DRAFT INSTREAM FLOW RECOMMENDATION – SUBJECT TO CHANGE

Mr. Rob Viehl
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Mr. Viehl:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right on West Muddy Creek, located in Water Division 4.

Location and Land Status. West Muddy Creek originates on the eastern slope of Chalk Mountain, approximately 17 miles north of Paonia. This recommendation covers a reach that starts at the confluence with Sheep Creek and extends to the confluence with East Muddy Creek. This stream reach covers a distance of approximately 8.25 miles. BLM manages approximately 1.0 mile of this stream reach, while 7.25 miles are in private ownership.

Biological Summary. West Muddy Creek is a cold-water, moderate gradient stream. The upper four miles of the reach flow through a valley approximately 0.5 miles in width with some meadows and irrigated fields. The lower four miles flow through a narrow mountain valley approximately 0.25 miles in width. The stream cuts through alluvial deposits in some locations and is constrained by bedrock in locations where the stream comes close to valley walls. The upper four miles of the creek generally has medium sized substrate, ranging from silt to one-foot boulders, while the lower four miles of the creek generally have large-sized substrate, ranging from small cobbles to two-foot boulders. The stream has a good mix of pool and riffle habitat for supporting salmonids.

Fisheries surveys have revealed self-sustaining populations of bluehead suckers, speckled dace, and mottled sculpin, all of which are native species. Bluehead suckers appear on BLM's sensitive species list, and BLM is a signatory to a multi-party, multi-state conservation agreement for that species that is designed to prevent a listing of bluehead suckers under the Endangered Species Act. The stream also supports self-sustaining populations of brook trout, rainbow trout, and white suckers, all of which are introduced species. Northern leopard frogs, which also appear on BLM's sensitive species list, have been documented along the creek.

The riparian community in this part of West Muddy Creek is generally comprised of willow species, alder, narrowleaf cottonwood and spruce. In general, the riparian community is in good condition, provides substantial shading and cover for fish habitat, and provides stream stability during flood events.

R2Cross Analysis. BLM collected the following R2Cross data from West Fork Muddy Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
06/01/2018 #1	4.73 cfs	33.5 feet	3.28 cfs	10.08 cfs
06/01/2018 #2	5.42 cfs	33.5 feet	4.41 cfs	12.34 cfs
05/11/2021 #1	33.34 cfs	47.04 feet	7.43 cfs	19.16 cfs
08/06/2021 #1	4.57 cfs	30.13 feet	3.39 cfs	13.65 cfs
08/06/2021 #2	4.57 cfs	36.16 feet	8.75 cfs	9.30 cfs
		Averages:	5.45 cfs	12.91 cfs

BLM's analysis of this data indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

> 12.9 cubic feet per second is recommended for the snowmelt runoff period from April 1 through July 15. This recommendation is driven by the average velocity criteria.
>
> 5.4 cubic feet per second is recommended for the late summer and fall period between July 16 and November 30. This recommendation is driven by limited water availability during this period. On average, this flow rate meets two of the three instream flow criteria in the cross sections analyzed.
>
> 4.0 cubic feet per second is recommended during the winter period between December 1 and February 29. This recommendation is driven by limited water availability during the winter. This flow rate meets the average depth and wetted perimeter criteria in most riffle habitats and should prevent icing in pools.
>
> 5.4 cubic feet per second is recommended from March 1 to March 31. This is the period when frozen portions of the stream channel start to melt, and the fish population starts to become more active. On average, this flow rate meets two of the three instream flow criteria in the cross sections analyzed.

Water Availability. The BLM recommends relying upon historic gage data to confirm water availability. USGS Gage 09131200 (West Muddy Creek Near Somerset, CO) was operated between 1961 and 1973, reflecting a 13-year period of record. The gage records will have to be adjusted to account for new diversions below the gage that have commenced since 1973. In addition, the gage data will need be adjusted to reflect the fact that some tributaries enter the creek downstream of the gage.

The BLM is aware of only one active surface water rights in the proposed reach, the Snooks Ditch No. 2, which is decreed for 1.5 cfs. Upstream from the proposed instream flow reach, BLM is aware of at least 12 active surface water rights, totaling just over 60 cubic feet per second in decreed diversion rates.

Relationship to Land Management Plans. The BLM land use plan for this area calls for

actions to maintain and enhance riparian and fisheries habitat. In general, any proposed new land use, such as right-of-way corridors or mineral development, must be implemented with no surface occupancy to avoid impacts to the creek. Establishing an instream flow water right would assist in meeting these objectives.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2020. We thank both Colorado Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

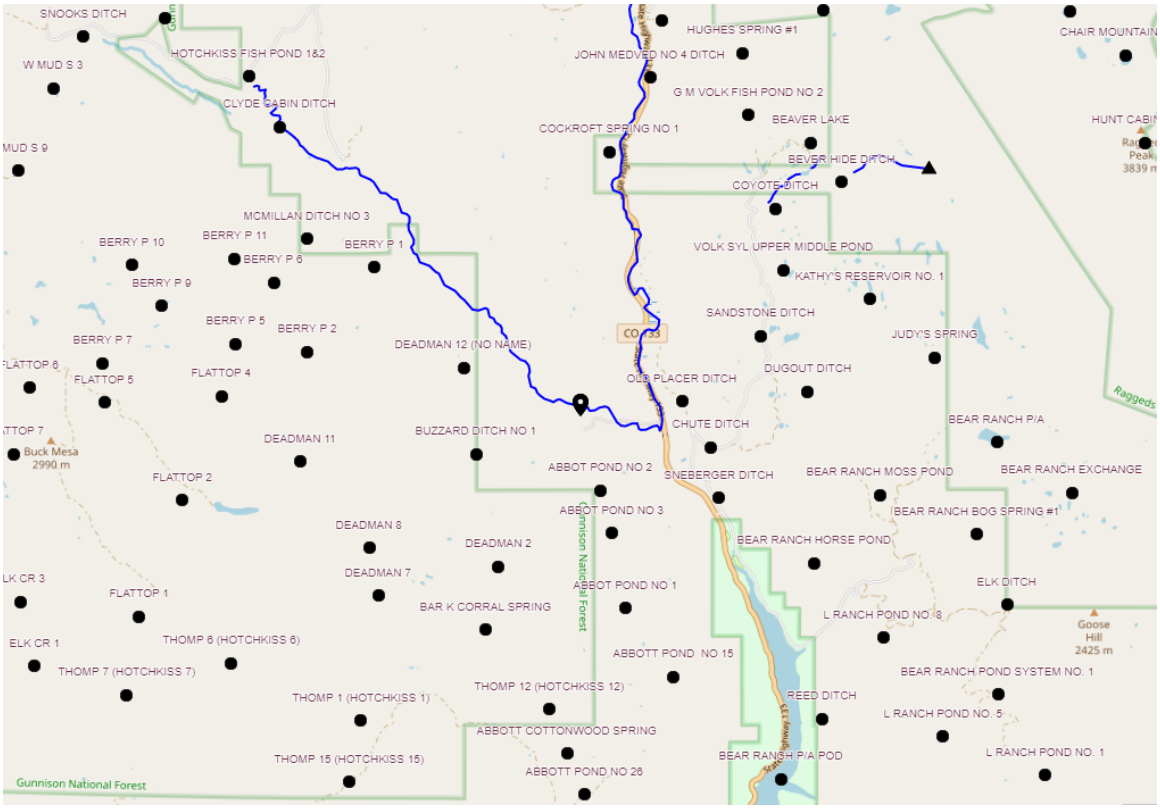
Allan Bittner
Deputy State Director
Resources

Cc: Jedd Sondergard, Uncompahgre FO
Suzanne Copping, Uncompahgre FO
Stephanie Connolly, Southwest District

R2Cross RESULTS

Stream Name: West Muddy Creek
Stream Locations: Approx 1/4 mile upstream from BLM-private boundary
Fieldwork Date: 06/01/2018
Cross-section: 1
Observers: R. Smith, J. Sondergard
Coordinate System: UTM Zone 13
X (easting): 294644
Y (northing): 4319767
Date Processed: 05/22/2023
Slope: 0.014
Discharge: R2Cross data file: 4.73 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: West Muddy Creek 6-1-18.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 33.5

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.3	2.98
Percent Wetted Perimeter (%)	50.0	3.28
Mean Velocity (ft/s)	1.0	10.08

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	4.0	33.5	1.39	2.4	46.67	35.41	100.0	1.32	0.06	3.83	178.62
	4.0	33.5	1.39	2.4	46.66	35.41	100.0	1.32	0.06	3.83	178.61
	4.05	32.96	1.37	2.35	45.0	34.86	98.45	1.29	0.06	3.74	168.2
	4.1	32.43	1.34	2.3	43.37	34.31	96.9	1.26	0.06	3.65	158.17
	4.15	31.89	1.31	2.25	41.76	33.77	95.36	1.24	0.06	3.56	148.51
	4.2	31.35	1.28	2.2	40.18	33.22	93.81	1.21	0.06	3.46	139.21
	4.25	30.81	1.25	2.15	38.63	32.67	92.26	1.18	0.06	3.37	130.28
	4.3	30.28	1.23	2.1	37.1	32.12	90.71	1.15	0.06	3.28	121.7
	4.35	29.74	1.2	2.05	35.6	31.57	89.17	1.13	0.06	3.19	113.46
	4.4	29.2	1.17	2.0	34.12	31.03	87.62	1.1	0.06	3.09	105.57
	4.45	28.73	1.14	1.95	32.68	30.54	86.25	1.07	0.06	2.99	97.77
	4.5	28.25	1.11	1.9	31.25	30.05	84.87	1.04	0.06	2.89	90.31
	4.55	27.78	1.07	1.85	29.85	29.57	83.5	1.01	0.06	2.79	83.19
	4.6	27.31	1.04	1.8	28.47	29.08	82.13	0.98	0.06	2.68	76.4
	4.65	26.83	1.01	1.75	27.12	28.6	80.76	0.95	0.07	2.58	69.94
	4.7	26.36	0.98	1.7	25.79	28.11	79.38	0.92	0.07	2.47	63.8
	4.75	25.88	0.95	1.65	24.48	27.62	78.01	0.89	0.07	2.37	57.98
	4.8	25.41	0.91	1.6	23.2	27.14	76.64	0.85	0.07	2.26	52.47
	4.85	24.93	0.88	1.55	21.94	26.65	75.27	0.82	0.07	2.15	47.28
	4.9	24.49	0.85	1.5	20.71	26.2	74.0	0.79	0.07	2.04	42.31
	4.95	24.11	0.81	1.45	19.49	25.81	72.88	0.76	0.08	1.93	37.54
	5.0	23.73	0.77	1.4	18.3	25.41	71.76	0.72	0.08	1.81	33.09
	5.05	23.35	0.73	1.35	17.12	25.01	70.64	0.68	0.08	1.69	28.94
	5.1	22.9	0.7	1.3	15.96	24.56	69.35	0.65	0.08	1.58	25.18
	5.15	22.36	0.66	1.25	14.83	24.01	67.8	0.62	0.09	1.47	21.84

	5.2	21.82	0.63	1.2	13.73	23.46	66.25	0.59	0.09	1.37	18.77
	5.25	21.28	0.59	1.15	12.65	22.91	64.7	0.55	0.09	1.26	15.98
	5.3	20.74	0.56	1.1	11.6	22.36	63.15	0.52	0.1	1.16	13.44
	5.35	20.2	0.52	1.05	10.58	21.81	61.6	0.48	0.1	1.05	11.15
	5.4	19.66	0.49	1.0	9.58	21.26	60.05	0.45	0.11	0.95	9.11
	5.45	19.12	0.45	0.95	8.61	20.71	58.49	0.42	0.12	0.85	7.31
	5.5	18.58	0.41	0.9	7.67	20.16	56.94	0.38	0.12	0.75	5.73
Waterline	5.55	17.04	0.4	0.85	6.75	18.61	52.57	0.36	0.13	0.7	4.72
	5.6	16.43	0.36	0.8	5.91	17.93	50.63	0.33	0.14	0.61	3.61
	5.65	15.86	0.32	0.75	5.11	17.27	48.78	0.3	0.15	0.52	2.66
	5.7	14.46	0.3	0.7	4.35	15.8	44.62	0.28	0.16	0.47	2.04
	5.75	13.14	0.28	0.65	3.65	14.39	40.65	0.25	0.17	0.42	1.52
	5.8	11.68	0.26	0.6	3.03	12.85	36.3	0.24	0.18	0.37	1.13
	5.85	10.38	0.24	0.55	2.48	11.44	32.32	0.22	0.19	0.33	0.82
	5.9	9.55	0.21	0.5	1.98	10.51	29.69	0.19	0.22	0.27	0.53
	5.95	8.66	0.18	0.45	1.52	9.52	26.9	0.16	0.25	0.21	0.32
	6.0	6.53	0.18	0.4	1.15	7.28	20.55	0.16	0.25	0.21	0.24
	6.05	5.52	0.15	0.35	0.85	6.15	17.37	0.14	0.28	0.17	0.14
	6.1	4.52	0.13	0.3	0.59	5.04	14.23	0.12	0.32	0.13	0.08
	6.15	3.36	0.11	0.25	0.38	3.76	10.61	0.1	0.35	0.11	0.04
	6.2	2.52	0.09	0.2	0.24	2.81	7.93	0.08	0.41	0.08	0.02
	6.25	1.68	0.08	0.15	0.13	1.86	5.24	0.07	0.48	0.06	0.01
	6.3	1.26	0.05	0.1	0.06	1.34	3.77	0.04	0.71	0.03	0.0
	6.35	0.31	0.02	0.05	0.01	0.33	0.93	0.02	1.22	0.01	0.0
	6.38	0.09	0.01	0.01	0.0	0.1	0.28	0.01	3.32	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) =	4.73	(cfs)
Calculated Flow (Qc) =	4.73	(cfs)
(Qm-Qc)/Qm * 100 =	0.16%	
Measured Waterline (WLm) =	5.55	(ft)
Calculated Waterline (WLc) =	5.55	(ft)
(WLm-WLc)/WLm * 100 =	0.09%	
Max Measured Depth (Dm) =	0.85	(ft)
Max Calculated Depth (Dc) =	0.85	(ft)
(Dm-Dc)/Dm * 100 =	0.01%	
Mean Velocity =	0.7	(ft/s)
Manning's n =	0.128	
0.4 * Qm =	1.89	(cfs)
2.5 * Qm =	11.83	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
Bankfull	0	4	0	0
	3	4.4	0	0
	6	4.88	0	0
Waterline	9	5.56	0	0
	9.1	5.65	0.1	0
	9.5	5.73	0.18	0
	10	5.55	0	0
	10.5	5.55	0	0
	11	5.55	0	0
	11.5	5.75	0.2	0
	12	5.85	0.3	0
	12.5	5.75	0.2	0
	13	5.75	0.2	0
	13.5	5.8	0.25	0.08
	14	5.55	0	0
	14.6	5.87	0.32	0.96
	15	5.95	0.4	0.55
	15.5	5.98	0.43	0.19
	16	6	0.45	0.06
	16.5	5.8	0.25	0.26
	17	5.98	0.43	0.65
	17.5	5.95	0.4	0.48
	18	6.4	0.85	1.07
	18.5	6.3	0.75	1.16
	19	5.85	0.3	1.51
	19.5	5.65	0.1	0.98
	20	5.7	0.15	1.08
	20.5	6	0.45	1.61
	21	6.3	0.75	1.56
	21.5	6	0.45	1.07

	22	6.05	0.5	1.09
	22.5	6.1	0.55	1.07
	23	6.25	0.7	0.79
	23.5	6.15	0.6	0.5
	24	6.15	0.6	0.54
	24.5	5.8	0.25	0.53
	25	6.05	0.5	0.53
	25.5	6.35	0.8	0.48
	26	6.35	0.8	0.28
Waterline	27	5.55	0	0
	30	5.08	0	0
Bankfull	33.5	4	0	0

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
0.13	0.1	0.03	0	0
0.41	0.18	0.08	0	0
0.53	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.54	0.2	0.1	0	0
0.51	0.3	0.15	0	0
0.51	0.2	0.1	0	0
0.5	0.2	0.1	0	0
0.5	0.25	0.12	0.01	0.21
0.56	0	0	0	0
0.68	0.32	0.16	0.15	3.25
0.41	0.4	0.18	0.1	2.09
0.5	0.43	0.21	0.04	0.86
0.5	0.45	0.23	0.01	0.29
0.54	0.25	0.12	0.03	0.69
0.53	0.43	0.21	0.14	2.95
0.5	0.4	0.2	0.1	2.03
0.67	0.85	0.42	0.45	9.61
0.51	0.75	0.38	0.43	9.19
0.67	0.3	0.15	0.23	4.79
0.54	0.1	0.05	0.05	1.03
0.5	0.15	0.07	0.08	1.71
0.58	0.45	0.23	0.36	7.65
0.58	0.75	0.38	0.58	12.36
0.58	0.45	0.23	0.24	5.09

0.5	0.5	0.25	0.27	5.76
0.5	0.55	0.28	0.29	6.22
0.52	0.7	0.35	0.28	5.84
0.51	0.6	0.3	0.15	3.17
0.5	0.6	0.3	0.16	3.42
0.61	0.25	0.12	0.07	1.4
0.56	0.5	0.25	0.13	2.8
0.58	0.8	0.4	0.19	4.06
0.5	0.8	0.6	0.17	3.55
1.28	0	0	0	0
0	0	0	0	0
0	0	0	0	0

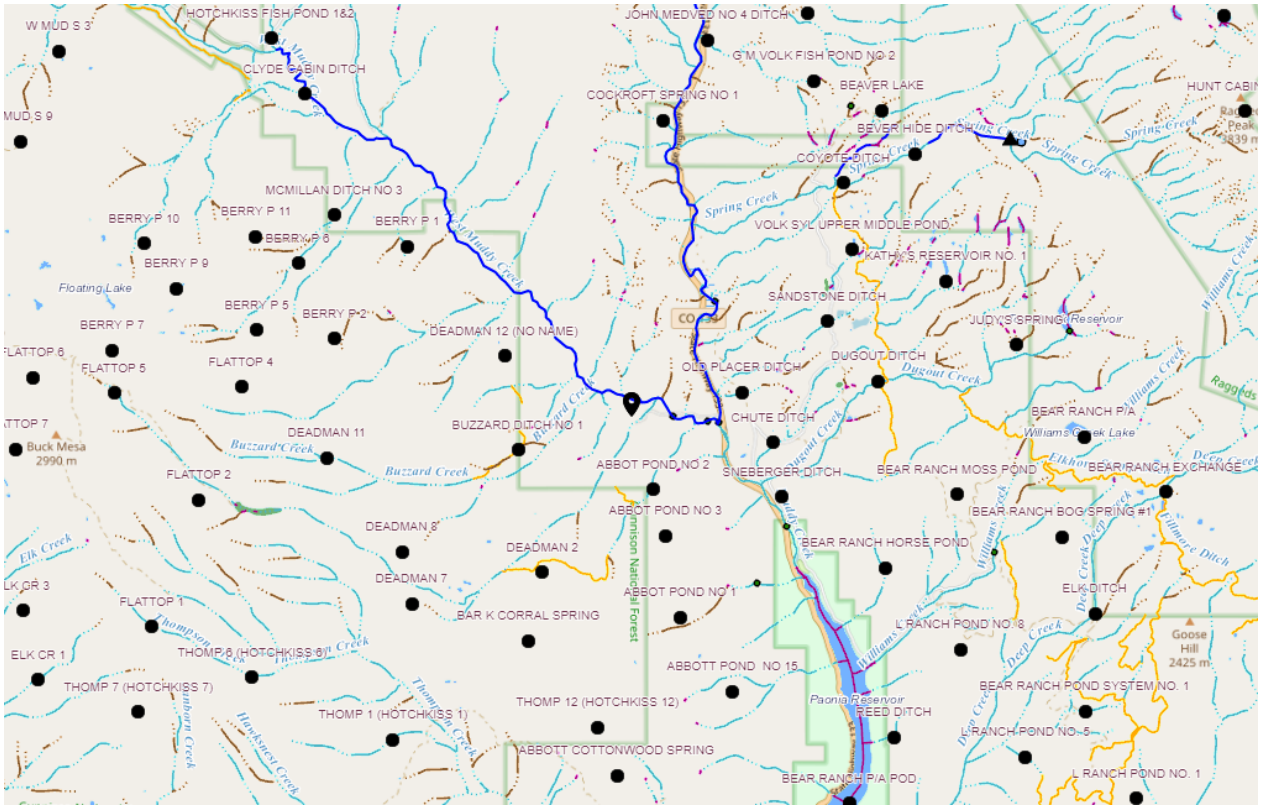
DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

R2Cross RESULTS

Stream Name: West Muddy Creek
Stream Locations: Approx 1/4 mile upstream from BLM-private boundary
Fieldwork Date: 06/01/2018
Cross-section: 2
Observers: R. Smith, J. Sondergard
Coordinate System: UTM Zone 13
X (easting): 294728
Y (northing): 4319727
Date Processed: 05/22/2023
Slope: 0.25
Discharge: R2Cross data file: 5.82 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: West Muddy Creek 6-1-18 #2.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 33.49

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.3	4.41
Percent Wetted Perimeter (%)	50.0	1.3
Mean Velocity (ft/s)	1.0	12.34

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	5.06	33.49	1.22	1.79	40.72	35.39	100.0	1.15	0.2	4.1	167.07
	5.1	33.26	1.18	1.75	39.39	35.14	99.29	1.12	0.2	3.95	155.59
	5.15	32.96	1.14	1.7	37.74	34.82	98.4	1.08	0.21	3.76	141.85
	5.2	32.66	1.11	1.65	36.1	34.51	97.51	1.05	0.21	3.57	128.85
	5.25	32.37	1.07	1.6	34.47	34.19	96.62	1.01	0.22	3.38	116.57
	5.3	32.07	1.02	1.55	32.86	33.88	95.73	0.97	0.23	3.2	105.01
	5.35	31.77	0.98	1.5	31.27	33.56	94.85	0.93	0.24	3.01	94.15
	5.4	31.48	0.94	1.45	29.68	33.25	93.96	0.89	0.24	2.83	83.98
	5.45	31.18	0.9	1.4	28.12	32.93	93.07	0.85	0.25	2.65	74.48
	5.5	30.52	0.87	1.35	26.58	32.26	91.16	0.82	0.26	2.51	66.78
	5.55	29.86	0.84	1.3	25.07	31.58	89.26	0.79	0.27	2.38	59.61
	5.6	29.2	0.81	1.25	23.59	30.91	87.35	0.76	0.28	2.24	52.95
	5.65	28.66	0.77	1.2	22.15	30.36	85.8	0.73	0.29	2.1	46.49
	5.7	28.32	0.73	1.15	20.72	30.01	84.8	0.69	0.3	1.94	40.12
	5.75	27.98	0.69	1.1	19.31	29.65	83.79	0.65	0.31	1.78	34.29
	5.8	27.64	0.65	1.05	17.92	29.29	82.78	0.61	0.33	1.62	29.0
	5.85	27.3	0.61	1.0	16.55	28.94	81.78	0.57	0.35	1.46	24.22
	5.9	26.96	0.56	0.95	15.19	28.58	80.77	0.53	0.37	1.31	19.94
	5.95	26.63	0.52	0.9	13.85	28.23	79.76	0.49	0.4	1.17	16.15
	6.0	26.29	0.48	0.85	12.53	27.87	78.76	0.45	0.43	1.02	12.82
	6.05	25.95	0.43	0.8	11.22	27.51	77.75	0.41	0.46	0.89	9.93
	6.1	25.61	0.39	0.75	9.93	27.16	76.75	0.37	0.51	0.75	7.47
Waterline	6.15	23.86	0.36	0.7	8.66	25.39	71.75	0.34	0.54	0.68	5.87
	6.2	22.06	0.34	0.65	7.51	23.49	66.39	0.32	0.56	0.62	4.62
	6.25	20.92	0.31	0.6	6.44	22.26	62.91	0.29	0.61	0.53	3.41

6.3	19.22	0.28	0.55	5.43	20.46	57.81	0.27	0.66	0.47	2.53
6.35	17.02	0.26	0.5	4.5	18.15	51.28	0.25	0.7	0.42	1.9
6.4	16.58	0.22	0.45	3.66	17.6	49.75	0.21	0.81	0.32	1.19
6.45	14.9	0.19	0.4	2.88	15.8	44.66	0.18	0.9	0.26	0.76
6.5	13.29	0.16	0.35	2.17	14.06	39.72	0.15	1.03	0.21	0.45
6.55	10.69	0.14	0.3	1.55	11.31	31.96	0.14	1.14	0.17	0.27
6.6	9.25	0.11	0.25	1.05	9.72	27.48	0.11	1.39	0.12	0.13
6.65	6.43	0.1	0.2	0.63	6.76	19.11	0.09	1.57	0.1	0.06
6.7	5.29	0.06	0.15	0.34	5.52	15.6	0.06	2.23	0.05	0.02
6.75	2.24	0.06	0.1	0.14	2.38	6.72	0.06	2.34	0.05	0.01
6.8	1.37	0.03	0.05	0.05	1.44	4.07	0.03	3.77	0.02	0.0
6.83	0.76	0.01	0.01	0.01	0.78	2.21	0.01	8.62	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) =	5.82	(cfs)
Calculated Flow (Qc) =	5.84	(cfs)
(Qm-Qc)/Qm * 100 =	-0.41%	
Measured Waterline (WLm) =	6.12	(ft)
Calculated Waterline (WLc) =	6.15	(ft)
(WLm-WLc)/WLm * 100 =	-0.41%	
Max Measured Depth (Dm) =	0.7	(ft)
Max Calculated Depth (Dc) =	0.7	(ft)
(Dm-Dc)/Dm * 100 =	-0.02%	
Mean Velocity =	0.67	(ft/s)
Manning's n =	0.538	
0.4 * Qm =	2.33	(cfs)
2.5 * Qm =	14.54	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
Bankfull	2	5.06	0	0
Waterline	4.3	6.15	0	0
	5	6.3	0.15	0
	5.5	6.15	0	0
	6	6.45	0.3	0.04
	6.5	6.15	0	0
	7	6.15	0	0
	7.5	6.25	0.1	0.41
	8	6.3	0.15	0.28
	8.5	6.65	0.5	0.47
	9	6.65	0.5	0.79
	9.5	6.65	0.5	0.2
	10	6.55	0.4	0.38
	10.5	6.35	0.2	0.42
	11	6.25	0.1	0.26
	11.5	6.75	0.6	0.18
	12	6.75	0.6	0.5
	12.5	6.85	0.7	0.86
	13	6.85	0.7	0.99
	13.5	6.55	0.4	1.48
	14	6.75	0.6	1.1
	15.5	6.7	0.55	0.38
	16	6.45	0.3	0.99
	16.5	6.65	0.5	0.77
	17	6.4	0.25	0
	17.5	6.6	0.45	0
	18	6.65	0.5	0.1
	18.5	6.85	0.7	1.03
	19	6.65	0.5	1.08
	19.5	6.45	0.3	0.35

	20	6.4	0.25	0.39
	20.5	6.45	0.3	0.08
	21	6.55	0.4	0.19
	21.5	6.55	0.4	1.44
	22	6.55	0.4	2.25
	22.5	6.45	0.3	1.72
	23	6.55	0.4	0.91
	23.5	6.65	0.5	0.56
	24	6.7	0.55	0.74
	24.5	6.75	0.6	0.92
	25	6.85	0.7	0.48
	25.5	6.15	0	0
	26	6.15	0	0
	26.5	6.35	0.2	0
	27	6.35	0.2	0.36
	27.5	6.35	0.2	1.07
	28	6.3	0.15	0
	28.5	6.15	0	0
	29	6.15	0	0
	29.5	6.2	0.05	0
Waterline	29.8	6.1	0	0
	32	5.63	0	0
	34	5.45	0	0
Bankfull	35.8	4.98	0	0

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
0.72	0.15	0.09	0	0
0.52	0	0	0	0
0.58	0.3	0.15	0.01	0.1
0.58	0	0	0	0
0	0	0	0	0
0.51	0.1	0.05	0.02	0.35
0.5	0.15	0.07	0.02	0.36
0.61	0.5	0.25	0.12	2.02
0.5	0.5	0.25	0.2	3.4
0.5	0.5	0.25	0.05	0.86
0.51	0.4	0.2	0.08	1.31
0.54	0.2	0.1	0.04	0.72
0.51	0.1	0.05	0.01	0.22
0.71	0.6	0.3	0.05	0.93
0.5	0.6	0.3	0.15	2.58
0.51	0.7	0.35	0.3	5.17
0.5	0.7	0.35	0.35	5.96
0.58	0.4	0.2	0.3	5.09
0.54	0.6	0.6	0.66	11.35
1.5	0.55	0.55	0.21	3.59
0.56	0.3	0.15	0.15	2.55
0.54	0.5	0.25	0.19	3.31
0.56	0.25	0.12	0	0
0.54	0.45	0.23	0	0
0.5	0.5	0.25	0.03	0.43
0.54	0.7	0.35	0.36	6.2
0.54	0.5	0.25	0.27	4.64
0.54	0.3	0.15	0.05	0.9

0.5	0.25	0.12	0.05	0.84
0.5	0.3	0.15	0.01	0.21
0.51	0.4	0.2	0.04	0.65
0.5	0.4	0.2	0.29	4.95
0.5	0.4	0.2	0.45	7.74
0.51	0.3	0.15	0.26	4.44
0.51	0.4	0.2	0.18	3.13
0.51	0.5	0.25	0.14	2.41
0.5	0.55	0.28	0.2	3.5
0.5	0.6	0.3	0.28	4.75
0.51	0.7	0.35	0.17	2.89
0.86	0	0	0	0
0	0	0	0	0
0.54	0.2	0.1	0	0
0.5	0.2	0.1	0.04	0.62
0.5	0.2	0.1	0.11	1.84
0.5	0.15	0.07	0	0
0.52	0	0	0	0
0	0	0	0	0
0.5	0.05	0.02	0	0
0.32	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

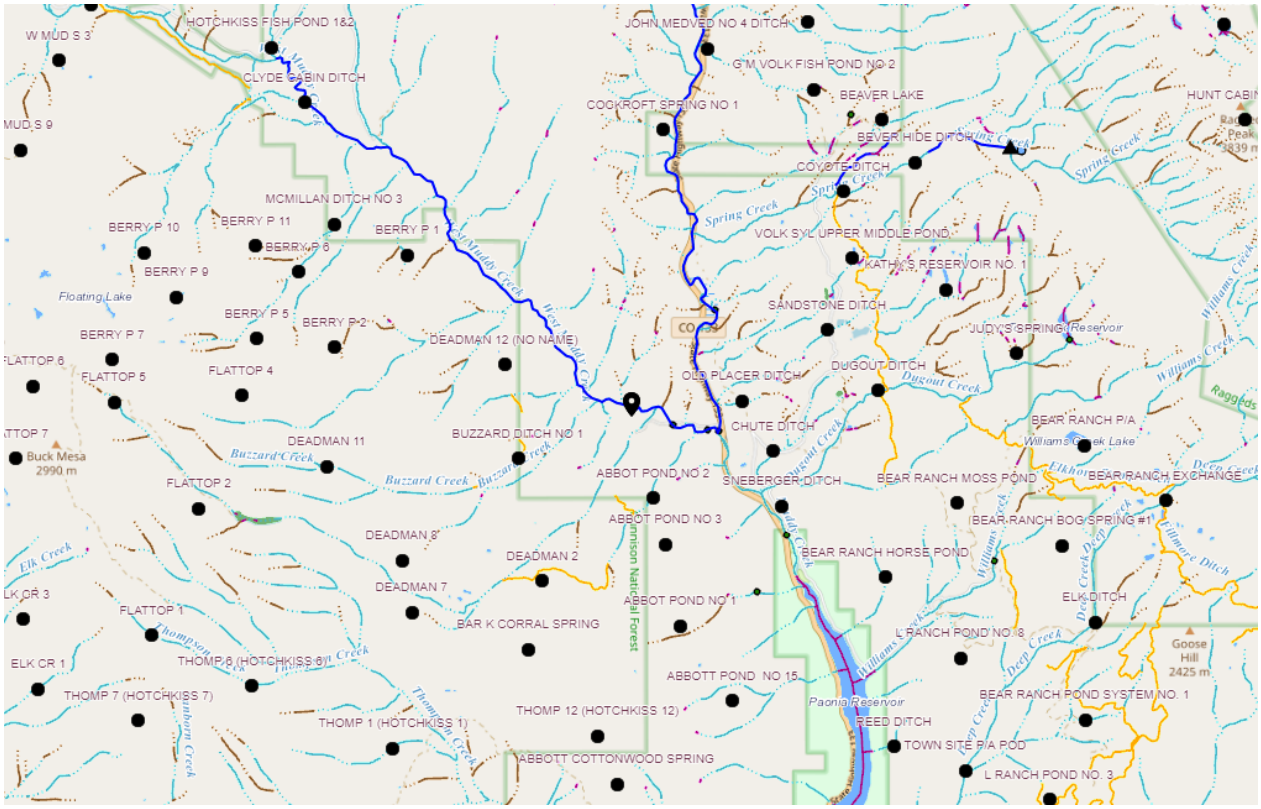
DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

R2Cross RESULTS

Stream Name: West Muddy Creek
Stream Locations: 1/4 mile upstream from BLM-private land boundary
Fieldwork Date: 05/11/2021
Cross-section:
Observers: R Smith, J Sondergard
Coordinate System: UTM Zone 13
X (easting): 294724
Y (northing): 4319739
Date Processed: 05/22/2023
Slope: 0.009
Discharge: R2Cross data file: 33.34 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: West Muddy Creek 5-11-21 #1.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 47.04

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.5	7.43
Percent Wetted Perimeter (%)	53.5	1.89
Mean Velocity (ft/s)	1.0	19.16

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	6.08	47.04	2.17	3.32	102.03	48.73	100.0	2.09	0.05	4.32	440.35
	6.1	46.9	2.16	3.3	101.17	48.59	99.71	2.08	0.05	4.29	433.96
	6.15	46.54	2.12	3.25	98.83	48.21	98.94	2.05	0.05	4.22	416.82
	6.2	46.18	2.09	3.2	96.51	47.83	98.16	2.02	0.05	4.14	400.04
	6.25	45.81	2.06	3.15	94.21	47.45	97.38	1.99	0.05	4.07	383.62
	6.3	45.45	2.02	3.1	91.93	47.07	96.6	1.95	0.06	4.0	367.55
	6.35	45.09	1.99	3.05	89.67	46.7	95.83	1.92	0.06	3.92	351.84
	6.4	44.72	1.95	3.0	87.42	46.32	95.05	1.89	0.06	3.85	336.49
	6.45	44.36	1.92	2.95	85.2	45.94	94.27	1.85	0.06	3.77	321.5
	6.5	44.0	1.89	2.9	82.99	45.56	93.5	1.82	0.06	3.7	306.86
	6.55	43.64	1.85	2.85	80.8	45.18	92.72	1.79	0.06	3.62	292.57
	6.6	43.27	1.82	2.8	78.62	44.8	91.94	1.75	0.06	3.54	278.64
	6.65	42.91	1.78	2.75	76.47	44.42	91.16	1.72	0.06	3.47	265.06
	6.7	42.55	1.75	2.7	74.33	44.04	90.39	1.69	0.06	3.39	251.83
	6.75	42.18	1.71	2.65	72.21	43.67	89.61	1.65	0.06	3.31	238.95
	6.8	41.82	1.68	2.6	70.11	43.29	88.83	1.62	0.06	3.23	226.43
	6.85	41.46	1.64	2.55	68.03	42.91	88.05	1.59	0.06	3.15	214.25
	6.9	41.09	1.61	2.5	65.97	42.53	87.28	1.55	0.06	3.07	202.43
	6.95	40.73	1.57	2.45	63.92	42.15	86.5	1.52	0.06	2.99	190.95
	7.0	40.37	1.53	2.4	61.9	41.77	85.72	1.48	0.06	2.91	179.82
	7.05	40.01	1.5	2.35	59.89	41.39	84.95	1.45	0.06	2.82	169.04
	7.1	39.64	1.46	2.3	57.89	41.01	84.17	1.41	0.06	2.74	158.61
	7.15	39.25	1.42	2.25	55.92	40.6	83.32	1.38	0.07	2.66	148.67
	7.2	38.83	1.39	2.2	53.97	40.17	82.43	1.34	0.07	2.58	139.19
	7.25	38.41	1.35	2.15	52.04	39.73	81.54	1.31	0.07	2.5	130.04

	7.3	37.99	1.32	2.1	50.13	39.3	80.64	1.28	0.07	2.42	121.22
	7.35	37.57	1.28	2.05	48.24	38.86	79.75	1.24	0.07	2.34	112.74
	7.4	37.14	1.25	2.0	46.37	38.43	78.85	1.21	0.07	2.26	104.59
	7.45	36.72	1.21	1.95	44.53	37.99	77.96	1.17	0.07	2.17	96.77
	7.5	36.3	1.18	1.9	42.7	37.55	77.07	1.14	0.07	2.09	89.28
	7.55	35.86	1.14	1.85	40.9	37.09	76.12	1.1	0.07	2.01	82.19
	7.6	35.36	1.11	1.8	39.12	36.59	75.09	1.07	0.08	1.93	75.54
	7.65	34.87	1.07	1.75	37.36	36.09	74.05	1.04	0.08	1.85	69.2
	7.7	34.38	1.04	1.7	35.63	35.58	73.02	1.0	0.08	1.77	63.17
	7.75	33.88	1.0	1.65	33.92	35.08	71.98	0.97	0.08	1.69	57.45
	7.8	33.39	0.97	1.6	32.24	34.57	70.95	0.93	0.08	1.61	52.03
	7.85	32.9	0.93	1.55	30.58	34.07	69.91	0.9	0.09	1.53	46.92
	7.9	32.4	0.89	1.5	28.95	33.56	68.88	0.86	0.09	1.45	42.09
	7.95	31.91	0.86	1.45	27.34	33.06	67.85	0.83	0.09	1.37	37.56
Waterline	8.0	31.42	0.82	1.4	25.76	32.56	66.81	0.79	0.09	1.29	33.32
	8.05	31.07	0.78	1.35	24.2	32.19	66.06	0.75	0.1	1.21	29.18
	8.1	30.72	0.74	1.3	22.65	31.83	65.32	0.71	0.1	1.12	25.33
	8.15	29.07	0.73	1.25	21.18	30.14	61.85	0.7	0.1	1.1	23.28
	8.2	28.4	0.7	1.2	19.75	29.44	60.41	0.67	0.1	1.03	20.34
	8.25	27.73	0.66	1.15	18.34	28.73	58.97	0.64	0.11	0.96	17.63
	8.3	27.07	0.63	1.1	16.97	28.03	57.52	0.61	0.11	0.89	15.15
	8.35	26.87	0.58	1.05	15.62	27.81	57.06	0.56	0.12	0.8	12.55
	8.4	26.69	0.54	1.0	14.28	27.6	56.63	0.52	0.13	0.71	10.21
	8.45	26.51	0.49	0.95	12.95	27.39	56.21	0.47	0.14	0.63	8.14
	8.5	26.37	0.44	0.9	11.63	27.22	55.85	0.43	0.15	0.54	6.31
	8.55	26.23	0.39	0.85	10.32	27.05	55.5	0.38	0.16	0.46	4.75
	8.6	26.09	0.35	0.8	9.01	26.88	55.15	0.34	0.18	0.38	3.44
	8.65	25.65	0.3	0.75	7.72	26.39	54.16	0.29	0.2	0.31	2.41
	8.7	25.2	0.26	0.7	6.45	25.89	53.14	0.25	0.23	0.25	1.59
	8.75	24.76	0.21	0.65	5.2	25.4	52.12	0.2	0.27	0.18	0.96
	8.8	20.73	0.2	0.6	4.08	21.31	43.73	0.19	0.28	0.17	0.68
	8.85	15.37	0.21	0.55	3.25	15.88	32.59	0.2	0.27	0.18	0.6
	8.9	13.03	0.19	0.5	2.54	13.48	27.66	0.19	0.28	0.16	0.41
	8.95	11.25	0.17	0.45	1.93	11.61	23.82	0.17	0.31	0.14	0.26

9.0	9.94	0.14	0.4	1.4	10.23	21.0	0.14	0.37	0.1	0.14
9.05	8.65	0.11	0.35	0.94	8.87	18.2	0.11	0.46	0.07	0.06
9.1	7.36	0.07	0.3	0.54	7.51	15.41	0.07	0.63	0.04	0.02
9.15	2.87	0.13	0.25	0.38	2.98	6.11	0.13	0.4	0.09	0.03
9.2	2.41	0.1	0.2	0.24	2.47	5.08	0.1	0.49	0.06	0.02
9.25	1.82	0.08	0.15	0.14	1.86	3.82	0.07	0.62	0.04	0.01
9.3	1.22	0.05	0.1	0.06	1.25	2.56	0.05	0.86	0.02	0.0
9.35	0.62	0.03	0.05	0.02	0.63	1.3	0.03	1.51	0.01	0.0
9.38	0.18	0.01	0.02	0.0	0.18	0.38	0.01	4.22	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) =	33.34	(cfs)
Calculated Flow (Qc) =	33.33	(cfs)
(Qm-Qc)/Qm * 100 =	0.03%	
Measured Waterline (WLm) =	8	(ft)
Calculated Waterline (WLc) =	8	(ft)
(WLm-WLc)/WLm * 100 =	0.02%	
Max Measured Depth (Dm) =	1.4	(ft)
Max Calculated Depth (Dc) =	1.4	(ft)
(Dm-Dc)/Dm * 100 =	-0.11%	
Mean Velocity =	1.29	(ft/s)
Manning's n =	0.093	
0.4 * Qm =	13.34	(cfs)
2.5 * Qm =	83.35	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	5.52	0	0
Bankfull	0.8	6.08	0	0
	6.1	7.12	0	0
Waterline	11.6	8	0	0
	13	8.3	0.3	0.38
	14	8.1	0.1	0.41
	15	8.1	0.1	0.43
	16	8.8	0.8	0.84
	17	8.75	0.75	0.64
	18	8.75	0.75	1.21
	19	8.9	0.9	0.84
	20	8.6	0.6	0.7
	21	8.95	0.95	1.28
	22	8.8	0.8	1.21
	23	8.8	0.8	1.24
	24	8.8	0.8	1.64
	25	8.8	0.8	1.24
	26	8.75	0.75	2.25
	27	8.9	0.9	2.05
	28	9.1	1.1	1.82
	29	9.1	1.1	1.43
	30	9.1	1.1	1.62
	31	9.1	1.15	1.23
	32	8.8	0.8	2.1
	33	8.9	0.9	1.56
	34	9.1	1.1	0
	35	9.1	1.1	0.63
	36	8.8	0.8	2.03
	37	9.2	1.2	1.97
	38	9.3	1.3	1.62

	39	9.4	1.4	1.51
	40	8.9	0.9	1.04
	41	9.2	1.2	0.68
	42	8.45	0.45	0.81
Waterline	43	8	0	0
	44.7	7.53	0	0
Bankfull	47.9	6.05	0	0
	52	4.9	0	0

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
1.43	0.3	0.36	0.14	0.41
1.02	0.1	0.1	0.04	0.12
1	0.1	0.1	0.04	0.13
1.22	0.8	0.8	0.67	2.02
1	0.75	0.75	0.48	1.44
1	0.75	0.75	0.91	2.72
1.01	0.9	0.9	0.76	2.27
1.04	0.6	0.6	0.42	1.26
1.06	0.95	0.95	1.22	3.65
1.01	0.8	0.8	0.97	2.9
1	0.8	0.8	0.99	2.98
1	0.8	0.8	1.31	3.94
1	0.8	0.8	0.99	2.98
1	0.75	0.75	1.69	5.06
1.01	0.9	0.9	1.84	5.53
1.02	1.1	1.1	2	6
1	1.1	1.1	1.57	4.72
1	1.1	1.1	1.78	5.34
1	1.15	1.15	1.41	4.24
1.04	0.8	0.8	1.68	5.04
1	0.9	0.9	1.4	4.21
1.02	1.1	1.1	0	0
1	1.1	1.1	0.69	2.08
1.04	0.8	0.8	1.62	4.87
1.08	1.2	1.2	2.36	7.09
1	1.3	1.3	2.11	6.32

1	1.4	1.4	2.11	6.34
1.12	0.9	0.9	0.94	2.81
1.04	1.2	1.2	0.82	2.45
1.25	0.45	0.45	0.36	1.09
1.1	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

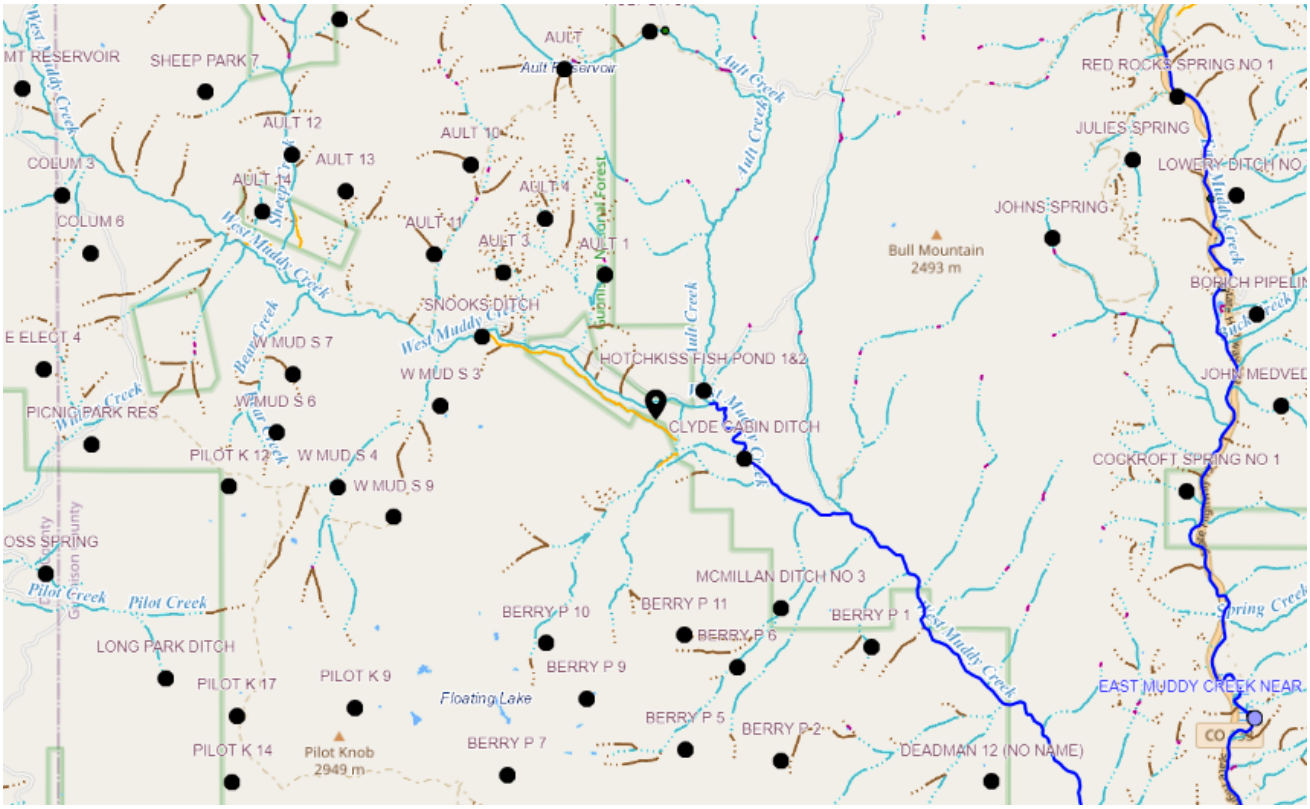
DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

R2Cross RESULTS

Stream Name: West Muddy Creek
Stream Locations: 1/4 mile upstream from confluence with Ault Creek
Fieldwork Date: 08/06/2021
Cross-section: 1
Observers: R Smith, J Sondergard, K Birch
Coordinate System: UTM Zone 13
X (easting): 289802
Y (northing): 4324286
Date Processed: 05/28/2023
Slope: 0.0041
Discharge: Entered Value: 4.57 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: West Muddy Creek 8-6-21 #1.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 30.13

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.3	1.14
Percent Wetted Perimeter (%)	50.0	3.39
Mean Velocity (ft/s)	1.0	13.65

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	4.5	30.13	1.52	2.49	45.71	31.42	100.0	1.45	0.05	2.28	104.2
	4.55	29.73	1.49	2.44	44.21	30.99	98.63	1.43	0.05	2.23	98.6
	4.6	29.34	1.46	2.39	42.73	30.56	97.27	1.4	0.05	2.18	93.17
	4.65	28.95	1.43	2.34	41.28	30.13	95.9	1.37	0.06	2.13	87.91
	4.7	28.55	1.4	2.29	39.84	29.7	94.54	1.34	0.06	2.08	82.82
	4.75	28.16	1.36	2.24	38.42	29.27	93.17	1.31	0.06	2.03	77.9
	4.8	27.77	1.33	2.19	37.02	28.84	91.81	1.28	0.06	1.98	73.15
	4.85	27.38	1.3	2.14	35.64	28.41	90.44	1.25	0.06	1.92	68.56
	4.9	26.98	1.27	2.09	34.29	27.98	89.07	1.23	0.06	1.87	64.14
	4.95	26.59	1.24	2.04	32.95	27.55	87.71	1.2	0.06	1.82	59.88
	5.0	26.2	1.21	1.99	31.63	27.12	86.34	1.17	0.06	1.76	55.78
	5.05	25.8	1.18	1.94	30.33	26.7	84.98	1.14	0.06	1.71	51.84
	5.1	25.41	1.14	1.89	29.05	26.27	83.61	1.11	0.06	1.65	48.06
	5.15	25.02	1.11	1.84	27.79	25.84	82.24	1.08	0.06	1.6	44.44
	5.2	24.84	1.07	1.79	26.54	25.62	81.54	1.04	0.06	1.53	40.55
	5.25	24.66	1.03	1.74	25.3	25.4	80.84	1.0	0.07	1.46	36.83
	5.3	24.48	0.98	1.69	24.07	25.18	80.14	0.96	0.07	1.38	33.29
	5.35	24.3	0.94	1.64	22.85	24.95	79.43	0.92	0.07	1.31	29.93
	5.4	24.12	0.9	1.59	21.64	24.73	78.73	0.88	0.07	1.24	26.75
	5.45	23.89	0.86	1.54	20.44	24.48	77.91	0.84	0.07	1.16	23.79
	5.5	23.62	0.82	1.49	19.26	24.19	77.01	0.8	0.07	1.09	21.05
	5.55	23.36	0.77	1.44	18.08	23.91	76.11	0.76	0.08	1.02	18.48
	5.6	21.09	0.8	1.39	16.96	21.63	68.85	0.78	0.08	1.07	18.18
	5.65	18.32	0.87	1.34	15.97	18.85	59.99	0.85	0.07	1.19	18.95
	5.7	18.15	0.83	1.29	15.06	18.65	59.36	0.81	0.07	1.11	16.78

	5.75	17.98	0.79	1.24	14.16	18.45	58.73	0.77	0.08	1.04	14.76
	5.8	17.81	0.74	1.19	13.26	18.25	58.1	0.73	0.08	0.97	12.86
	5.85	17.64	0.7	1.14	12.38	18.06	57.47	0.69	0.08	0.9	11.11
	5.9	17.46	0.66	1.09	11.5	17.84	56.8	0.64	0.09	0.83	9.5
	5.95	17.27	0.62	1.04	10.63	17.63	56.12	0.6	0.09	0.75	8.02
	6.0	16.97	0.58	0.99	9.78	17.31	55.1	0.56	0.09	0.69	6.74
	6.05	16.63	0.54	0.94	8.94	16.96	53.98	0.53	0.1	0.63	5.6
Waterline	6.1	16.3	0.5	0.89	8.11	16.61	52.87	0.49	0.1	0.56	4.57
	6.15	15.89	0.46	0.84	7.31	16.19	51.53	0.45	0.11	0.5	3.68
	6.2	14.91	0.44	0.79	6.53	15.19	48.34	0.43	0.12	0.47	3.07
	6.25	14.18	0.41	0.74	5.81	14.44	45.96	0.4	0.12	0.43	2.49
	6.3	13.92	0.37	0.69	5.11	14.16	45.08	0.36	0.13	0.37	1.87
	6.35	13.67	0.32	0.64	4.42	13.89	44.21	0.32	0.15	0.31	1.35
	6.4	13.38	0.28	0.59	3.74	13.59	43.25	0.28	0.16	0.25	0.93
	6.45	12.98	0.24	0.54	3.08	13.17	41.92	0.23	0.19	0.2	0.6
	6.5	11.69	0.21	0.49	2.46	11.86	37.76	0.21	0.2	0.16	0.4
	6.55	9.9	0.19	0.44	1.93	10.05	31.99	0.19	0.22	0.15	0.28
	6.6	8.74	0.17	0.39	1.46	8.87	28.24	0.16	0.25	0.12	0.17
	6.65	7.12	0.15	0.34	1.07	7.25	23.07	0.15	0.27	0.1	0.11
	6.7	6.78	0.11	0.29	0.72	6.89	21.92	0.11	0.36	0.06	0.04
	6.75	4.57	0.1	0.24	0.44	4.66	14.84	0.09	0.39	0.05	0.02
	6.8	3.14	0.08	0.19	0.25	3.21	10.22	0.08	0.45	0.04	0.01
	6.85	2.02	0.07	0.14	0.14	2.07	6.58	0.07	0.52	0.03	0.0
	6.9	1.46	0.03	0.09	0.05	1.5	4.76	0.03	0.98	0.01	0.0
	6.95	0.36	0.02	0.04	0.01	0.37	1.19	0.02	1.45	0.0	0.0
	6.97	0.14	0.01	0.01	0.0	0.14	0.45	0.01	3.28	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) =	4.57	(cfs)
Calculated Flow (Qc) =	4.57	(cfs)
(Qm-Qc)/Qm * 100 =	-0.00%	
Measured Waterline (WLm) =	6.1	(ft)
Calculated Waterline (WLc) =	6.1	(ft)
(WLm-WLc)/WLm * 100 =	0.00%	
Max Measured Depth (Dm) =	0.89	(ft)
Max Calculated Depth (Dc) =	0.89	(ft)
(Dm-Dc)/Dm * 100 =	-0.00%	
Mean Velocity =	0.56	(ft/s)
Manning's n =	0.105	
0.4 * Qm =	1.83	(cfs)
2.5 * Qm =	11.43	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	4.06		
Bankfull	2.4	4.5		
	2.8	5.42		
	3.7	5.85		
Waterline	4.3	6.1	0	
	4.7	6.17	0.07	
	5.2	6.21	0.11	
	5.9	6.19	0.09	
	6.6	6.45	0.35	
	7.3	6.5	0.4	
	8	6.61	0.51	
	8.7	6.61	0.51	
	9.4	6.65	0.55	
	10.1	6.99	0.89	
	10.8	6.89	0.79	
	11.5	6.93	0.83	
	12.2	6.76	0.66	
	12.9	6.71	0.61	
	13.6	6.72	0.62	
	14.3	6.8	0.7	
	15	6.81	0.71	
	15.7	6.75	0.65	
	16.4	6.69	0.59	
	17.1	6.46	0.36	
	17.8	6.6	0.5	
	18.5	6.52	0.42	
	19.2	6.52	0.42	
	19.9	6.39	0.29	
Waterline	20.6	6.1	0	
	21.2	5.96		

	21.6	5.65
	26.4	5.56
	27.7	5.15
Bankfull	32.6	4.49
	36.4	3.71

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
0.41	0.07	0.03	0.02	0.39
0.5	0.11	0.07	0.04	0.81
0.7	0.09	0.06	0.04	0.78
0.75	0.35	0.24	0.14	3.02
0.7	0.4	0.28	0.16	3.45
0.71	0.51	0.36	0.2	4.4
0.7	0.51	0.36	0.2	4.4
0.7	0.55	0.39	0.22	4.75
0.78	0.89	0.62	0.35	7.68
0.71	0.79	0.55	0.31	6.82
0.7	0.83	0.58	0.33	7.16
0.72	0.66	0.46	0.26	5.7
0.7	0.61	0.43	0.24	5.26
0.7	0.62	0.43	0.24	5.35
0.7	0.7	0.49	0.28	6.04
0.7	0.71	0.5	0.28	6.13
0.7	0.65	0.46	0.26	5.61
0.7	0.59	0.41	0.23	5.09
0.74	0.36	0.25	0.14	3.11
0.71	0.5	0.35	0.2	4.31
0.7	0.42	0.29	0.17	3.62
0.7	0.42	0.29	0.17	3.62
0.71	0.29	0.2	0.11	2.5
0.76	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

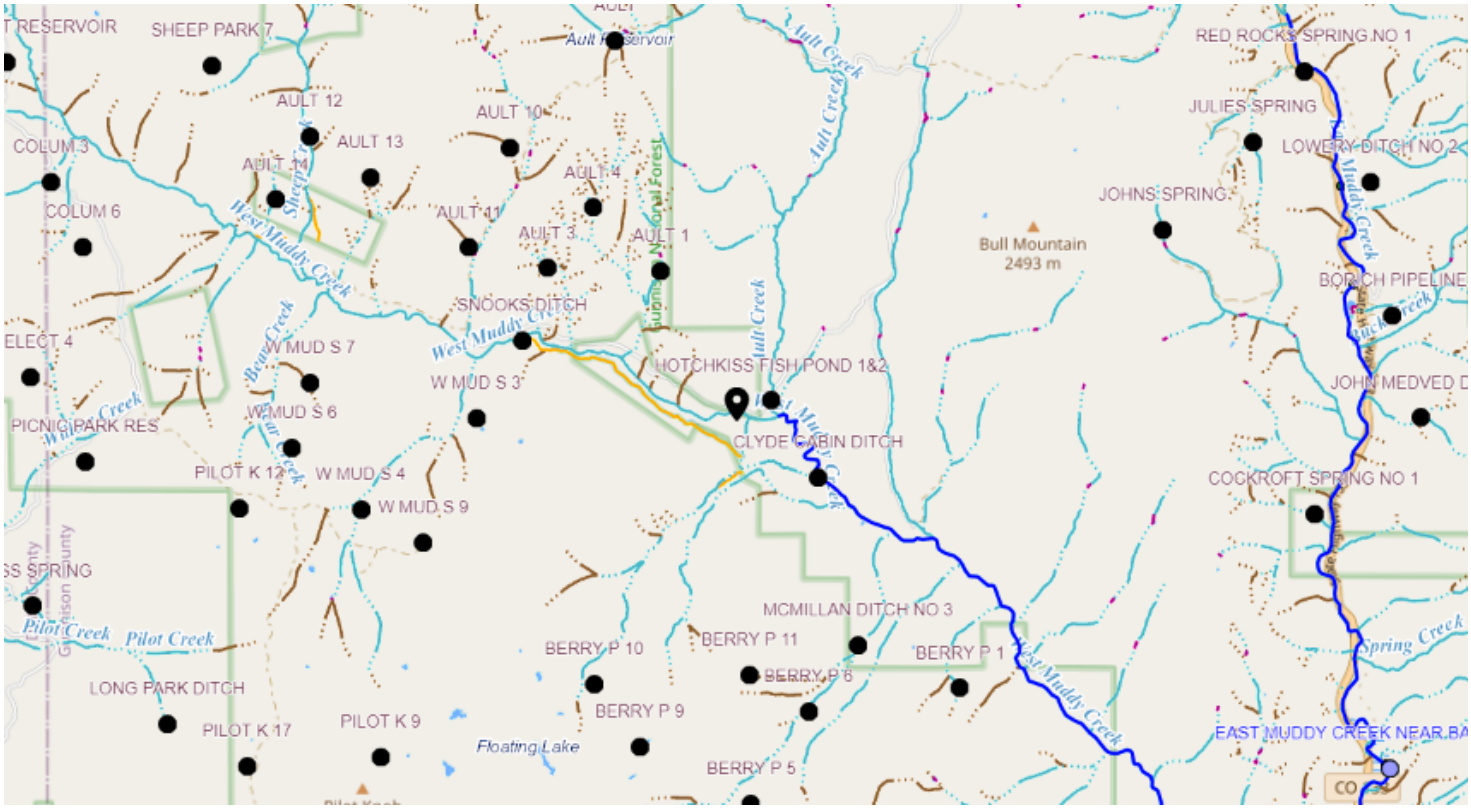
DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

R2Cross RESULTS

Stream Name: West Muddy Creek
Stream Locations: 1/4 mile upstream from confluence with Ault Creek
Fieldwork Date: 08/06/2021
Cross-section:
Observers: R Smith, J Sondergard, K Birch
Coordinate System: UTM Zone 13
X (easting): 289946
Y (northing): 4324302
Date Processed: 05/28/2023
Slope: 0.0055
Discharge: Entered Value: 4.57 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: West Muddy Creek 8-6-21 #2.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 36.16

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.4	8.75
Percent Wetted Perimeter (%)	50.0	0.45
Mean Velocity (ft/s)	1.0	9.3

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	3.81	36.16	1.08	1.59	38.98	36.56	100.0	1.07	0.04	3.16	123.17
	3.85	35.64	1.05	1.55	37.54	36.03	98.56	1.04	0.04	3.09	116.17
	3.9	34.99	1.02	1.5	35.78	35.38	96.76	1.01	0.04	3.01	107.73
	3.95	34.34	0.99	1.45	34.04	34.72	94.96	0.98	0.04	2.93	99.62
	4.0	33.69	0.96	1.4	32.34	34.06	93.15	0.95	0.04	2.84	91.85
	4.05	33.03	0.93	1.35	30.68	33.4	91.35	0.92	0.04	2.75	84.41
	4.1	32.38	0.9	1.3	29.04	32.74	89.55	0.89	0.04	2.66	77.29
	4.15	31.73	0.86	1.25	27.44	32.08	87.75	0.86	0.04	2.57	70.49
	4.2	31.08	0.83	1.2	25.87	31.42	85.95	0.82	0.04	2.47	64.02
	4.25	30.52	0.8	1.15	24.33	30.85	84.39	0.79	0.04	2.37	57.68
	4.3	29.96	0.76	1.1	22.81	30.29	82.84	0.75	0.04	2.26	51.67
	4.35	29.47	0.72	1.05	21.33	29.78	81.45	0.72	0.04	2.15	45.87
	4.4	28.99	0.69	1.0	19.87	29.29	80.11	0.68	0.04	2.03	40.38
	4.45	28.51	0.65	0.95	18.43	28.8	78.77	0.64	0.04	1.91	35.21
	4.5	28.03	0.61	0.9	17.02	28.31	77.43	0.6	0.04	1.79	30.38
	4.55	27.55	0.57	0.85	15.63	27.82	76.09	0.56	0.05	1.66	25.89
	4.6	27.07	0.53	0.8	14.26	27.33	74.75	0.52	0.05	1.52	21.75
	4.65	26.59	0.49	0.75	12.92	26.84	73.41	0.48	0.05	1.39	17.95
	4.7	26.07	0.45	0.7	11.6	26.31	71.98	0.44	0.05	1.25	14.53
	4.75	25.5	0.4	0.65	10.31	25.74	70.4	0.4	0.05	1.11	11.5
	4.8	24.94	0.36	0.6	9.05	25.16	68.82	0.36	0.06	0.98	8.83
	4.85	24.37	0.32	0.55	7.82	24.58	67.24	0.32	0.06	0.83	6.52
Waterline	4.9	23.8	0.28	0.5	6.62	24.01	65.66	0.28	0.07	0.69	4.57
	4.95	22.8	0.24	0.45	5.45	22.99	62.89	0.24	0.07	0.56	3.07
	5.0	21.64	0.2	0.4	4.34	21.81	59.66	0.2	0.08	0.44	1.92

	5.05	20.48	0.16	0.35	3.29	20.63	56.44	0.16	0.1	0.32	1.06
	5.1	19.0	0.12	0.3	2.3	19.12	52.3	0.12	0.12	0.22	0.5
	5.15	14.24	0.1	0.25	1.47	14.33	39.2	0.1	0.14	0.17	0.25
	5.2	10.37	0.08	0.2	0.85	10.42	28.5	0.08	0.17	0.12	0.1
	5.25	6.25	0.07	0.15	0.44	6.28	17.18	0.07	0.19	0.1	0.04
	5.3	4.13	0.04	0.1	0.18	4.14	11.33	0.04	0.28	0.05	0.01
	5.35	1.33	0.02	0.05	0.03	1.34	3.66	0.02	0.45	0.02	0.0
	5.38	0.4	0.01	0.01	0.0	0.4	1.1	0.01	1.22	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) =	4.57	(cfs)
Calculated Flow (Qc) =	4.57	(cfs)
(Qm-Qc)/Qm * 100 =	0.01%	
Measured Waterline (WLm) =	4.9	(ft)
Calculated Waterline (WLc) =	4.9	(ft)
(WLm-WLc)/WLm * 100 =	-0.00%	
Max Measured Depth (Dm) =	0.5	(ft)
Max Calculated Depth (Dc) =	0.5	(ft)
(Dm-Dc)/Dm * 100 =	0.00%	
Mean Velocity =	0.69	(ft/s)
Manning's n =	0.068	
0.4 * Qm =	1.83	(cfs)
2.5 * Qm =	11.43	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	2.99		
Bankfull	4	3.76		
	7	4.2		
Waterline	10.5	4.9	0	
	12	5.13	0.23	
	13	5.1	0.2	
	14	5.26	0.36	
	15	5.22	0.32	
	16	5.23	0.33	
	17	5.11	0.21	
	18	5.17	0.27	
	18.5	5.28	0.38	
	19	5.33	0.43	
	19.5	5.3	0.4	
	20	5.29	0.39	
	20.5	5.19	0.29	
	21	5.06	0.16	
	22	5.19	0.29	
	23	5.21	0.31	
	24	5.11	0.21	
	25	5.18	0.28	
	26	4.92	0.02	
	27	5.16	0.26	
	28	5.3	0.4	
	29	5.4	0.5	
	30	5.34	0.44	
	31	5.34	0.44	
	32	5.22	0.32	
	33	5.05	0.15	
Waterline	34.3	4.9	0	

	35.7	4.68
	37.4	4.31
Bankfull	40.5	3.81
	43.3	2.56

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
1.52	0.23	0.29	0.2	4.34
1	0.2	0.2	0.14	3.02
1.01	0.36	0.36	0.25	5.44
1	0.32	0.32	0.22	4.84
1	0.33	0.33	0.23	4.99
1.01	0.21	0.21	0.15	3.17
1	0.27	0.2	0.14	3.06
0.51	0.38	0.19	0.13	2.87
0.5	0.43	0.21	0.15	3.25
0.5	0.4	0.2	0.14	3.02
0.5	0.39	0.2	0.13	2.95
0.51	0.29	0.14	0.1	2.19
0.52	0.16	0.12	0.08	1.81
1.01	0.29	0.29	0.2	4.38
1	0.31	0.31	0.21	4.68
1	0.21	0.21	0.15	3.17
1	0.28	0.28	0.19	4.23
1.03	0.02	0.02	0.01	0.3
1.03	0.26	0.26	0.18	3.93
1.01	0.4	0.4	0.28	6.04
1	0.5	0.5	0.35	7.56
1	0.44	0.44	0.3	6.65
1	0.44	0.44	0.3	6.65
1.01	0.32	0.32	0.22	4.84
1.01	0.15	0.17	0.12	2.61
1.31	0	0	0	0

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

Combined Summaries

Water **41777** **Muddy Creek, West**

Station **GU2515** **1 Km ABV Willow Creek**

Date **6/28/2016**

Drainage **Gunnison River**

UtmX **283522** UtmY **4327941** Elevation **7896 ft**

Length **336 ft** Width **12.00 ft** Area **0.09 acre**

Surveyors **Woody, Branson, Hayner**

Gear Effort Metric Protocol **PRESENCE/ABSENCE**

Proportional Stocking Density and Catch/Unit Effort

Species	Total Catch	Min Cut inch	Max Cut inch	Total used	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Max Length inches
BLUEHEAD SUCKER	1			1							7.05
BROOK TROUT	1			1							3.98
MOTTLED SCULPIN	7			7							4.80
SPECKLED DACE	27			27							3.78
WHITE-BLUEHEAD SUCKER HYBRID	1			1							6.06

Mean, Minimum and Maximum Length and Weight

Species	Total Catch	Min cut inch	Max cut inch	Total Used	Length (inches) Mean	Length (inches) Minimum	Length (inches) Maximum	Weight (lb) Mean	Weight (lb) Minimum	Weight (lb) Maximum
BLUEHEAD SUCKER	1			1	7.05	7.05	7.05	0.11	0.11	0.11
BROOK TROUT	1			1	3.98	3.98	3.98	0.03	0.03	0.03
MOTTLED SCULPIN	7			7	3.44	2.76	4.80	0.02	0.01	0.06
SPECKLED DACE	27			27	3.03	2.28	3.78	0.01	0.01	0.02
WHITE-BLUEHEAD SUCKER HYBRID	1			1	6.06	6.06	6.06	0.07	0.07	0.07

Combined Summaries

Water **41777** **Muddy Creek, West** Date **6/28/2016**

Station **GU2515** **1 Km ABV Willow Creek**

Relative Abundance and Catch/Unit Effort

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total used	Weight Lbs	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BLUEHEAD SUCKER	1			1	0.11	2.70	16.90		
BROOK TROUT	1			1	0.03	2.70	3.87		
MOTTLED SCULPIN	7			7	0.17	18.92	25.47		
SPECKLED DACE	27			27	0.29	72.97	43.27		
WHITE-BLUEHEAD SUCKER HYBRID	1			1	0.07	2.70	10.49		

Abundance and Biomass

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total Used	Population estimate	Biomass Lbs	Percent Number	Percent Weight	Density estimates Lb/Acre	Density estimates Fish/Acre	Density estimates Fish/Mile
BLUEHEAD SUCKER	1			1		0.11	2.70	16.90	1.22	10.80	15.71
BROOK TROUT	1			1		0.03	2.70	3.87	0.28	10.80	15.71
MOTTLED SCULPIN	7			7		0.17	18.92	25.47	1.83	75.63	110.00
SPECKLED DACE	27			27		0.29	72.97	43.27	3.12	291.70	424.29
WHITE-BLUEHEAD SUCKER HYBRID	1			1		0.07	2.70	10.49	0.76	10.80	15.71

Notes: Fisrt pass- 589 sec; Second pass- 681 sec