October 27, 2022

Mr. Robert Viehl
Colorado Water Conservation Board
1313 Sherman Street
Denver, CO 80203

Dear Mr. Viehl,

High Country Conservation Advocates (HCCA) submits this instream flow recommendation for Deer Creek, located in Gunnison County, Water Division 4.

HCCA's mission is to protect the health and natural beauty of the land, rivers, and wildlife in and around Gunnison County. Many of our members live and work here and enjoy recreational opportunities and a quality of life that is preserved by our valley's wildlife, habitat, and water resources. HCCA's 30 year-old water program has a long history of protecting waters in the Upper Gunnison Basin and in developing an environmental voice within key regional and state forums. In the past HCCA has partnered with the Bureau of Land Management to support instream flow proposals on the Slate River and Oh-Be-Joyful Creek. In 2016 HCCA submitted proposals to protect updated instream flows for Coal Creek and Brush Creek. HCCA partnered with Western Resource Advocates in 2017 to submit an instream flow proposal on Dutchman Creek. More recently HCCA submitted instream flow proposals for Gold Creek, Lottis Creek, Italian Creek, Elk Creek, Wildcat Creek, Cameron Creek, and Cross Creek all in Division 4.

The headwaters of Deer Creek originate on United States Forest Service lands in Gunnison County. The Deer Creek riparian area supports high-quality habitat dominated by willows. HCCA staff observed several macroinvertebrates when completing R2Cross assessments in 2022.

HCCA has coordinated with local consultants to arrive at a preliminary instream flow recommendation. In considering this application, the Colorado Water Conservation Board (CWCB) has an opportunity to protect an important stream ecosystem by moving forward with an instream flow protection that would preserve the natural environment to a reasonable degree.

Enclosed you will find the preliminary instream flow proposal, R2Cross modeling run, stream photos, and maps of the relevant reach. If you have any further questions regarding this recommendation, please feel free to contact Julie Nania at (509) 999-0012. HCCA thanks the CWCB for their support in developing this recommendation.

Sincerely,

Julie Nania
High Country Conservation Advocates
Water Director

Enclosure

ENCLOSURE - INSTREAM FLOW RECOMMENDATIONS FOR DEER CREEK

Below is a description of the proposed instream flow. Additional details can be found in Attachments A-C.

Location

Deer Creek is located within the East River Watershed (HUC: 14020001) in Gunnison County, Water Division 4. The headwaters of Deer Creek originate in a small basin located on the slopes south of White Rock Mountain. Deer Creek generally flows south to the confluence with the East River, approximately 4 miles east of the Town of Crested Butte. The Deer Creek Watershed is about 2.1 square miles and is on the Gothic United States Geologic Survey quad map (Attachment A).

The stream segment identified for the proposed instream flow appropriation is approximately 2.0 miles long from its headwaters to the confluence with the Beilter Ditch No. 2.

Table 1. Land Status in the Deer Creek Watershed.

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			Private (%)	Public (%)[1]
Headwaters	Confluence with Beilter No. 2	2.0	Riparian Corridor[2] 0%	Riparian Corridor 100%
			Watershed Composition 0%	Watershed Composition 100%

1. The public land in the Deer Creek Watershed is managed by the USFS.
2. The riparian corridor ownership percentages were estimated using stream length.

The Deer Creek Watershed is 100 percent public land managed by the United States Forest Service (USFS). The riparian corridor of the proposed segment is 100 percent public land managed by the USFS.

Existing Instream Flow Rights

Deer Creek does not have an existing instream flow water right.

Water Availability

Physical Availability

There is not a gage on Deer Creek. The nearest gage is on the East River below Cement Creek near Crested Butte, CO (USGS 09112200).

Legal Availability

There is one active diversion on Deer Creek, the Beitler No. 2 ditch that irrigates a pasture adjacent to the East River. The right is decreed for 11.5 cfs with a 6/2/1912 priority date (CA5590). This ditch uses a significant amount of the flow from Deer Creek during the irrigation season. This water right is summarized in Attachment B.

Biological Summary

The headwaters of Deer Creek form as a cold-water, high gradient stream to the west of a prominent ridge on the south face of White Rock Mountain. Near the headwaters there is a mix of aspen and evergreen trees. As the stream loses elevation there is an increase in willows and alders immediately adjacent to the creek. There are a series of pools and drops at locations as well as meadows with finer substrate. Generally, Deer Creek has a mix of gravel and cobble-sized substrate and a moderate amount of woody debris. Flows from Deer Creek support a robust riparian area that provides shade and cover for the extant aquatic community.

While conducting R2Cross assessments, we saw numerous macroinvertebrates and small fish (unknown species). Colorado Parks and Wildlife (CPW) has not surveyed or stocked Deer Creek[1].There are signs of grazing in the riparian area; but little evidence to indicate meaningful impacts to the natural environment.

Photo 1. Macroinvertebrate found in Deer Creek (7/8/2022).

[1] Treble, Andrew. "Re: Data Request for Division 4." Received by Julie Nania, July 14, 2022. Electronic data request.

Preliminary R2Cross Analysis

HCCA relied on the expertise of Alpine Environmental Consultants LLC to interpret output from the R2Cross model and develop a preliminary instream flow recommendation that will protect Deer Creek's natural environment to a reasonable degree.

An R2Cross field survey was completed at one location on July 8, 2022. The cross-section was in Deer Creek approximately 2.2 miles upstream of the confluence with the East River. R2Cross data entry, analysis, and interpretation were completed following fieldwork. These data were used to create the preliminary instream flow recommendations for Deer Creek (Table 2). The R2Cross output and field forms are attached for review (Attachment C).

A summer flow rate of 1.0 cfs and a winter flow rate of 0.6 cfs are recommended based on the results of the 2022 cross-section (Table 2).

Initially, the proposed dates for the winter ISF rate are October 1 to April 30. The proposed dates for the summer ISF rate are May 1 to September 30. The dates may be revised based upon additional review of physical and legal water availability.

Table 2. R2CROSS analysis summary and preliminary instream flow recommendations.

Cross Section (Date)	Measured Discharge (cfs)	Bankfull Top Width (ft)	Winter Flow Recommendation[1] (cfs)	Summer Flow Recommendation[2] (cfs)
Deer Creek #1 (7-8-22)	0.33	4.5	0.61	1.01
Preliminary Proposed ISF Rates:			**0.6 cfs**	**1.0 cfs**

1) The proposed dates for the winter flow rate are October 1 to April 30.
2) The proposed dates for the summer flow recommendation are May 1 to September 30.

Photographs

Photo 1. Deer Creek near cross-section looking downstream (7-8-2022).

Photo 2. Deer Creek near cross-section looking upstream (7-8-2022).

Photo 3. Deer Creek cross-section view from the river-left bank (7-8-2022).

Photo 4. Deer Creek cross-section view from the river-right bank (7-8-2022).

Relationship to Existing State Policy

HCCA is proposing this instream flow to the CWCB in furtherance of the State of Colorado's policy "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." C.R.S. 33-1-101(1).

Attachments

A – USGS Topographic Quadrangle Map
B – Water Rights Summary
C –R2Cross Analysis

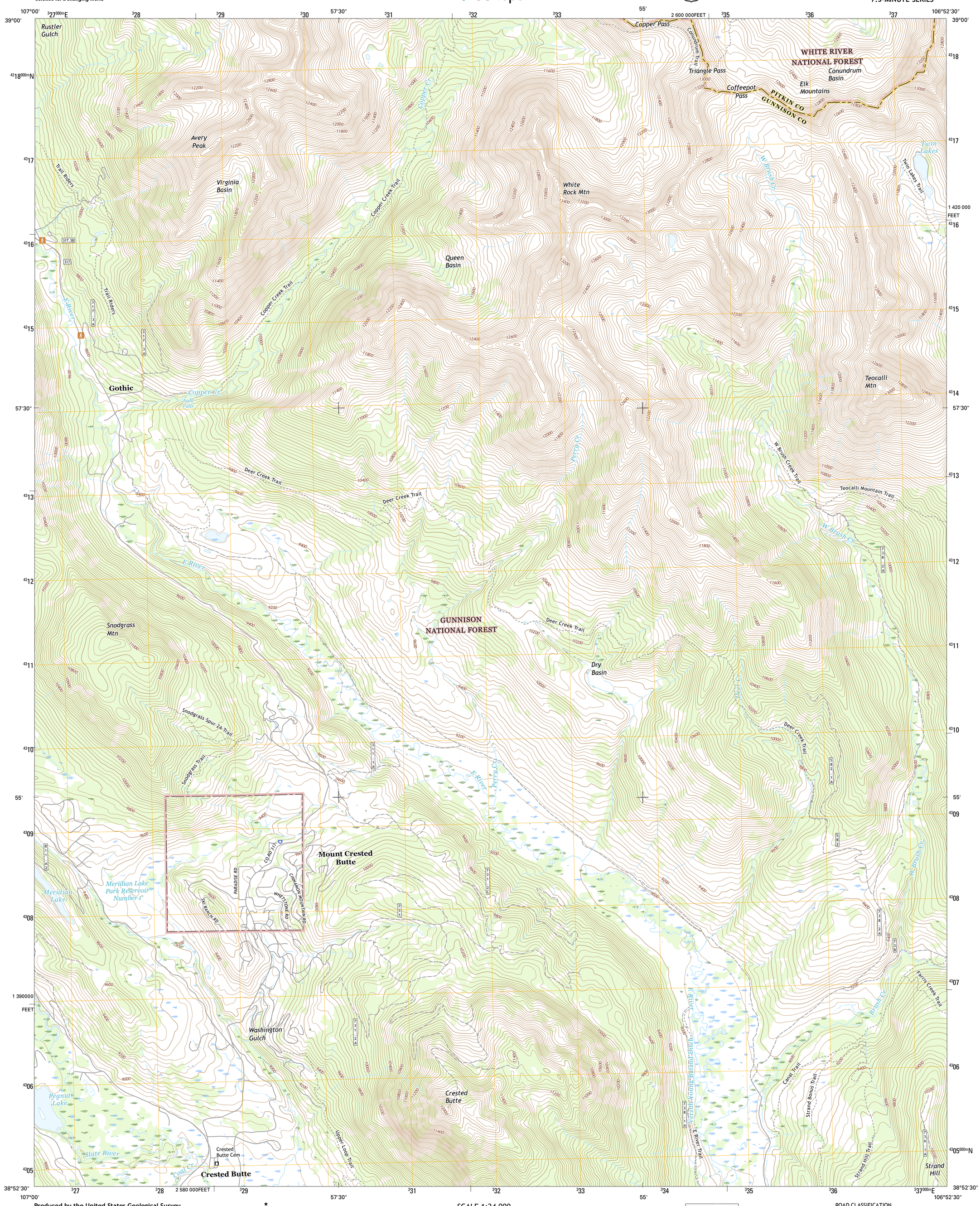
Attachment A- USGS Topographic Quadrangle Map

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

USGS science for a changing world

The National Map US Topo

GOTHIC QUADRANGLE
COLORADO
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 13S
10 000-foot ticks: Colorado Coordinate System of 1983 (central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, September 2013
Roads..... U.S. Census Bureau, 2015 - 2016
Roads within US Forest Service Lands.....FSTopo Data with limited Forest Service updates, 2012 - 2016
Names.....GNIS, 2016
Hydrography.....National Hydrography Dataset, 2013
Contours.....National Elevation Dataset, 2005
Boundaries.....Multiple sources; see metadata file 1972 - 2016
Public Land Survey System.....BLM, 2011
Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
9° 18'
165 MILS
1° 13'
22 MILS
UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

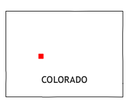
U.S. National Grid
100,000-m Square ID
CD
Grid Zone Designation
13S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19



QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Snowmass Mountain
2 Maroon Bells
3 Hayden Peak
4 Oh-be-joyful
5 Pearl Pass
6 Mount Axtell
7 Crested Butte
8 Cement Mountain
ADJOINING QUADRANGLES

ROAD CLASSIFICATION

Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route
FS Primary Route
FS Passenger Route
FS High Clearance Route

Check with local Forest Service unit for current travel conditions and restrictions.

GOTHIC, CO
2016

NSN 7643016355893
NGA REF NO. USGSX24K178445

Attachment B– Water Rights Summary

There is one diversion on Deer Creek, the Beitler Ditch No. 2. The Beitler Ditch No. 2 has a water right of 11.5 cfs with a priority date of 1912 (CA5590) and an adjudication date of 1/27/1961. The diversion structure is located at the terminus of the proposed instream flow. The structure summary is provided below.

COLORADO
Division of Water Resources
Department of Natural Resources

Structure Summary Report

Structure Name: BEITLER DITCH NO 2 (5900751)

Structure Type: DITCH

CIU Code: Active Structure with contemporary diversion records (A)

Associated Permits:

Water Source Type: Tributary

Water Source: EAST RIVER [00188856] @ Stream Mile: 21.20

Physical Location

Feature Type	Dist N/S	Dist E/W	Q10	Q40	Q160	Sec	Township	Range	PM	UTMx	UTMy	Latitude	Longitude	Location Accuracy
Point of Diversion			NW	NW	NW	28	13.0 S	85.0 W	S	334733.0	4307636.0	38.902078	-106.905888	GPS

Division: 4 District: 59

County: GUNNISON

Designated Basin:

Management District:

Water Rights - Net Amounts

Adj Date	Appro Date	Priority Admin No	Order No	Priority No	Associated Case Numbers	Net Absolute	Net Conditional	Net APEX Absolute	Net APEX Conditional	Decreed Units	Seasonal Limits	Comments
1/27/1961	6/2/1912	39252.22798	0	542	CA5590	11.5000	0.0000	0.0000	0.0000	C	No	E BK BEITLER CR LOC IN DCR IN ERROR P785

Diversion Record - Totals

Water Class	Irr Year	FDU	LDU	MaxQ	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual Amount	Units	Data Status
Total (Diversions)	2022	6/30/22	9/29/22	0.50								0.99	25.79	15.07	11.31		53.16	AF	Provisional
Total (Diversions)	2021	6/9/21	10/11/21	1.00								43.64	33.22	14.58	11.90	4.36	107.70	AF	Approved
Total (Diversions)	2020	6/4/20	9/27/20	1.00								47.11	35.41	18.05	5.36	0.00	105.92	AF	Approved
Total (Diversions)	2019	7/15/19	10/30/19	1.00								0.00	33.72	31.74	9.22	5.95	80.63	AF	Approved
Total (Diversions)	2018	5/29/18	7/30/18	0.50							2.98	27.77	14.88	0.00	0.00	0.00	45.62	AF	Approved
Total (Diversions)	2017	6/27/17	10/3/17	4.00							0.00	31.74	216.20	49.59	14.88	1.49	313.89	AF	Approved

Note:
FDU - First day used
LDU - Last day used
MaxQ - Maximum flow rate

Attachment C- R2Cross Analysis

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Deer Creek | CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: Deer Creek west of Deer Creek Trail, approximately 2 miles upstream of the confluence w/ the East River.

DATE: 7/18/22 | OBSERVERS: Ashley Bembenek, Julie Nania

LEGAL DESCRIPTION | ¼ SECTION: | SECTION: | TOWNSHIP: N/S | RANGE: E/W | PM:

COUNTY: Gunnison | WATERSHED: East River | WATER DIVISION: 4 | DOW WATER CODE:

MAP(S): USGS: GPS Point: DEER01 Coordinates 13N 0335636, 4309970 Elevation: 9,611'

USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO | METER TYPE: Hach FH950

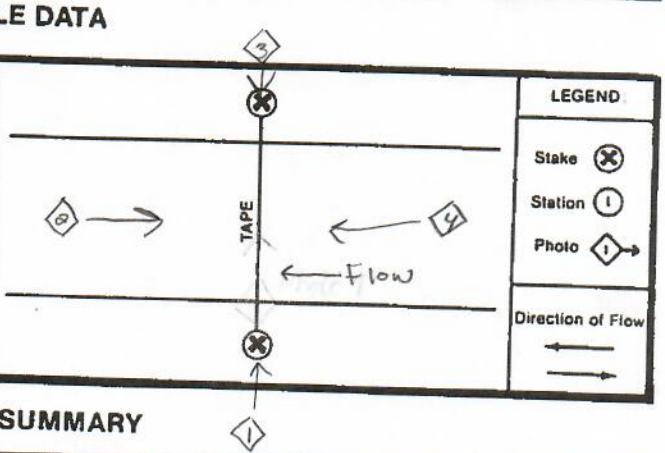
METER NUMBER: AEC | DATE RATED: NA | CALIB/SPIN NA sec | TAPE WEIGHT NA lbs/foot | TAPE TENSION NA lbs

CHANNEL BED MATERIAL SIZE RANGE: sand to large cobble | PHOTOGRAPHS TAKEN YES/NO | NUMBER OF PHOTOGRAPHS: Many

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0 2ft	.85
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	4.05/4.05
② WS Upstream	9.0'	4.85'
③ WS Downstream	11.0'	5.41'
SLOPE	0.56'/20' = 0.028	

SKETCH



AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO | DISTANCE ELECTROFISHED _____ ft | FISH CAUGHT YES/NO | WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

COMMENTS

Bugs on rocks during pebble count. River rt bank has some hoof shear immediately downstream of x section. Hoof shear did not impact channel form at x section location.

FORM #ISF FD 1-85

File # 78DeerO1

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Deer Creek | CROSS-SECTION NO.: 1 | DATE: 7/8/22 | SHEET 2 OF 3

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT/RIGHT | Gage Reading: NA ft | TIME: 3:00pm / END 3:30

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) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	2		.85								
terrace	2.7		1.05								
	3.5		1.50								
	4.5		2.35								
	5.5		3.40								
	6.5		3.60								
BF	7.5		3.85								
W	7.8		4.05	Ø				Ø			
too shallow to measure velocity	8.0		4.10	.05				— * KTSTM			
	8.2		4.15	.10				0.17			
	8.4		4.15	.10				0.03			
too shallow to measure velocity	8.6		4.10	.05				— *TSTM			
	8.7		4.15	.10				0.03			
	8.9		4.20	.15				0.02			
	9.2		4.25	.20				.16			
	9.4		4.25	.20				.41			
	9.6		4.25	.20				.50			
	9.8		4.25	.20				1.02			
	10.0		4.25	.20				1.01			
	10.2		4.25	.20				1.16			
	10.4		4.25	.20				.87			
	10.6		4.30	.25				.96			
	10.8		4.25	.20				.71			
	11.0		4.25	.20				.56			
	11.2		4.25	.20				.28			
	11.4		4.20	.15				.22			
(W)	11.6		4.05	Ø				Ø			
(BF)	12		3.85								
	12.5		3.20								
	13.5		2.00								
	14.5		1.85								
	15.5		1.50								
	16.5		1.25								
(S)	17.2		1.20								
TOTALS:											

End of Measurement | Time: 3:30 | Gage Reading: NA ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY

Total flow: .33 cfs (confirm in office)

7/8/22 Ashley Bembenek
Julie Nania
Deer Creek #1

Riffle Pebble Count Actual Measurements (mm)

1	11	26	7	51	21	76	18	101	25		
2	47	27	9	52	43	77	83	102			
3	130	28	41	53	31	78	8	103			
4	222	29	48	54	91	79	19	104			
5	83	30	39	55	40	80	45	105			
6	46	31	12	56	38	81	31	106			
7	63	32	14	57	105	82	29	107			
8	79	33	61	58	25	83	fines	108			
9	51	34	4	59	27	84	fines	109			
10	36	35	6	60	21	85	14	110			
11	57	36	302	61	62	86	32	111			
12	19	37	70 pit	62	106	87	8	112			
13	69	38	70	63	52	88	23	113			
14	64	39	31	64	81	89	79	114			
15	27	40	46	65	38	90	27	115			
16	15	41	52	66	26	91	72				
17	69	42	31	67	53	92	67				
18	31	43	27	68	51	93	48				
19	39	44	28	69	39	94	74				
20	8	45	45	70	9	95	77				
21	51	46	35	71	54	96	123				
22	6	47	fines	72	145	97	24				
23	8	48	fines	73	73	98	28				
24	74	49	25	74	26	99	14				
25	102	50	41	75	22	100	54				

****Please be sure to measure at least 100 pebbles (10 in 10 transects or 5 in 20 transects- depending on stream size, for accurate distributional representation.****

EMBEDDEDNESS:

If intermediate particle axis is less than 32 mm chose the nearest cobble for embeddedness.
If no cobble >32 mm is present without taking a step, record 100% embedded.

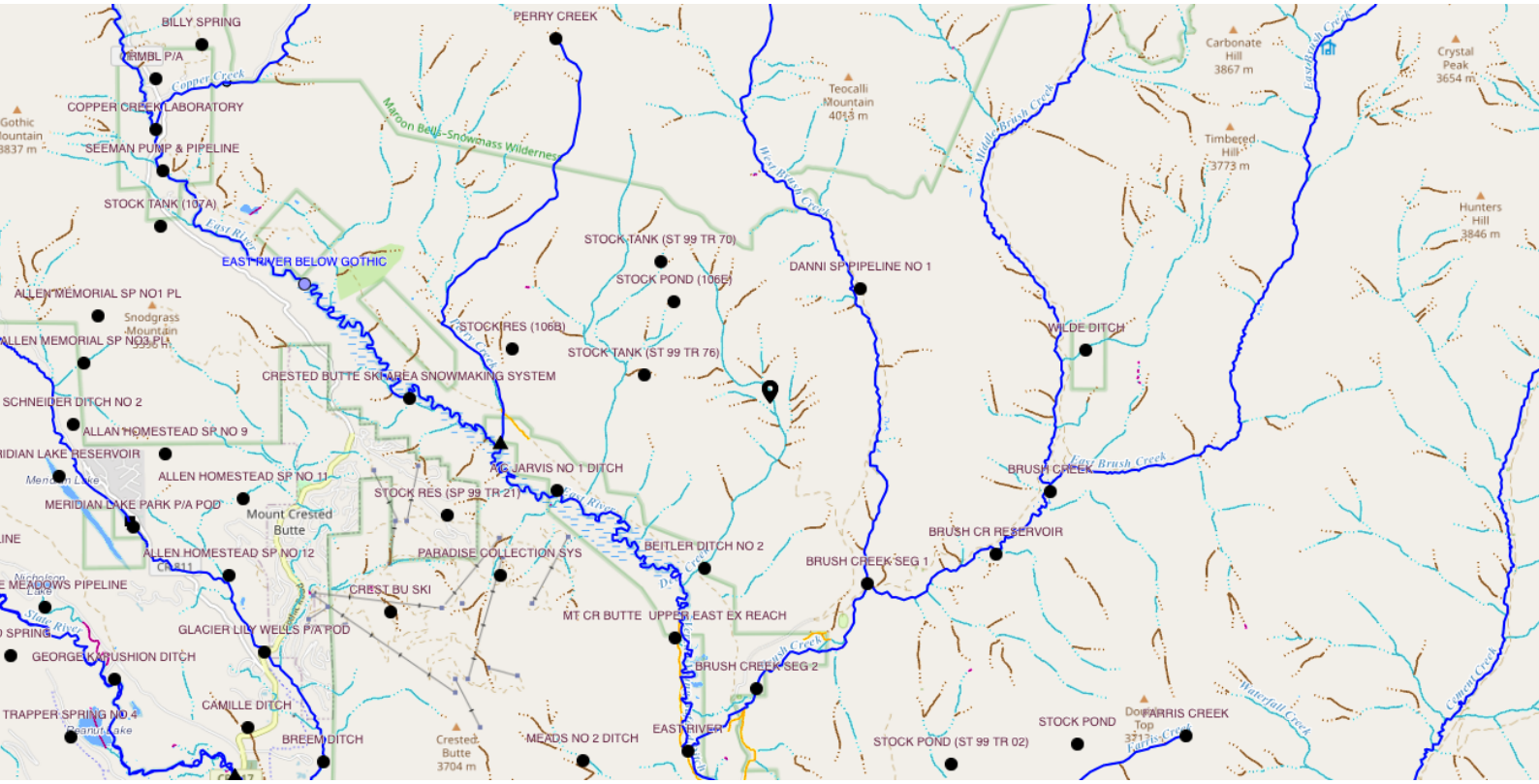
	Random pebble for **Percent Embeddedness** (one per transect)									
5	7	10	9	3	8	5	2	1	7	#
										D(e)/ D(t)

D(e) = embedded depth; D(t) = total depth

R2Cross RESULTS

Stream Name: Deer Creek
Stream Locations: Deer Creek west of the Deer Creek Trail, approximately 2 miles upstream of the confluence with the East River.
Fieldwork Date: 07/08/2022
Cross-section: 1
Observers: J. Nania, A. Bembenek
Coordinate System: UTM Zone 13
X (easting): 335636
Y (northing): 4309970
Date Processed: 09/16/2022
Slope: 0.028
Discharge: R2Cross data file: 0.33 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: Deer Creek R2Cross Data File 22-09-16.xlsx
R2Cross version: 2.0.0

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 4.5

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.61
Percent Wetted Perimeter (%)	50.0	0.01
Mean Velocity (ft/s)	1.0	1.01

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	3.85	4.5	0.32	0.45	1.43	4.72	100.0	0.3	0.08	1.43	2.05
	3.86	4.46	0.31	0.44	1.38	4.67	99.04	0.3	0.08	1.38	1.91
	3.87	4.42	0.3	0.43	1.33	4.63	98.07	0.29	0.08	1.33	1.77
	3.88	4.38	0.29	0.42	1.28	4.58	97.11	0.28	0.08	1.28	1.64
	3.9	4.34	0.28	0.41	1.23	4.54	96.15	0.27	0.08	1.23	1.52
	3.91	4.3	0.27	0.39	1.18	4.49	95.18	0.26	0.09	1.18	1.4
	3.92	4.26	0.27	0.38	1.13	4.44	94.22	0.26	0.09	1.13	1.28
	3.93	4.22	0.26	0.37	1.09	4.4	93.26	0.25	0.09	1.08	1.17
	3.94	4.18	0.25	0.36	1.04	4.35	92.29	0.24	0.09	1.03	1.07
	3.95	4.15	0.24	0.35	0.99	4.31	91.33	0.23	0.1	0.98	0.97
	3.96	4.11	0.23	0.34	0.95	4.26	90.37	0.22	0.1	0.93	0.88
	3.97	4.07	0.22	0.33	0.9	4.22	89.4	0.21	0.1	0.88	0.79
	3.98	4.03	0.21	0.32	0.85	4.17	88.44	0.2	0.1	0.83	0.71
	4.0	3.99	0.2	0.3	0.81	4.13	87.48	0.2	0.11	0.78	0.63
	4.01	3.95	0.19	0.29	0.76	4.08	86.51	0.19	0.11	0.73	0.56
	4.02	3.91	0.18	0.28	0.72	4.04	85.55	0.18	0.12	0.68	0.49
	4.03	3.87	0.17	0.27	0.68	3.99	84.59	0.17	0.12	0.63	0.43
	4.04	3.83	0.17	0.26	0.63	3.94	83.62	0.16	0.13	0.59	0.37
Waterline	4.05	3.8	0.16	0.25	0.6	3.91	82.87	0.15	0.13	0.55	0.33
	4.05	3.79	0.16	0.25	0.59	3.89	82.57	0.15	0.13	0.54	0.32
	4.06	3.73	0.15	0.24	0.55	3.83	81.19	0.14	0.14	0.5	0.27
	4.08	3.67	0.14	0.23	0.51	3.76	79.81	0.13	0.14	0.45	0.23
	4.09	3.61	0.13	0.21	0.47	3.7	78.43	0.13	0.15	0.41	0.19
	4.1	3.55	0.12	0.2	0.43	3.63	77.04	0.12	0.16	0.37	0.16
	4.11	3.43	0.11	0.19	0.39	3.51	74.48	0.11	0.17	0.34	0.13

	4.12	3.31	0.11	0.18	0.35	3.38	71.59	0.1	0.18	0.31	0.11
	4.13	3.18	0.1	0.17	0.31	3.24	68.69	0.1	0.19	0.28	0.09
	4.14	3.05	0.09	0.16	0.28	3.1	65.79	0.09	0.2	0.25	0.07
	4.15	2.75	0.09	0.15	0.24	2.79	59.16	0.09	0.2	0.24	0.06
	4.17	2.69	0.08	0.14	0.21	2.73	57.78	0.08	0.22	0.2	0.04
	4.18	2.63	0.07	0.12	0.18	2.66	56.4	0.07	0.25	0.17	0.03
	4.19	2.57	0.06	0.11	0.15	2.59	55.02	0.06	0.28	0.14	0.02
	4.2	2.51	0.05	0.1	0.13	2.53	53.63	0.05	0.32	0.1	0.01
	4.21	2.4	0.04	0.09	0.1	2.42	51.32	0.04	0.38	0.08	0.01
	4.22	2.29	0.03	0.08	0.07	2.31	48.88	0.03	0.48	0.05	0.0
	4.23	2.17	0.02	0.07	0.05	2.19	46.45	0.02	0.66	0.03	0.0
	4.24	2.06	0.01	0.06	0.02	2.08	44.01	0.01	1.14	0.01	0.0
	4.25	0.36	0.02	0.04	0.01	0.37	7.87	0.02	0.64	0.03	0.0
	4.27	0.27	0.02	0.03	0.0	0.28	5.9	0.02	0.81	0.02	0.0
	4.28	0.18	0.01	0.02	0.0	0.19	3.93	0.01	1.14	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) =	0.33	(cfs)
Calculated Flow (Qc) =	0.33	(cfs)
(Qm-Qc)/Qm * 100 =	0.02%	
Measured Waterline (WLm) =	4.05	(ft)
Calculated Waterline (WLc) =	4.05	(ft)
(WLm-WLc)/WLm * 100 =	-0.00%	
Max Measured Depth (Dm) =	0.25	(ft)
Max Calculated Depth (Dc) =	0.25	(ft)
(Dm-Dc)/Dm * 100 =	0.01%	
Mean Velocity =	0.55	(ft/s)
Manning's n =	0.13	
0.4 * Qm =	0.13	(cfs)
2.5 * Qm =	0.82	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	2	0.85		
	2.7	1.05		
	3.5	1.5		
	4.5	2.35		
	5.5	3.4		
	6.5	3.6		
Bankfull	7.5	3.85		
Waterline	7.8	4.05	0	0
	8	4.1	0.05	0
	8.2	4.15	0.1	0.17
	8.4	4.15	0.1	0.03
	8.6	4.1	0.05	0.03
	8.7	4.15	0.1	0.03
	8.9	4.2	0.15	0.02
	9.2	4.25	0.2	0.16
	9.4	4.25	0.2	0.41
	9.6	4.25	0.2	0.5
	9.8	4.25	0.2	1.02
	10	4.25	0.2	1.01
	10.2	4.25	0.2	1.16
	10.4	4.25	0.2	0.87
	10.6	4.3	0.25	0.96
	10.8	4.25	0.2	0.71
	11	4.25	0.2	0.56
	11.2	4.25	0.2	0.28
	11.4	4.2	0.15	0.22
Waterline	11.6	4.05	0	0
Bankfull	12	3.85		
	12.5	3.2		
	13.5	2		

	14.5	1.85
	15.5	1.5
	16.5	1.25
	17.2	1.2

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	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.21	0.05	0.01	0	0
0.21	0.1	0.02	0	1.03
0.2	0.1	0.02	0	0.18
0.21	0.05	0.01	0	0.07
0.11	0.1	0.01	0	0.14
0.21	0.15	0.04	0	0.23
0.3	0.2	0.05	0.01	2.43
0.2	0.2	0.04	0.02	4.99
0.2	0.2	0.04	0.02	6.08
0.2	0.2	0.04	0.04	12.41
0.2	0.2	0.04	0.04	12.29
0.2	0.2	0.04	0.05	14.11
0.2	0.2	0.04	0.03	10.58
0.21	0.25	0.05	0.05	14.6
0.21	0.2	0.04	0.03	8.64
0.2	0.2	0.04	0.02	6.81
0.2	0.2	0.04	0.01	3.41
0.21	0.15	0.03	0.01	2.01
0.25	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	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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