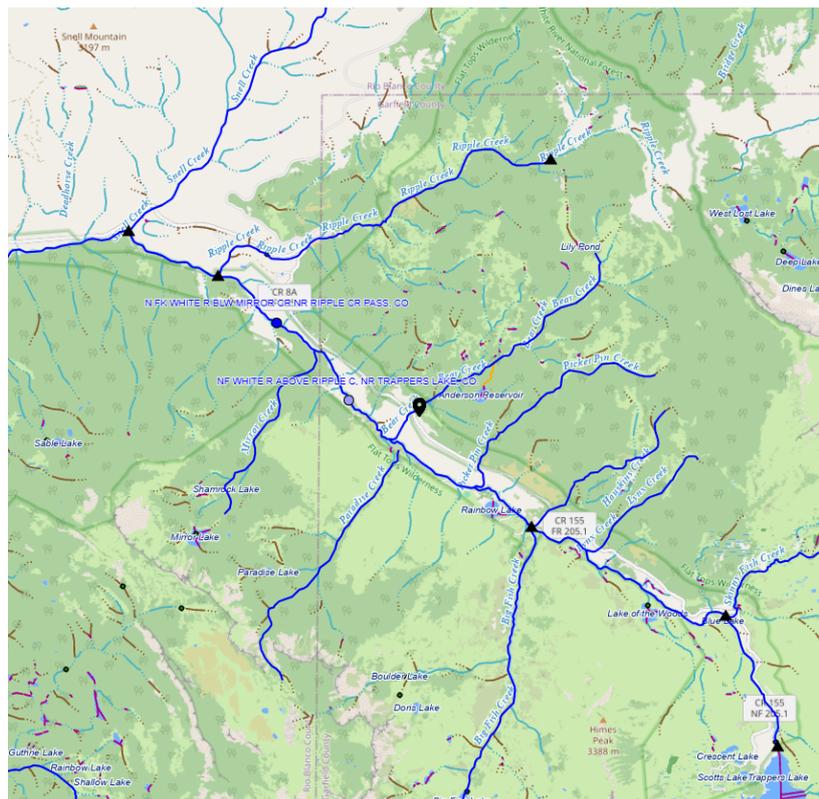
DISCLAIMER

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R2Cross RESULTS

Stream Name: Bear Creek
Stream Locations: Above FS Road
Fieldwork Date: 08/01/2018
Cross-section: 2
Observers: Birch May Antonelli
Coordinate System: UTM Zone 13
X (easting): 303960
Y (northing): 4435361
Date Processed: 07/11/2025
Slope: 0.089
Discharge: R2Cross data file: 1.6 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: R2CrossData_Bear2-8-1-2018 - chekced lower.xlsx
R2Cross version: 2.0.4

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 8.85

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.34
Percent Wetted Perimeter (%)	50.0	0.22
Mean Velocity (ft/s)	1.0	3.23

STAGING TABLE

Feature	Distance to Water (ft)	Top Width (ft)	Mean Depth (ft)	Maximum Depth (ft)	Area (sq ft)	Wetted Perimeter (ft)	Percent Wetted Perimeter	Hydraulic Radius (ft)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	6.9	8.85	1.15	1.59	10.21	10.1	100.0	1.01	0.13	3.43	35.04
	6.9	8.85	1.15	1.59	10.18	10.09	99.91	1.01	0.13	3.42	34.84
	6.95	8.76	1.11	1.54	9.74	9.96	98.61	0.98	0.13	3.28	31.9
	7.0	8.68	1.07	1.49	9.3	9.83	97.3	0.95	0.14	3.13	29.09
	7.05	8.59	1.03	1.44	8.87	9.69	95.99	0.92	0.14	2.98	26.43
	7.1	8.51	0.99	1.39	8.44	9.56	94.68	0.88	0.14	2.83	23.91
	7.15	8.43	0.95	1.34	8.02	9.43	93.38	0.85	0.15	2.68	21.52
	7.2	8.34	0.91	1.29	7.6	9.3	92.07	0.82	0.15	2.54	19.26
	7.25	8.26	0.87	1.24	7.18	9.17	90.76	0.78	0.16	2.39	17.15
	7.3	8.18	0.83	1.19	6.77	9.03	89.46	0.75	0.16	2.24	15.16
	7.35	8.09	0.79	1.14	6.37	8.9	88.15	0.72	0.17	2.09	13.31
	7.4	8.01	0.74	1.09	5.96	8.77	86.84	0.68	0.18	1.94	11.59
	7.45	7.92	0.7	1.04	5.57	8.64	85.53	0.64	0.18	1.8	10.0
	7.5	7.84	0.66	0.99	5.17	8.51	84.23	0.61	0.19	1.65	8.54
	7.55	7.68	0.62	0.94	4.78	8.31	82.33	0.58	0.2	1.52	7.28
	7.6	7.51	0.59	0.89	4.4	8.11	80.34	0.54	0.21	1.4	6.15
	7.65	7.34	0.55	0.84	4.03	7.91	78.35	0.51	0.22	1.27	5.14
	7.7	7.17	0.51	0.79	3.67	7.71	76.36	0.48	0.23	1.15	4.23
	7.75	7.0	0.47	0.74	3.32	7.51	74.37	0.44	0.25	1.03	3.42
	7.8	6.82	0.44	0.69	2.97	7.31	72.38	0.41	0.27	0.91	2.71
	7.85	6.65	0.4	0.64	2.63	7.11	70.39	0.37	0.29	0.8	2.09
Waterline	7.9	6.48	0.36	0.59	2.3	6.9	68.36	0.33	0.31	0.68	1.57
	7.95	6.27	0.32	0.54	1.99	6.66	65.98	0.3	0.34	0.58	1.14
	8.0	6.14	0.27	0.49	1.68	6.48	64.15	0.26	0.39	0.47	0.78
	8.05	6.02	0.23	0.44	1.37	6.29	62.32	0.22	0.44	0.36	0.5

8.1	5.53	0.2	0.39	1.08	5.77	57.1	0.19	0.5	0.29	0.31
8.15	4.71	0.17	0.34	0.82	4.93	48.78	0.17	0.55	0.24	0.2
8.2	4.14	0.15	0.29	0.6	4.32	42.76	0.14	0.64	0.19	0.11
8.25	3.26	0.13	0.24	0.42	3.41	33.8	0.12	0.71	0.15	0.07
8.3	2.6	0.1	0.19	0.27	2.72	26.96	0.1	0.86	0.11	0.03
8.35	2.01	0.08	0.14	0.16	2.1	20.78	0.07	1.09	0.07	0.01
8.4	1.51	0.04	0.09	0.07	1.55	15.38	0.04	1.69	0.03	0.0
8.45	0.76	0.01	0.04	0.01	0.77	7.67	0.01	4.97	0.0	0.0
8.47	0.12	0.01	0.02	0.0	0.12	1.22	0.01	7.56	0.0	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	1.6	(cfs)
Calculated Flow (Qc) =	1.59	(cfs)
$(Qm-Qc)/Qm * 100 =$	0.82%	
Measured Waterline (WLM) =	7.92	(ft)
Calculated Waterline (WLC) =	7.9	(ft)
$(WLM-WLC)/WLM * 100 =$	0.21%	
Max Measured Depth (Dm) =	0.6	(ft)
Max Calculated Depth (Dc) =	0.59	(ft)
$(Dm-Dc)/Dm * 100 =$	2.22%	
Mean Velocity =	0.69	(ft/s)
Manning's n =	0.31	
$0.4 * Qm =$	0.64	(cfs)
$2.5 * Qm =$	4	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	4.02		
Bankfull	1.5	6.9		
Waterline	2.6	7.9	0	0
	3	8.06	0.15	0.6941431670281996
	3.5	8.23	0.3	0.6941431670281996
	4	8.22	0.3	0.6941431670281996
	4.5	8.08	0.2	0.6941431670281996
	5	8.15	0.25	0.6941431670281996
	5.5	8.4	0.5	0.6941431670281996
	6	8.49	0.55	0.6941431670281996
	6.5	8.28	0.35	0.6941431670281996
	7	8.31	0.45	0.6941431670281996
	7.5	8.47	0.6	0.6941431670281996
	8	8.45	0.55	0.6941431670281996
	8.5	8.24	0.35	0.6941431670281996
	9	8.07	0.15	0.6941431670281996
Waterline	9	7.94	0	0
	10	7.51		
Bankfull	10.5	6.64		
	11.5	5.59		
	13	5.13		

COMPUTED FROM MEASURED FIELD DATA

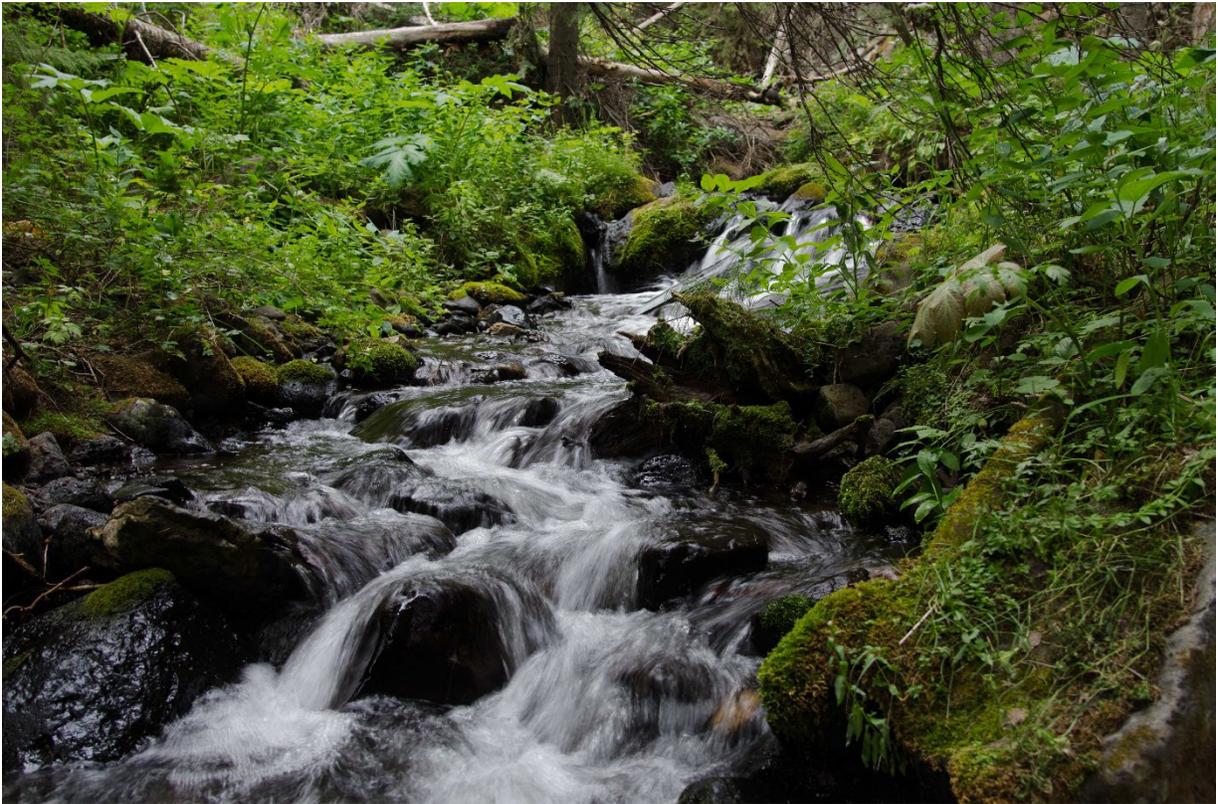
Wetted Perimeter (ft)	Water Depth (ft)	Area (ft ²)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.43	0.15	0.07	0.05	2.93
0.53	0.3	0.15	0.1	6.51
0.5	0.3	0.15	0.1	6.51
0.52	0.2	0.1	0.07	4.34
0.5	0.25	0.12	0.09	5.42
0.56	0.5	0.25	0.17	10.85
0.51	0.55	0.28	0.19	11.93
0.54	0.35	0.17	0.12	7.59
0.5	0.45	0.23	0.16	9.76
0.52	0.6	0.3	0.21	13.02
0.5	0.55	0.28	0.19	11.93
0.54	0.35	0.17	0.12	7.59
0.53	0.15	0.04	0.03	1.63
0.13	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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Bear Creek, Habitat Overview and Overhead Cover





Bear Creek, Abundant Large Woody Debris





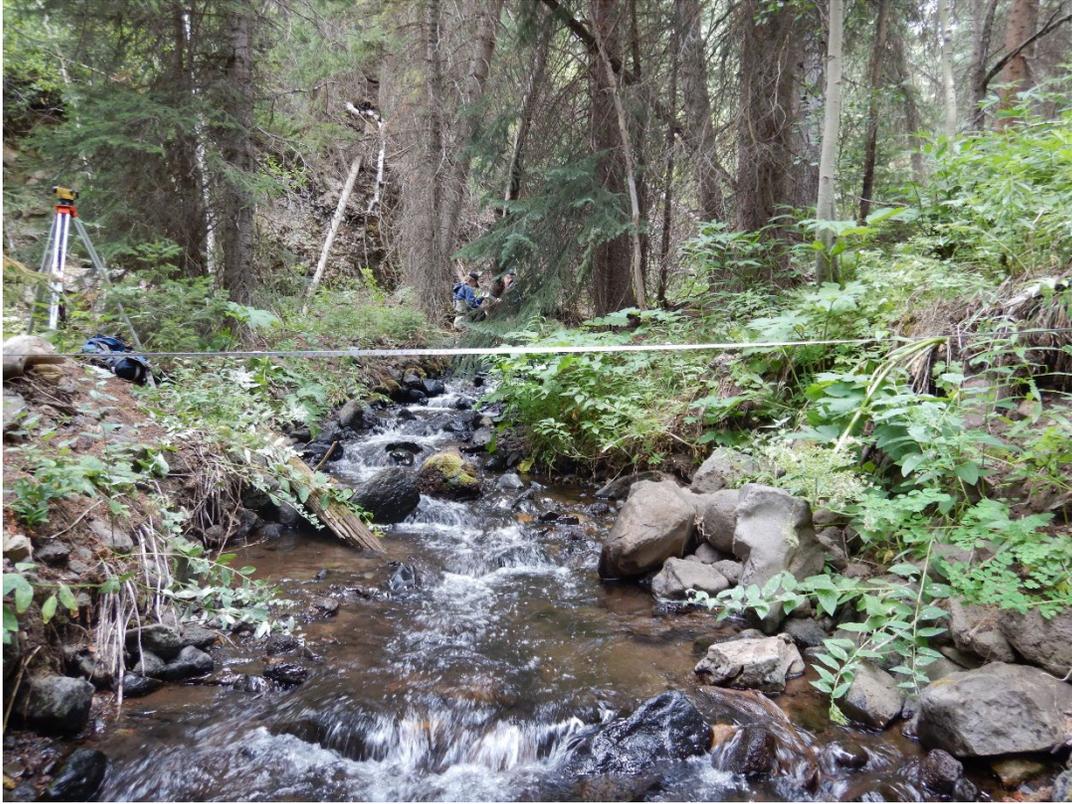
Bear Creek Cascade and pocket pool habitat.





Bear Creek Cross Section 1, looking downstream and upstream.





Bear Creek Cross Section 2, looking upstream and downstream.





Bear Creek, Cross-Section 1, & Discharge Measurement

