United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210

In Reply Refer To:
7250 (CO-932)

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 Spruce Creek, located in Water Division 5.

Location and Land Status. Spruce Creek originates from an unnamed peak on the crest of the Gore Range, approximately six miles west of Green Mountain Reservoir. Spruce Creek flows into the Blue River approximately eight miles south of Kremmling. This recommendation addresses the portion of Spruce Creek that starts at the headwaters and extends downstream to the headgate of the Hoagland Canal (also known as the Noonan Ditch), a distance of approximately 3.5 miles. The BLM manages 0.9 miles of this reach and approximately 2.6 miles are in private ownership.

Existing Instream Flow Water Right. In 1985, the Colorado Water Conservation Board (CWCB) appropriated an instream flow water right for 0.5 cubic feet per second, year-round. The purpose of this recommendation is to request an increase to the existing instream flow water right.

Biological Summary. Spruce Creek is a cold water, high gradient stream. The reach that is the subject of this recommendation flows through a valley that ranges from ¼ to ½ mile in width. The reach begins on densely forested USFS-managed lands, flows through BLM lands comprised of mixed forests and meadows, and then flows through private lands primarily used for recreation, hunting, and grazing.

Substrate is generally from small to medium in size, ranging from gravels to four-inch cobbles. Water quality is excellent for supporting cold water species.

Fish surveys have documented a self-supporting population of Colorado River Cutthroat Trout – Green Lineage. BLM works with partners, including Colorado Parks and Wildlife as well as Blue Valley Ranch, to manage the fishery in Spruce Creek as a conservation population. BLM and its partners have invested in habitat improvements, such as reconstruction of road crossings and changes in diversion practices. These projects are designed to improve habitat conditions,

fish passage, habitat connectivity, and increase fish populations lower in the stream reach. Surveys have indicated robust populations of stonefly and caddisfly, indicating high water quality.

The creek supports a healthy riparian community comprised of spruce and willow species. Bank stability appears to be good, except in limited areas of high livestock usage.

R2Cross Analysis. The BLM collected the following R2Cross data from Spruce 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)
07/14/2020 #1	0.44 cfs	5.20 feet	0.64 cfs	0.93 cfs
07/14/2020 #2	0.32 cfs	7.36 feet	0.49 cfs	Out of range
06/23/2021 #1	0.59 cfs	4.60 feet	0.31 cfs	0.83 cfs
		Averages:	0.48 cfs	0.88 cfs

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

> 0.90 cubic feet per second is recommended during the snowmelt runoff period and summer, from April 15 through June 30. This recommendation is driven by the average velocity and average depth criteria. Spruce Creek has limited riffle habitat, so protecting this flow rate will ensure that the limited habitat can be fully utilized during the spring and summer period. During May and June, the fish population is completing its spawning activities and the fish are moving actively between pools. Implementing this recommendation would require appropriating an additional instream flow water right for 0.4 cfs, which brings the total instream flow protection up to 0.9 cfs.

Water Availability. The BLM recommends using a variety of data sources to confirm water availability, because BLM is not aware of any historical gage data on this creek. Use of StreamStats can provide an estimate of natural hydrology. One nearby gage may provide an estimate of the seasonality of flows, because it is located on a watershed with similar characteristics. USGS Gage 09055300, on Cataract Creek west of Green Mountain Reservoir, is located on a larger watershed but appears to be relatively unaffected by diversion and storage operations. Analysis of diversion records for the Hoagland Canal (also known as Noonan Ditch) would also provide some documentation of flows available in Spruce Creek.

The BLM is not aware of any actively exercised water rights within the instream flow reach.

Relationship to Land Management Plans. The Colorado River Cutthroat Trout population in Spruce Creek has been identified as a core conservation population in the Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming (2007). In addition, BLM's management plan calls for actions to maintain and enhance habitat that supports sensitive fish species. Specifically, the BLM plan calls for making

instream flow recommendations to the Colorado Water Conservation Board to meet minimum instream flow requirements to maintain native fisheries. Finally, the plan calls for maintaining and improving the function of riparian areas to achieve advanced ecological stage for the riparian community, and it also calls for protecting riparian and wetland systems from activities that could degrade those habitats. 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 2021. BLM thanks 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,

ALAN BITTNER

Digitally signed by ALAN BITTNER
Date: 2021.12.14 11:23:21 -07'00'

Alan Bittner
Deputy State Director, Resources

Cc: Bill Mills, Kremmling Field Office
Paula Belcher, Kremmling Field Office
Elijah Waters, Northwest District Office

BLM/USU National Aquatic Monitoring Center (NAMC)
Department of Watershed Sciences (WATS) - Utah State University 5210 Old Main Hill Logan, UT 84322-5210 http://www.usu.edu/bugslab/

Report prepared by:
Scott Miller: 435.797.2612 / scott.miller@usu.edu
Jennifer Courtwright: 985.502.7530 / jennifer.courtwright@usu.edu

Report prepared for:

Customer contact:	Tom Fresques
Customer:	BLM - CO - Colorado River Valley Office
Customer Address :	50629 Hwy. 6 And 24,P.o. Box 1009
Customer City, State, Zip:	Glenwood Springs, CO 81602
Customer Phone:	970-876-9078
Customer Email:	t1fresqu@blm.gov

Sample ID	Station (NAMC)	Latitude	Longitude	Collection Date	Estimated MMI Score	Biological Condition
155742	SPRUCE_CK	39.89971	-106.415	7/29/2015	61.7	Not Impaired
155743	SPRUCE_CK-02	39.92328	-106.409	7/29/2015	89.7	Not Impaired

Taxa List

Taxa	Present at SPRUCE_CK	Present at SPRUCE_CK-02
Annelida Clitellata spp.	no	Yes
Trombidiformes	Yes	Yes
Lebertiidae Lebertia spp.	Yes	Yes
Sperchonidae Sperchon spp.	Yes	Yes
Coleoptera Dytiscidae Agabinae Agabus	No	Yes
Coleoptera Elmidae Spp	No	Yes
Coleoptera Elmidae Cleptelmis addenda	No	Yes
Coleoptera Elmidae Heterlimnius corpulentus	Yes	Yes

Coleoptera Elmidae Optioservus Spp	No	Yes
Coleoptera Elmidae Optioservus quadrimaculatus	No	Yes
Coleoptera Elmidae Zaitzevia parvulus	No	Yes
Coleoptera Helophoridae Helophorus	No	Yes
Coleoptera Hydrophilidae Spp	No	Yes
Coleoptera Hydrophilidae Ametor Spp	No	Yes
Diptera Ceratopogonidae Ceratopogoninae Probezzia Spp	Yes	Yes
Diptera Chironomidae Spp	Yes	No
Diptera Chironomidae Chironominae	Yes	Yes
Diptera Chironomidae Chironominae Paratendipes	No	Yes
Diptera Chironomidae Chironominae Polypedilum	Yes	No
Diptera Chironomidae Diamesinae Diamesa Spp	No	Yes
Diptera Chironomidae Diamesinae Pagastia Spp	Yes	Yes
Diptera Chironomidae Orthocladiinae Spp	Yes	Yes
Diptera Chironomidae Orthocladiinae Brillia Spp	Yes	Yes
Diptera Chironomidae Orthocladiinae Cricotopus Spp	Yes	Yes
Diptera Chironomidae Orthocladiinae Eukiefferiella Spp	Yes	Yes
Diptera Chironomidae Orthocladiinae Parametriocnemus Spp	Yes	No
Diptera Chironomidae Orthocladiinae Rheocricotopus Spp	Yes	No
Diptera Chironomidae Orthocladiinae Thienemanniella Spp	Yes	No
Diptera Chironomidae Orthocladiinae Tvetenia Spp	Yes	Yes
Diptera Chironomidae Prodiamesinae Prodiamesa	No	Yes

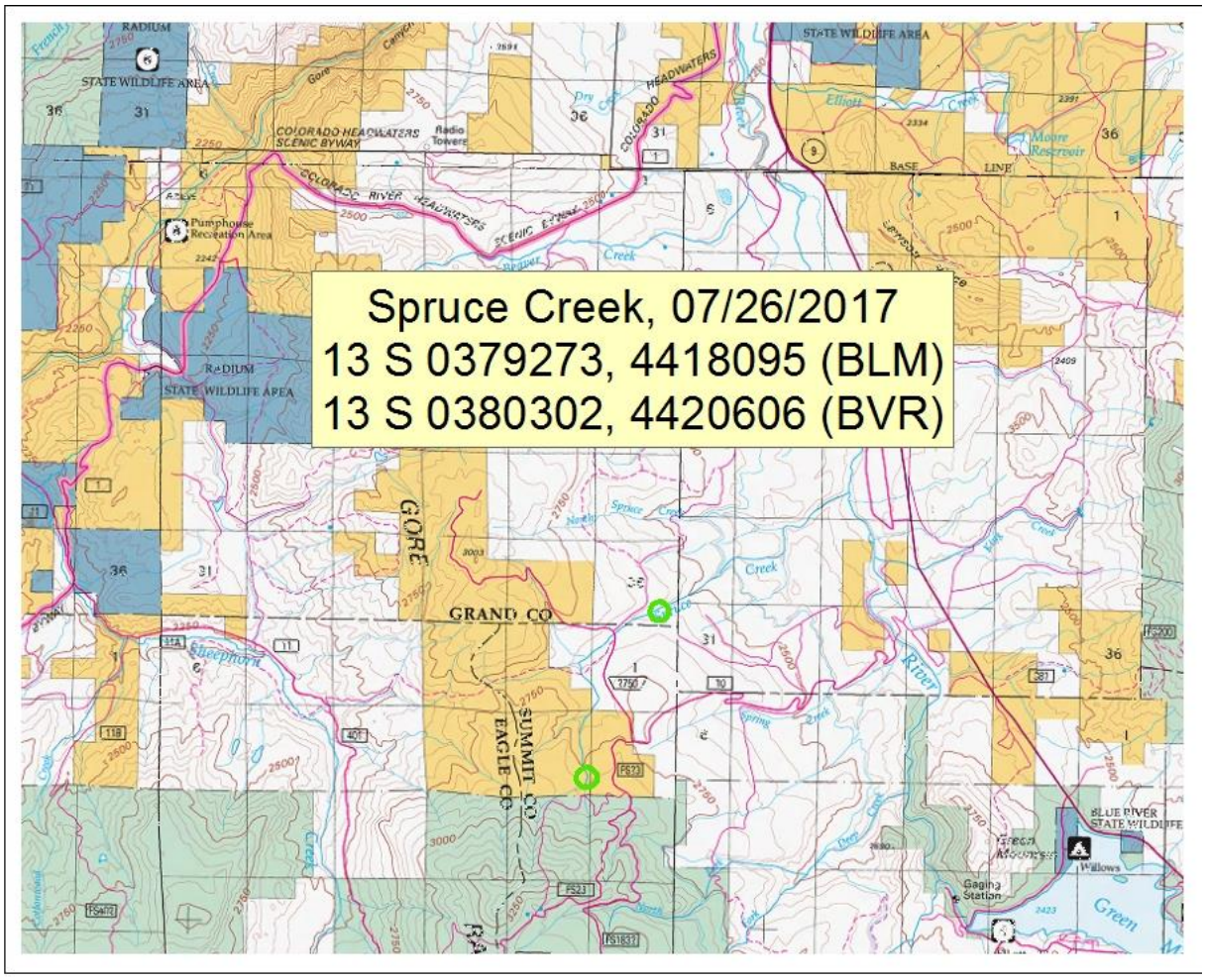
Diptera Chironomidae Tanypodinae Spp	Yes	No
Diptera Dixidae Dixa Spp	No	Yes
Diptera Empididae Clinocera Spp	Yes	No
Diptera Empididae Wiedemannia Spp	Yes	No
Diptera Empididae Hemerodromiinae Chelifera Spp	Yes	No
Diptera Psychodidae Pericoma Spp	No	Yes
Diptera Ptychopteridae Ptychoptera Spp	No	Yes
Diptera Simuliidae Simuliinae Simulium Spp	Yes	Yes
Diptera Tipulidae Dicranota	Yes	Yes
Ephemeroptera Ameletidae Ameletus Spp	No	Yes
Ephemeroptera Baetidae Spp	Yes	No
Ephemeroptera Baetidae Baetis Spp	Yes	Yes
Ephemeroptera Baetidae Diphetor hageni	No	Yes
Ephemeroptera Ephemerellidae Spp	Yes	Yes
Ephemeroptera Ephemerellidae Drunella doddsii	Yes	No
Ephemeroptera Ephemerellidae Drunella grandis	No	Yes
Ephemeroptera Ephemerellidae Ephemerella tibialis	No	Yes
Ephemeroptera Heptageniidae Spp	No	Yes
Ephemeroptera Heptageniidae Cinygmula Spp	Yes	Yes
Ephemeroptera Heptageniidae Epeorus Spp	No	Yes
Ephemeroptera Letophlebiidae Paraleptophlebia Spp	Yes	Yes
Plecoptera Spp	Yes	Yes
Plecoptera Chloroperlidae Sweltsa Spp	Yes	Yes
Plecoptera Chloroperlidae Chloroperlinae Spp	No	Yes
Plecoptera Chloroperlidae Chloroperlinae Suwallia Spp	No	Yes
Plecoptera Nemouridae Spp	Yes	No

Plecoptera Nemouridae Zapada Spp	Yes	No
Plecoptera Nemouridae Zapada cinctipes	Yes	Yes
Plecoptera Nemouridae Amphinemurinae Amphinemura Spp	Yes	Yes
Plecoptera Perlidae Hesperoperla pacifica	Yes	No
Plecoptera Perlodidae Spp	Yes	Yes
Plecoptera Perlodidae Megarcys signata	No	Yes
Plecoptera Perlodidae Isoperlinae Isoperla Spp	No	Yes
Plecoptera Pteronarcyidae Pteronarcyinae Pteronarcella badia	Yes	Yes
Trichoptera Glossosomatidae Agapetinae Agapetus Spp	Yes	Yes
Trichoptera Hydropsychidae Arctopsychinae Parapsyche elsis	Yes	No
Trichoptera Lepidostomatidae Lepidostomatinae Lepidostoma Spp	No	Yes
Trichoptera Limnephilidae Dicosmoecinae Dicosmoecus Spp	Yes	No
Trichoptera Philopotamidae Spp	Yes	No
Trichoptera Rhyacophilidae Rhyacophila Spp	Yes	Yes
Trichoptera Rhyacophilidae Rhyacophila brunnea/vemna group	Yes	Yes
Trichoptera Rhyacophilidae Rhyacophila vofixa group	Yes	No
Trichoptera Uenoidae Neothremma Spp	Yes	No
Trichoptera Uenoidae Oligophlebodes Spp	No	Yes
Amphipoda Hyalellidae Hyalella Spp	Yes	No
Veneroida Pisidiidae Pisidiinae Pisidium Spp	Yes	No

Kremmling Field Office
Stream Sampling July 2017

Spruce Creek - Water Code #22997

Introduction:
Spruce Creek, located southwest of Kremmling, CO on public lands managed by the Kremmling Field Office, was sampled on July 26, 2017. Specifically, two established monitoring sites were sampled to collect and assess macroinvertebrate populations. One site (lower) is located on Blue Valley Ranch property and the second (upper) is located on BLM land. Spruce Creek is home to a conservation population of Colorado River Cutthroat Trout – Green Linage. Invertebrate samples are used to help assess stream health and productivity, and data from this sampling will help inform flow improvement work being conducted on Blue Valley Ranch (BVR) as a water diversion on the stream has been moved to increase flow and improve habitat and population connectivity. Sampling was conducted by: Austin Wenke and Tom Fresques, BLM, and Brien Rose and Crew, BVR.



Spruce Creek on BLM lands

Healthy Riparian on Spruce Creek

Spruce trees providing shade and thermal regulation

Discussion:
Spruce Creek contains a cooperatively managed conservation population of Colorado River Cutthroat Trout. Recent work to improve habitat and population connectivity has been completed by Blue Valley Ranch. The ranch changed a point of diversion on the stream to provide better flow further downstream. This reach had been previously impacted by low flows which resulted in reduced habitat and population connectivity.

Both invertebrate samples were comprised of a composite of eight 1 ft^2 samples from 8 different riffles within each 500 foot sample reach using a Surber Sampler. Macroinvertebrate samples were sent to the BLM's National Aquatic Monitoring Center at Utah State University to be processed. Once samples are processed, and the data is received, it can be compared to 2015 and 2016 data to determine the health of invertebrates present and any differences or changes in species composition or densities amongst sites and years.

Other habitat work to be completed includes the replacement of the culverted stream crossing by BLM. This effort should further improve population connectivity in the stream. This work is planned for the summer of 2018.

Recommendations:
- Continue to monitor Spruce Creek Cutthroat populations over time to determine success of habitat improvement work
- Compare invertebrate data before and after flow improvement efforts on the lower BVR site

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

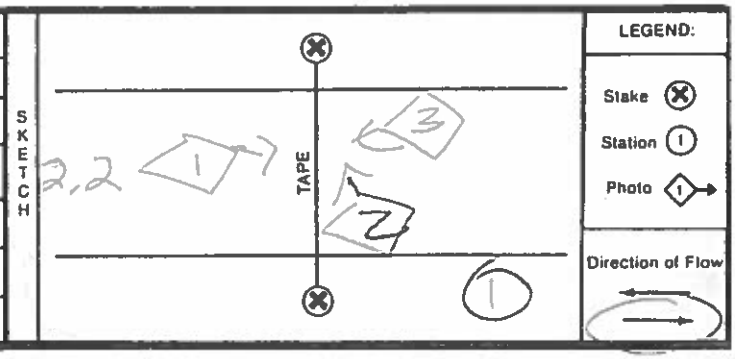
STREAM NAME: Spruce Creek					CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: Approx. 500 ft. upstream from BLM-private boundary						
DATE: 10-23-2	OBSERVERS: K. Smith, P. Belcher					
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 11	TOWNSHIP: 2 N(S)	RANGE: 81 E(W)	PM: Sixth	
COUNTY: Summit	WATERSHED: Blue River	WATER DIVISION: 5	DOW WATER CODE: 22997			
MAP(S): USGS: 13N 379094		39.909762				
USFS: 4418699		106.414542				

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: crawel to 4-inch cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0 5.0	6.0/6.0
② WS Upstream	11.0	5.88
③ WS Downstream	9.0	6.32
SLOPE	0.44/20.0 = .022	



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

pH = 7.80
Cond = 49.8
Salinity = 0
Temp = 10.4°

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO:	DATE:	SHEET ___ OF ___
Spruce Creek	1	6-23-4	

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 12:10 pm

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)
RS	0.0		4.67								
	1.5		5.08								
RF	2.0		5.33								
RW	2.2		6.00								
	2.4		6.25	.25				3.1			
	2.6		6.2	.2				0.91			
	2.8		6.2	.2				1.12			
	3		6.2	.2				0.88			
	3.2		6.2	.2				1.30			
	3.4		6.15	.15				1.52			
	3.6		6.15	.15				1.53			
	3.8		6.2	.2				1.87			
	4		6.15	.15				1.76			
	4.2		6.2	.2				1.64			
	4.4		6.2	.2				1.47			
	4.6		6.15	.15				1.37			
	4.8		6.1	.1				0.66			
LW	5.0		6.00								
	5.6		5.82								
	6.4		5.46								
VBF	6.6		5.33								
LS	9.3		4.70								
TOTALS:											

End of Measurement	Time:	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Spruce Creek						CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: Approx. 200' downstream from Spruce Creek Rd.							
DATE: 7-14-20	OBSERVERS: R. Smith, A. Williams						
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 11	TOWNSHIP: 2 N/S	RANGE: 81 E/W	PM: 6th		
COUNTY: Grand	WATERSHED: Blue River	WATER DIVISION: 5	DOW WATER CODE: 02997				
MAP(S): USGS:	Zone 13S 379024						
USFS:	4417444						

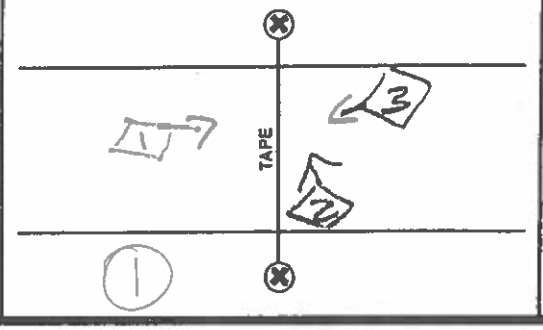
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4-inch cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.8 / 5.8
② WS Upstream	18.0	5.24
③ WS Downstream	3.2	6.14
SLOPE	0.9 / 21.2 = 0.045	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ①→
- Direction of Flow

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:

caddisfly, stonefly

COMMENTS

Temp = 8.7°C.
Salinity = 0.0 ppt
Cond = 38
pH = 6.58

Spruce-Willow Riparian

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Spruce Creek						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: Approx. 250' downstream from Spruce Creek Road							
DATE: 7-14-2	OBSERVERS: R. Smith, A. Williams						
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 11	TOWNSHIP: 2 N/S	RANGE: 81 E/W	PM: 6th		
COUNTY: Grand	WATERSHED:	WATER DIVISION:	DOW WATER CODE: 22997				
MAP(S): USGS:	Zone 13 379038						
USFS:	4417445						

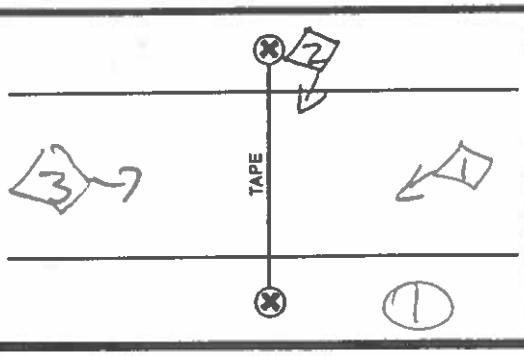
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.3 / 5.3
② WS Upstream	4.7	5.26
③ WS Downstream	10.0	5.70
SLOPE	0.44 / 14.7 = .0299	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ①→
- Direction of Flow

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

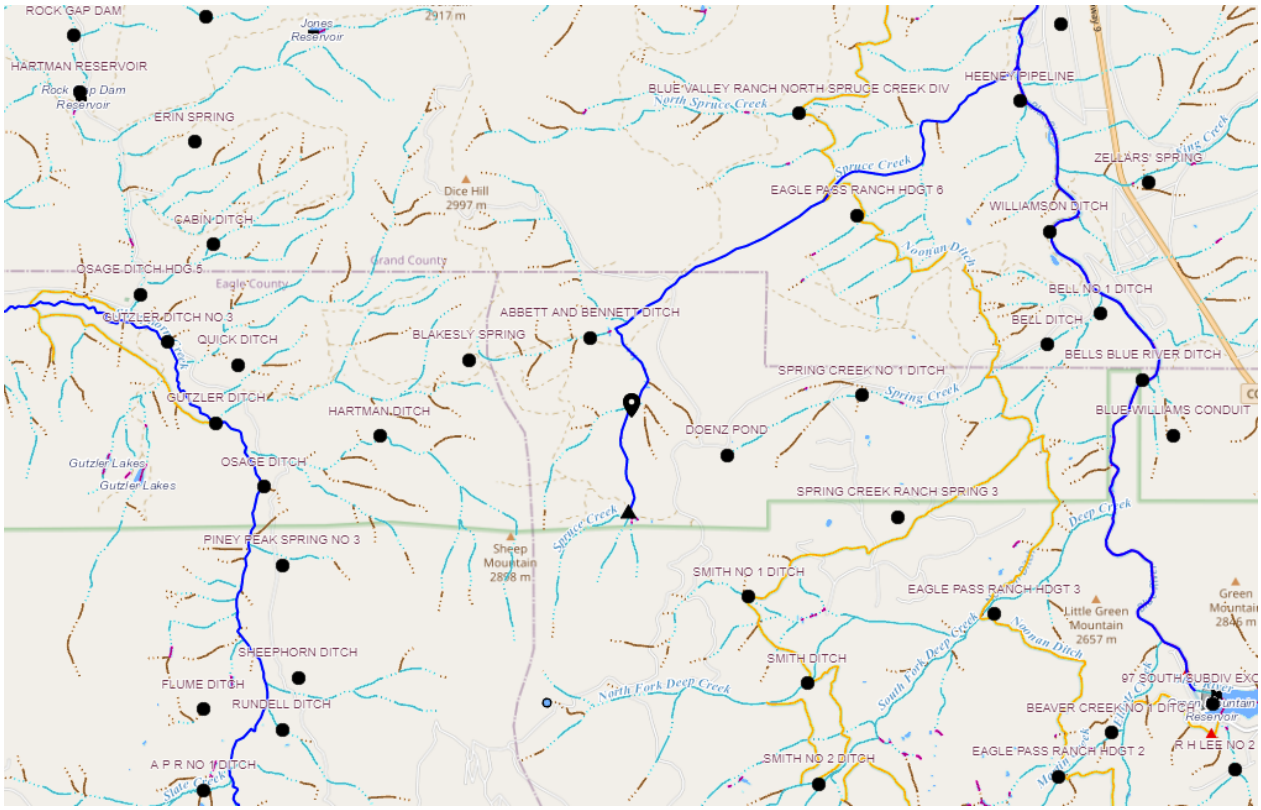
AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:
caddisfly, stonefly

COMMENTS

R2Cross RESULTS

Stream Name: Spruce Creek
Stream Locations: 500 ft upst from BLM-Private boundary - NE/4 Sec 11, T2S R81W
Fieldwork Date: 06/23/2021
Cross-section: 1
Observers: R Smith, P Belcher
Coordinate System: UTM Zone 13
X (easting): 379094
Y (northing): 4418699
Date Processed: 06/24/2021
Slope: 0.022
Computation method: Manning's n
R2Cross data filename: Spruce Creek 6-23-21 #1.xlsx
R2Cross version: 1.1.19

LOCATION

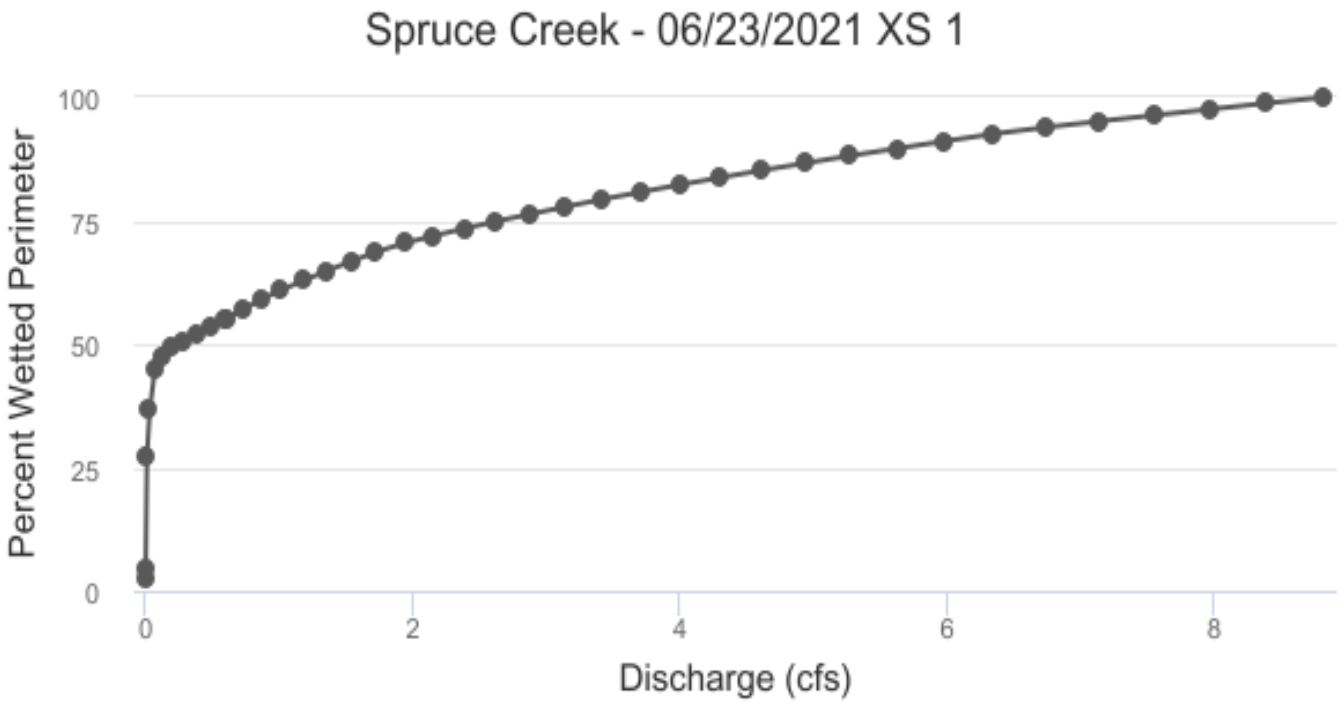


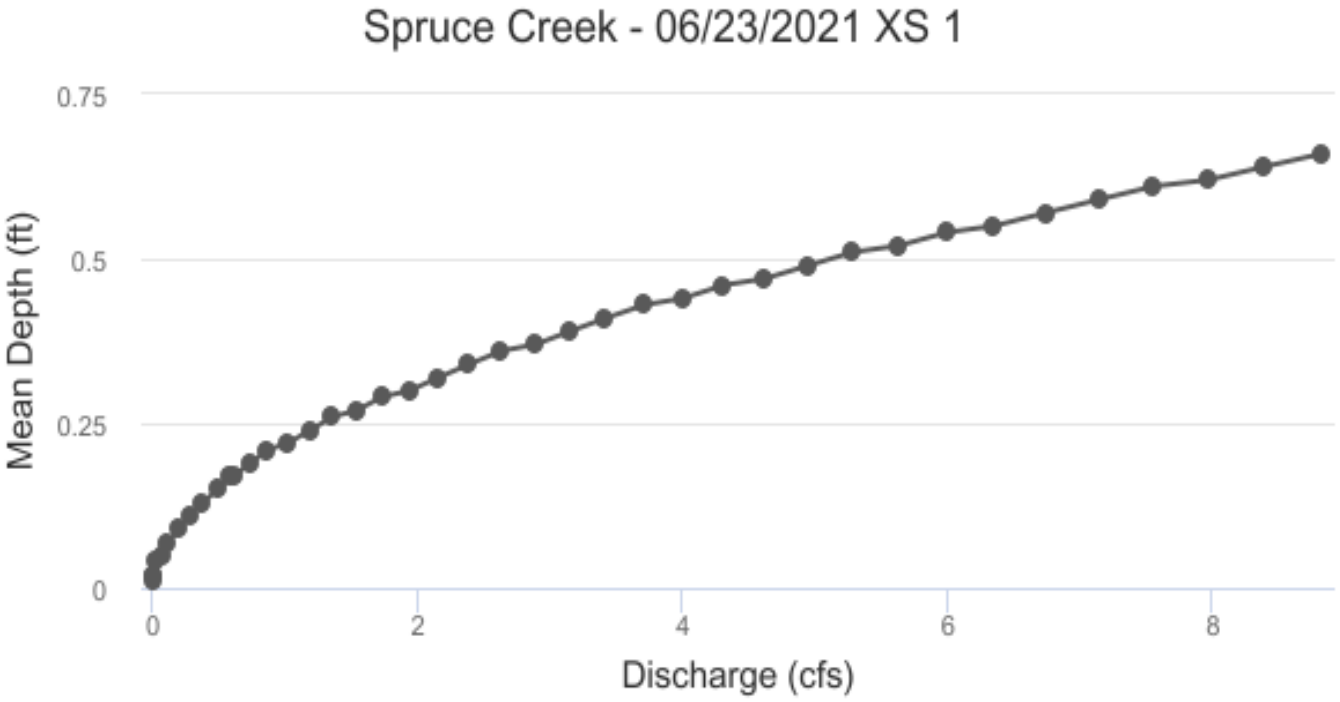
ANALYSIS RESULTS

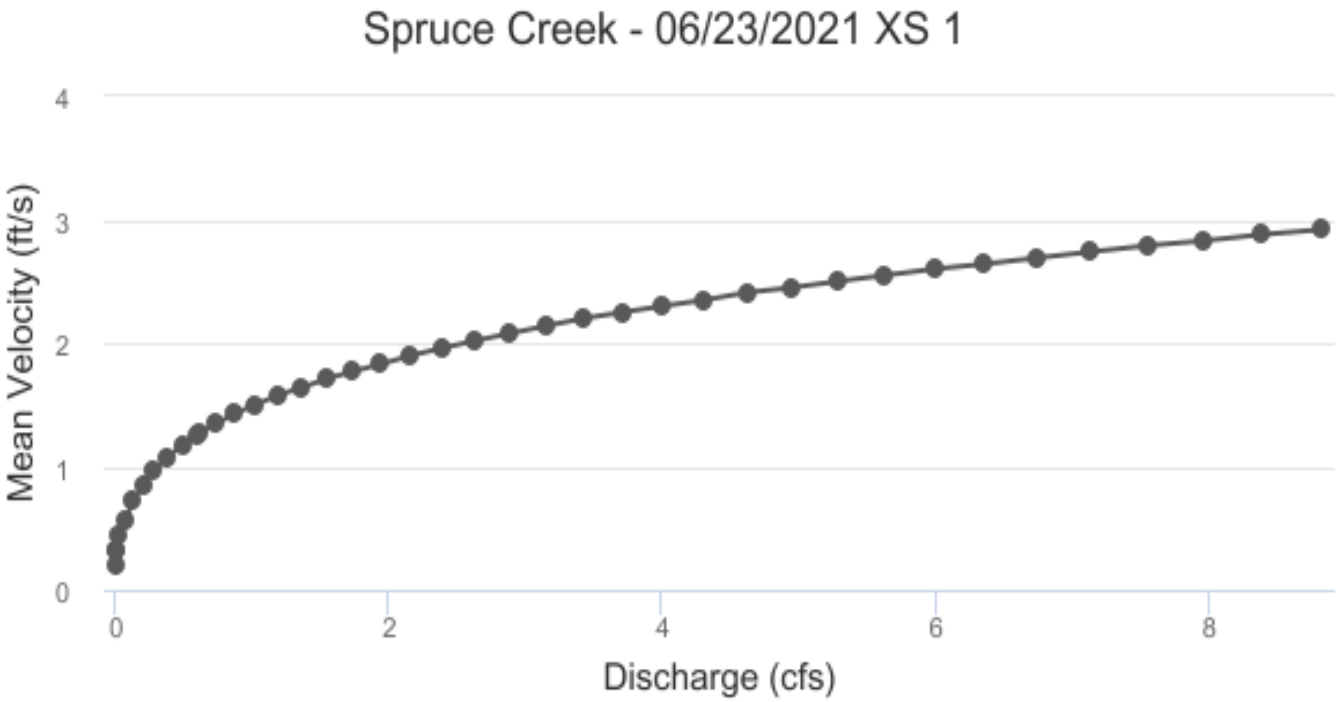
Habitat Criteria Results

Bankfull top width (ft) = 4.6

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.83
Percent Wetted Perimeter (%)	50.0	0.24
Mean Velocity (ft/s)	1.0	0.31




Spruce Creek - 06/23/2021 XS 1
Mean Depth (ft)
0.75
0.5
0.25
0
0
2
4
6
8
Discharge (cfs)


Spruce Creek - 06/23/2021 XS 1
Mean Velocity (ft/s)
4
3
2
1
0
0
2
4
6
8
Discharge (cfs)

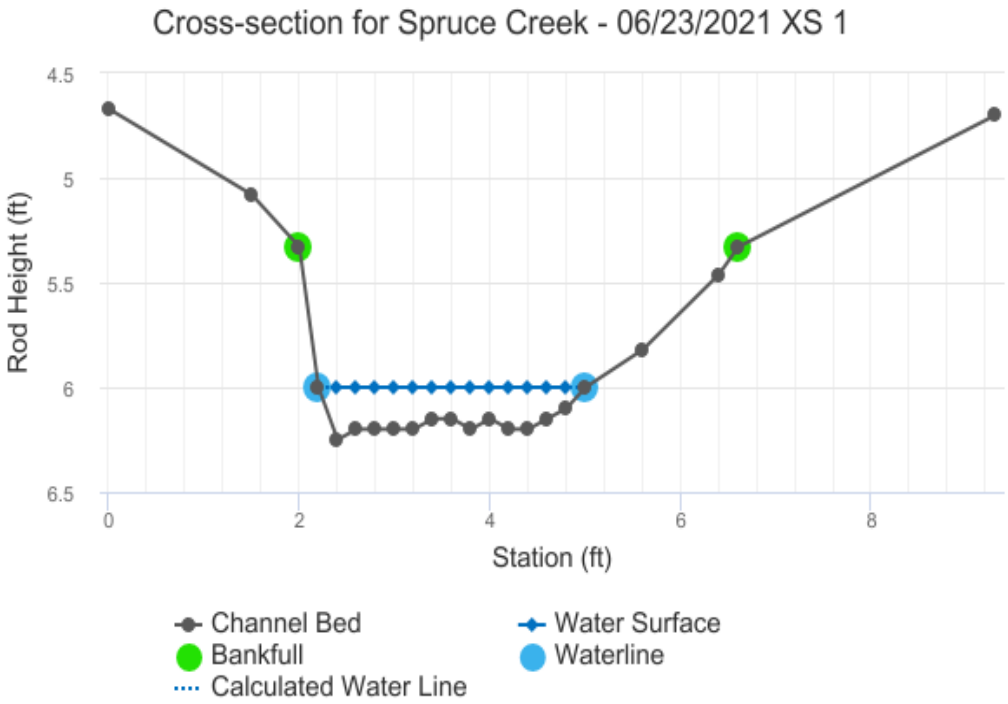
STAGING TABLE

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)	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	5.33	4.6	0.66	0.92	3.02	5.43	100.00%	0.56	2.92	8.83
	5.35	4.56	0.64	0.9	2.92	5.36	98.78%	0.54	2.88	8.39
	5.38	4.52	0.62	0.87	2.81	5.3	97.56%	0.53	2.83	7.97
	5.4	4.47	0.61	0.85	2.71	5.23	96.34%	0.52	2.79	7.55
	5.42	4.43	0.59	0.83	2.61	5.16	95.12%	0.5	2.74	7.14
	5.45	4.39	0.57	0.81	2.51	5.1	93.90%	0.49	2.69	6.74
	5.47	4.34	0.55	0.78	2.4	5.03	92.59%	0.48	2.64	6.35
	5.49	4.28	0.54	0.76	2.31	4.95	91.12%	0.47	2.6	5.99
	5.51	4.23	0.52	0.74	2.21	4.87	89.64%	0.45	2.55	5.63
	5.54	4.17	0.51	0.71	2.11	4.79	88.17%	0.44	2.5	5.28
	5.56	4.11	0.49	0.69	2.02	4.71	86.69%	0.43	2.45	4.95
	5.58	4.05	0.47	0.67	1.92	4.63	85.22%	0.42	2.41	4.62
	5.61	3.99	0.46	0.64	1.83	4.55	83.75%	0.4	2.35	4.31
	5.63	3.94	0.44	0.62	1.74	4.47	82.27%	0.39	2.3	4.0
	5.65	3.88	0.43	0.6	1.65	4.39	80.80%	0.38	2.25	3.71
	5.67	3.82	0.41	0.57	1.56	4.31	79.32%	0.36	2.2	3.42
	5.7	3.76	0.39	0.55	1.47	4.23	77.85%	0.35	2.14	3.15
	5.72	3.7	0.37	0.53	1.39	4.15	76.37%	0.33	2.08	2.89
	5.74	3.65	0.36	0.51	1.3	4.07	74.90%	0.32	2.02	2.63
	5.77	3.59	0.34	0.48	1.22	3.99	73.42%	0.31	1.96	2.39
	5.79	3.53	0.32	0.46	1.14	3.91	71.95%	0.29	1.9	2.16
	5.81	3.47	0.3	0.44	1.06	3.83	70.47%	0.28	1.83	1.94
	5.84	3.4	0.29	0.41	0.98	3.73	68.69%	0.26	1.77	1.73
	5.86	3.31	0.27	0.39	0.9	3.62	66.77%	0.25	1.71	1.54
	5.88	3.23	0.26	0.37	0.83	3.52	64.86%	0.23	1.64	1.36

	5.91	3.15	0.24	0.34	0.75	3.42	62.94%	0.22	1.58	1.19
	5.93	3.06	0.22	0.32	0.68	3.31	61.02%	0.21	1.5	1.02
	5.95	2.98	0.21	0.3	0.61	3.21	59.11%	0.19	1.43	0.87
	5.97	2.89	0.19	0.28	0.54	3.1	57.19%	0.18	1.35	0.74
	6.0	2.81	0.17	0.25	0.48	3.0	55.27%	0.16	1.27	0.61
Waterline	6.0	2.8	0.17	0.25	0.47	2.99	55.02%	0.16	1.26	0.59
	6.02	2.74	0.15	0.23	0.41	2.92	53.73%	0.14	1.18	0.49
	6.04	2.68	0.13	0.21	0.35	2.84	52.24%	0.12	1.08	0.38
	6.07	2.62	0.11	0.18	0.29	2.75	50.75%	0.11	0.97	0.28
	6.09	2.55	0.09	0.16	0.23	2.67	49.26%	0.09	0.85	0.2
	6.11	2.46	0.07	0.14	0.17	2.57	47.35%	0.07	0.72	0.12
	6.13	2.35	0.05	0.12	0.12	2.45	45.06%	0.05	0.57	0.07
	6.16	1.91	0.04	0.09	0.07	1.99	36.66%	0.03	0.45	0.03
	6.18	1.44	0.02	0.07	0.03	1.49	27.38%	0.02	0.32	0.01
	6.2	0.22	0.02	0.05	0.01	0.25	4.58%	0.02	0.32	0.0
	6.23	0.11	0.01	0.02	0.0	0.12	2.29%	0.01	0.2	0.0

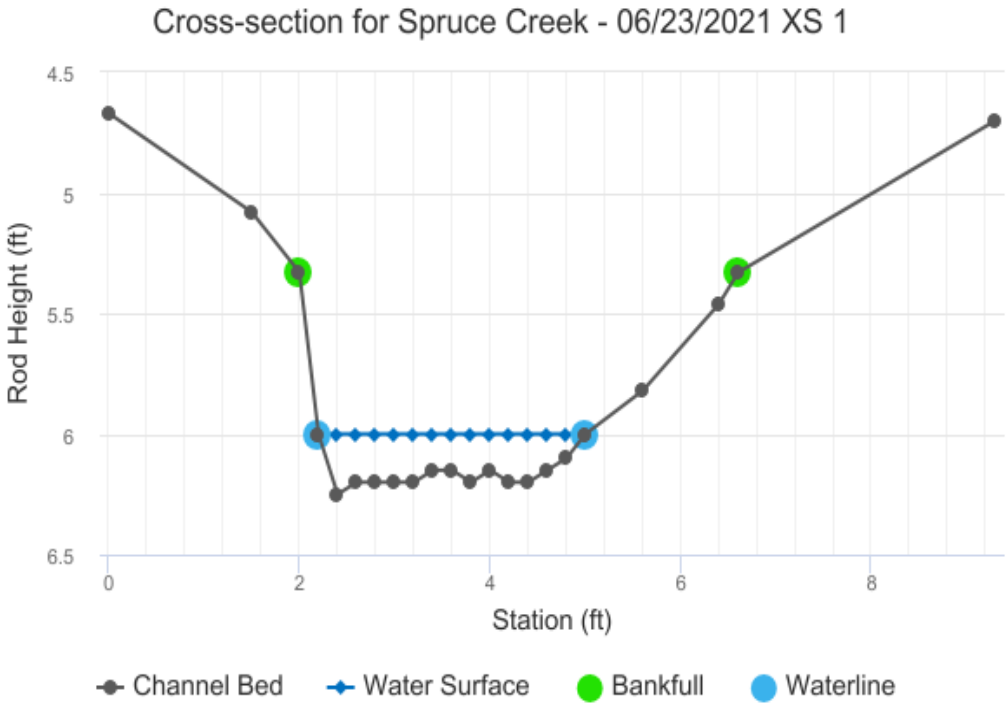
MODEL SUMMARY

Measured Flow (Qm) =	0.59
Calculated Flow (Qc) =	0.59
(Qm-Qc)/Qm * 100 =	0.01%
Measured Waterline (WLm) =	6
Calculated Waterline (WLc) =	6
(WLm-WLc)/WLm * 100 =	-0.00%
Max Measured Depth (Dm) =	0.25
Max Calculated Depth (Dc) =	0.25
(Dm-Dc)/Dm * 100 =	0.01%
Mean Velocity =	1.26
Manning's n =	0.051
0.4 * Qm =	0.24
2.5 * Qm =	1.48



FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	4.67		
	1.5	5.08		
Bankfull	2	5.33		
Waterline	2.2	6	0	0
	2.4	6.25	0.25	0.31
	2.6	6.2	0.2	0.96
	2.8	6.2	0.2	1.12
	3	6.2	0.2	0.88
	3.2	6.2	0.2	1.3
	3.4	6.15	0.15	1.52
	3.6	6.15	0.15	1.53
	3.8	6.2	0.2	1.87
	4	6.15	0.15	1.76
	4.2	6.2	0.2	1.64
	4.4	6.2	0.2	1.67
	4.6	6.15	0.15	1.37
	4.8	6.1	0.1	0.66
Waterline	5	6	0	0
	5.6	5.82		
	6.4	5.46		
Bankfull	6.6	5.33		
	9.3	4.7		


Cross-section for Spruce Creek - 06/23/2021 XS 1
Rod Height (ft)
4.5
5
5.5
6
6.5
0
2
4
6
8
Station (ft)
Channel Bed
Water Surface
Bankfull
Waterline

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (SQ ft)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.32	0.25	0.05	0.02	2.62
0.21	0.2	0.04	0.04	6.49
0.2	0.2	0.04	0.04	7.57
0.2	0.2	0.04	0.04	5.95
0.2	0.2	0.04	0.05	8.79
0.21	0.15	0.03	0.05	7.71
0.2	0.15	0.03	0.05	7.76
0.21	0.2	0.04	0.07	12.64
0.21	0.15	0.03	0.05	8.92
0.21	0.2	0.04	0.07	11.09
0.2	0.2	0.04	0.07	11.29
0.21	0.15	0.03	0.04	6.95
0.21	0.1	0.02	0.01	2.23
0.22	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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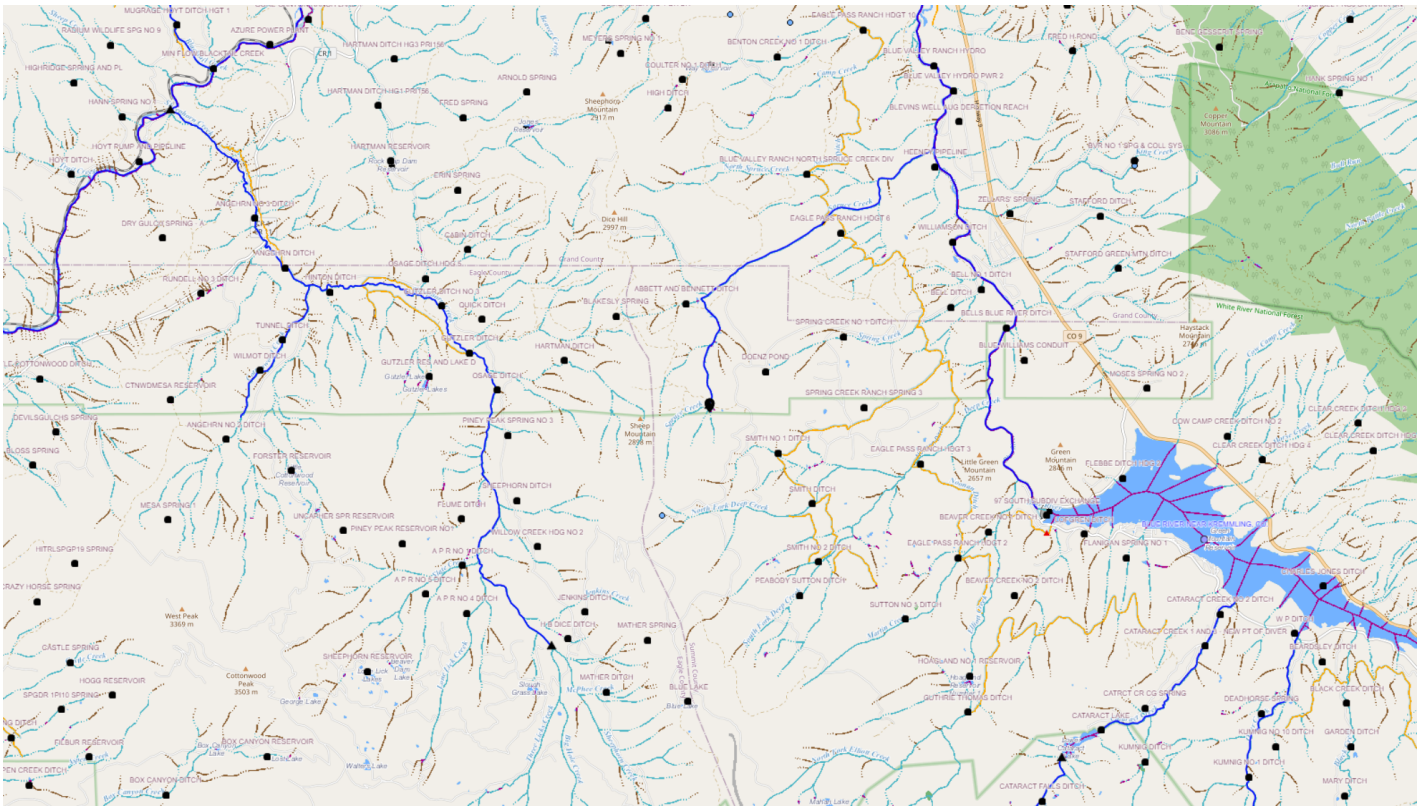
R2Cross RESULTS

Stream Name: Spruce Creek
Stream Locations: ~200ft downstream from Spruce Creek road
Fieldwork Date: 07/14/2020
Cross-section: 1
Observers: R Smith, A Williams
Coordinate System: UTM Zone 13
X (easting): 379024
Y (northing): 4417444
Date Processed: 12/02/2021
Slope: 0.022
Computation method: Manning's n
R2Cross data filename: Erams_Spruce Creek 7-14-20 #1.xlsx
R2Cross version: 1.3.4

LOCATION



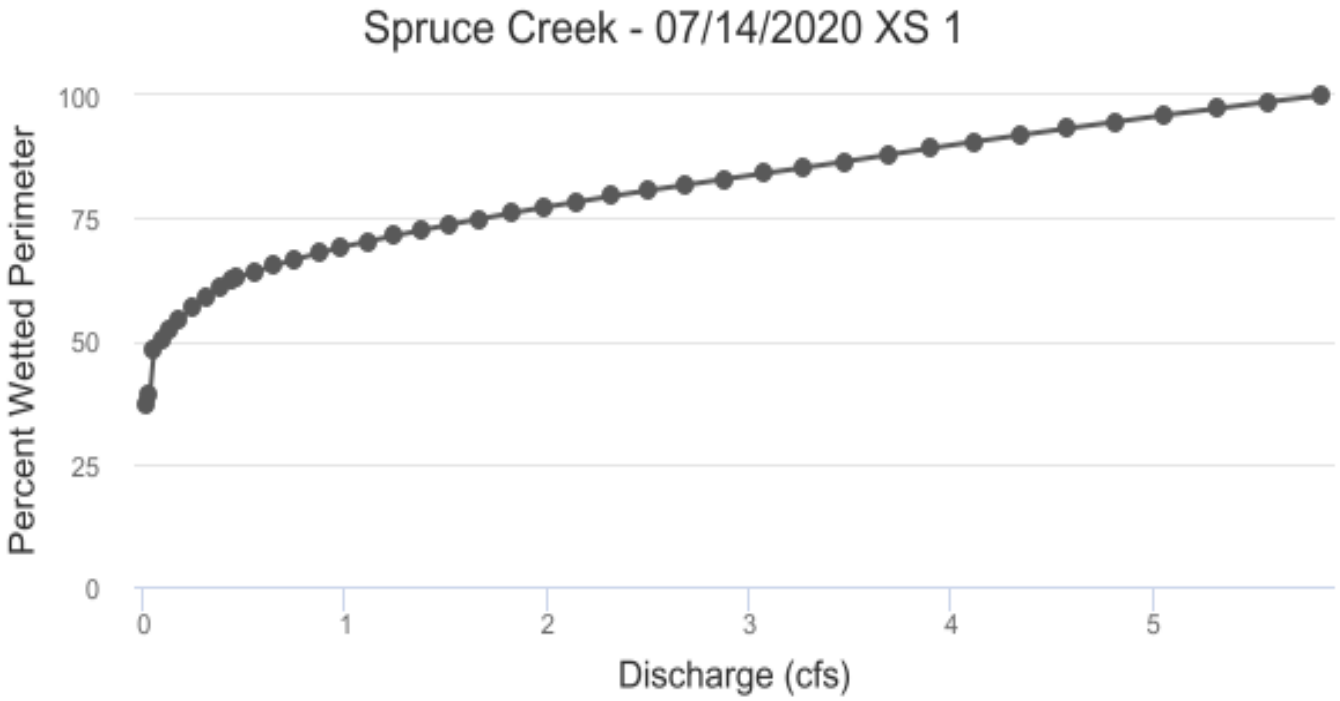
ANALYSIS RESULTS

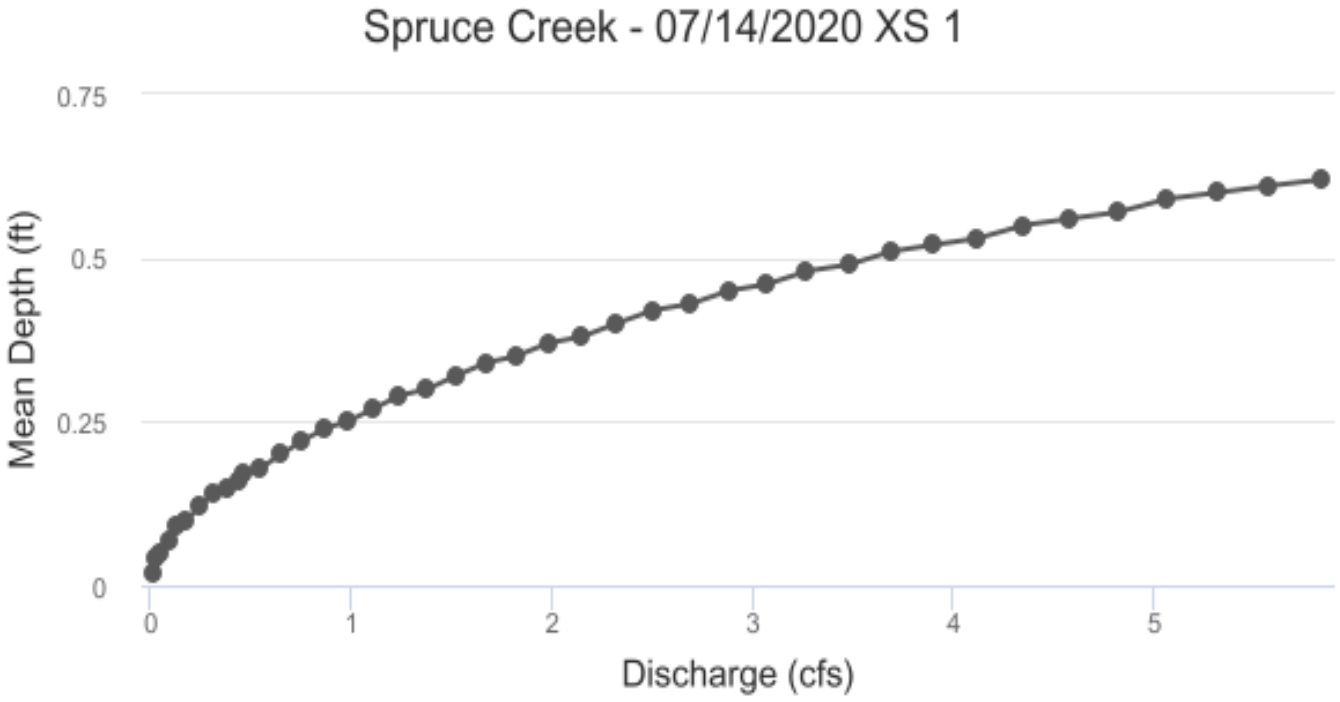
Habitat Criteria Results

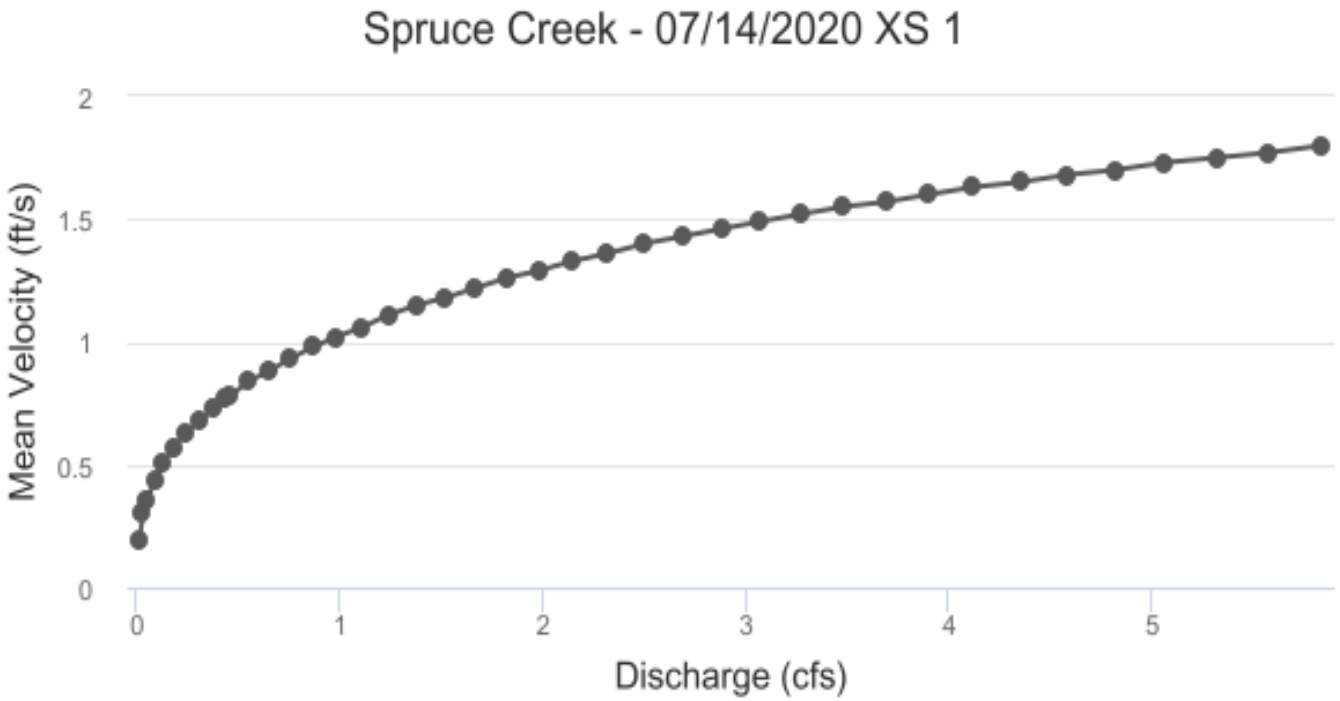
Bankfull top width (ft) = 5.2

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.637
Percent Wetted Perimeter (%) **	50.0	0.08
Mean Velocity (ft/s)	1.0	0.925

**Values highlighted in yellow indicate that the discharge is less than 40% of measured Q or greater than 250% of measured Q.




Spruce Creek - 07/14/2020 XS 1
Mean Depth (ft)
0.75
0.5
0.25
0
0
1
2
3
4
5
Discharge (cfs)


Spruce Creek - 07/14/2020 XS 1
Mean Velocity (ft/s)
2
1.5
1
0.5
0
0
1
2
3
4
5
Discharge (cfs)

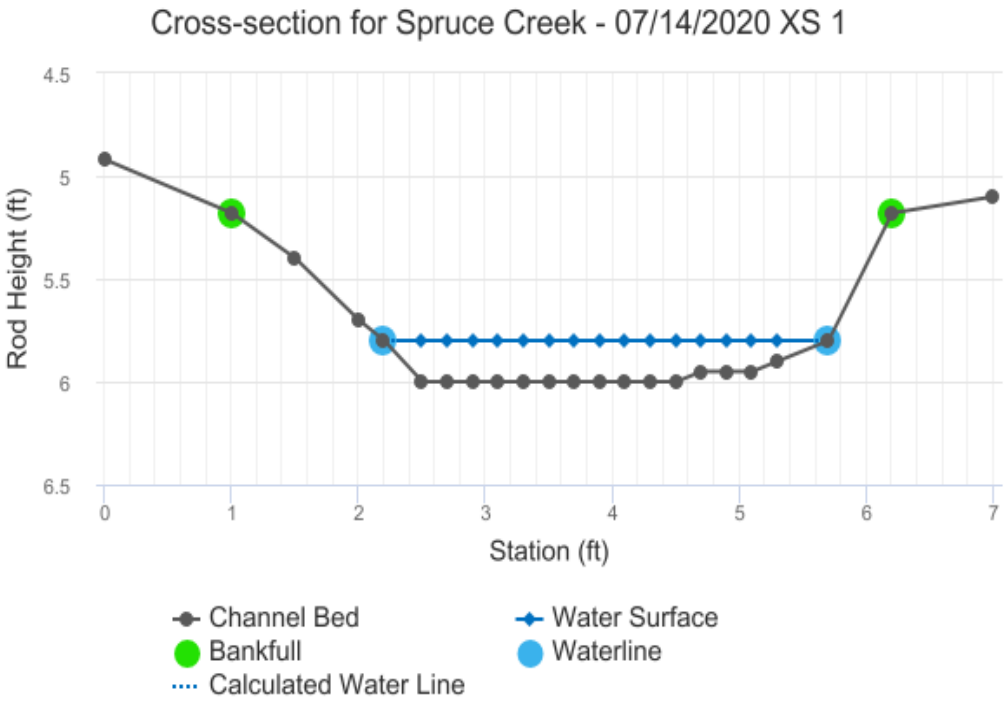
STAGING TABLE

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)	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	5.18	5.2	0.62	0.82	3.25	5.73	100.00%	0.57	1.8	5.84
	5.2	5.14	0.61	0.8	3.14	5.66	98.65%	0.56	1.77	5.57
	5.22	5.07	0.6	0.78	3.04	5.58	97.31%	0.54	1.75	5.32
	5.24	5.01	0.59	0.76	2.94	5.5	95.96%	0.53	1.73	5.06
	5.26	4.95	0.57	0.74	2.83	5.43	94.61%	0.52	1.7	4.82
	5.28	4.88	0.56	0.72	2.73	5.35	93.27%	0.51	1.68	4.58
	5.3	4.82	0.55	0.7	2.63	5.27	91.92%	0.5	1.65	4.35
	5.32	4.76	0.53	0.68	2.53	5.19	90.57%	0.49	1.63	4.12
	5.34	4.7	0.52	0.66	2.44	5.12	89.23%	0.48	1.6	3.9
	5.36	4.63	0.51	0.64	2.34	5.04	87.88%	0.46	1.57	3.69
	5.38	4.57	0.49	0.61	2.25	4.96	86.53%	0.45	1.55	3.48
	5.41	4.51	0.48	0.59	2.15	4.89	85.24%	0.44	1.52	3.27
	5.43	4.46	0.46	0.57	2.06	4.82	84.08%	0.43	1.49	3.07
	5.45	4.41	0.45	0.55	1.97	4.76	82.93%	0.41	1.46	2.88
	5.47	4.36	0.43	0.53	1.88	4.69	81.77%	0.4	1.43	2.69
	5.49	4.31	0.42	0.51	1.79	4.62	80.62%	0.39	1.4	2.5
	5.51	4.26	0.4	0.49	1.71	4.56	79.47%	0.37	1.36	2.32
	5.53	4.2	0.38	0.47	1.62	4.49	78.31%	0.36	1.33	2.15
	5.55	4.15	0.37	0.45	1.53	4.42	77.16%	0.35	1.29	1.98
	5.57	4.1	0.35	0.43	1.45	4.36	76.00%	0.33	1.26	1.82
	5.59	4.05	0.34	0.41	1.36	4.29	74.85%	0.32	1.22	1.67
	5.61	4.0	0.32	0.39	1.28	4.23	73.70%	0.3	1.18	1.52
	5.63	3.95	0.3	0.37	1.2	4.16	72.54%	0.29	1.15	1.38
	5.65	3.9	0.29	0.35	1.12	4.09	71.39%	0.27	1.11	1.24
	5.67	3.85	0.27	0.33	1.04	4.03	70.23%	0.26	1.06	1.11

	5.69	3.8	0.25	0.31	0.96	3.96	69.08%	0.24	1.02	0.98
	5.71	3.74	0.24	0.29	0.89	3.89	67.86%	0.23	0.98	0.87
	5.73	3.69	0.22	0.27	0.81	3.82	66.60%	0.21	0.93	0.75
	5.75	3.63	0.2	0.25	0.73	3.75	65.34%	0.2	0.88	0.65
	5.77	3.57	0.18	0.23	0.66	3.67	64.08%	0.18	0.84	0.55
	5.79	3.51	0.17	0.2	0.59	3.6	62.82%	0.16	0.78	0.46
Waterline	5.8	3.5	0.16	0.2	0.57	3.58	62.51%	0.16	0.77	0.44
	5.82	3.41	0.15	0.18	0.52	3.49	60.92%	0.15	0.73	0.38
	5.84	3.3	0.14	0.16	0.45	3.37	58.80%	0.13	0.68	0.31
	5.86	3.19	0.12	0.14	0.38	3.25	56.68%	0.12	0.63	0.24
	5.88	3.08	0.1	0.12	0.32	3.13	54.56%	0.1	0.57	0.18
	5.9	2.96	0.09	0.1	0.25	3.01	52.44%	0.08	0.51	0.13
	5.92	2.85	0.07	0.08	0.2	2.89	50.32%	0.07	0.44	0.09
	5.94	2.74	0.05	0.06	0.14	2.76	48.21%	0.05	0.36	0.05
	5.96	2.23	0.04	0.04	0.09	2.24	39.11%	0.04	0.3	0.03
	5.98	2.11	0.02	0.02	0.04	2.12	36.99%	0.02	0.19	0.01

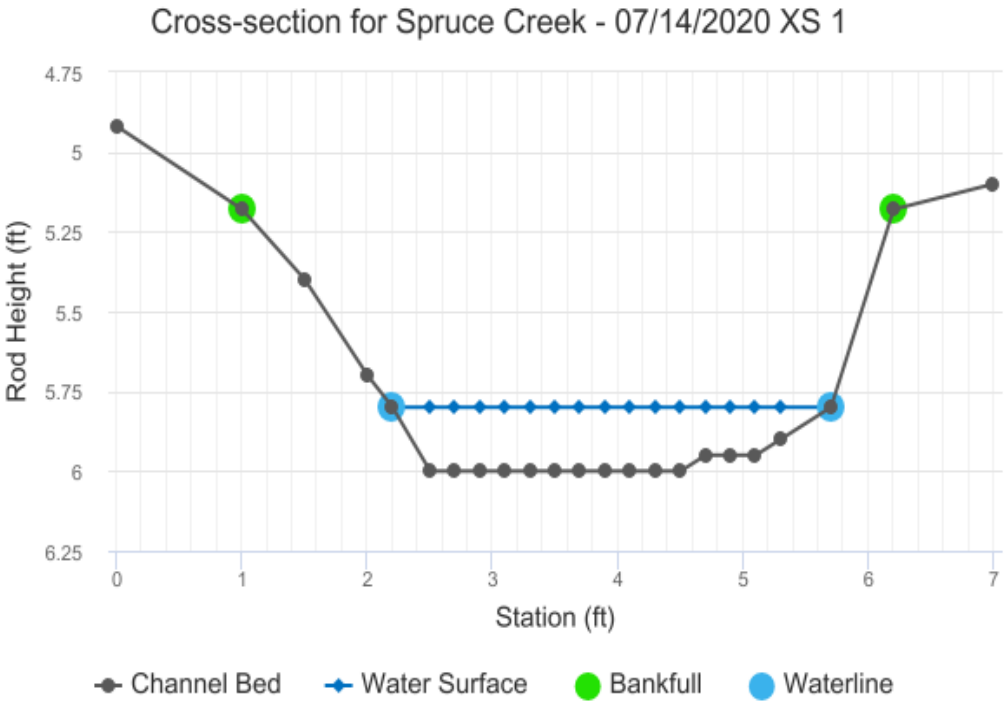
MODEL SUMMARY

Measured Flow (Qm) =	0.44
Calculated Flow (Qc) =	0.44
(Qm-Qc)/Qm * 100 =	0.03%
Measured Waterline (WLm) =	5.8
Calculated Waterline (WLc) =	5.8
(WLm-WLc)/WLm * 100 =	-0.00%
Max Measured Depth (Dm) =	0.2
Max Calculated Depth (Dc) =	0.2
(Dm-Dc)/Dm * 100 =	0.02%
Mean Velocity =	0.77
Manning's n =	0.084
0.4 * Qm =	0.18
2.5 * Qm =	1.1



FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	4.92		
Bankfull	1	5.18		
	1.5	5.4		
	2	5.7		
Waterline	2.2	5.8	0	0
	2.5	6	0.2	0.48
	2.7	6	0.2	0.71
	2.9	6	0.2	0.78
	3.1	6	0.2	0.65
	3.3	6	0.2	0.68
	3.5	6	0.2	0.95
	3.7	6	0.2	0.89
	3.9	6	0.2	1.08
	4.1	6	0.2	1.12
	4.3	6	0.2	0.98
	4.5	6	0.2	0.86
	4.7	5.95	0.15	0.78
	4.9	5.95	0.15	0.69
	5.1	5.95	0.15	0.58
	5.3	5.9	0.1	0.18
Waterline	5.7	5.8	0	0
Bankfull	6.2	5.18		
	7	5.1		


Cross-section for Spruce Creek - 07/14/2020 XS 1
Rod Height (ft)
4.75
5
5.25
5.5
5.75
6
6.25
0
1
2
3
4
5
6
7
Station (ft)
Channel Bed
Water Surface
Bankfull
Waterline

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (SQ ft)	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
0.36	0.2	0.05	0.02	5.47
0.2	0.2	0.04	0.03	6.47
0.2	0.2	0.04	0.03	7.11
0.2	0.2	0.04	0.03	5.92
0.2	0.2	0.04	0.03	6.2
0.2	0.2	0.04	0.04	8.66
0.2	0.2	0.04	0.04	8.11
0.2	0.2	0.04	0.04	9.84
0.2	0.2	0.04	0.04	10.21
0.2	0.2	0.04	0.04	8.93
0.2	0.2	0.04	0.03	7.84
0.21	0.15	0.03	0.02	5.33
0.2	0.15	0.03	0.02	4.72
0.2	0.15	0.03	0.02	3.96
0.21	0.1	0.03	0.01	1.23
0.41	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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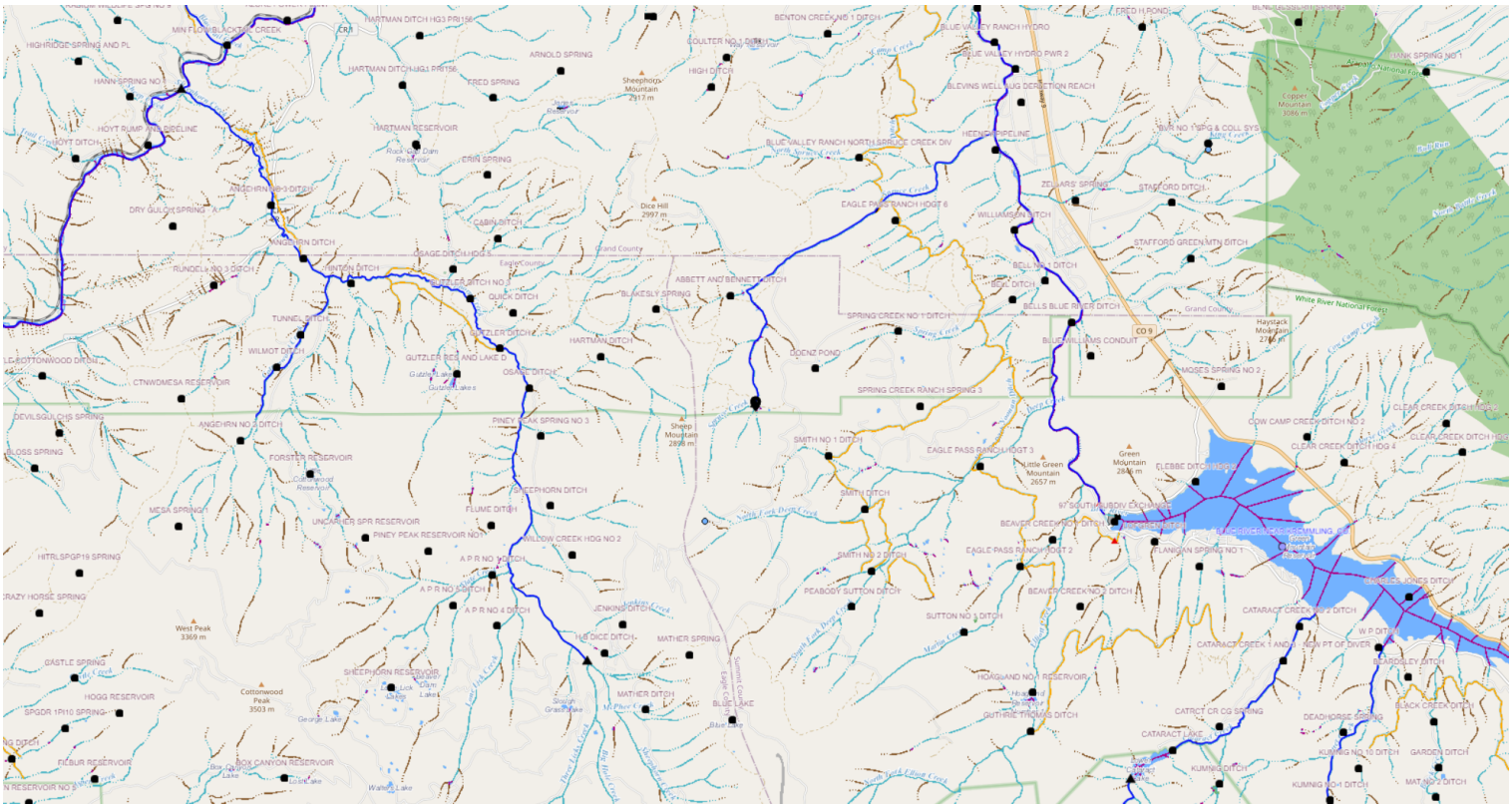
R2Cross RESULTS

Stream Name: Spruce Creek
Stream Locations: ~250ft downstream from Spruce Creek road
Fieldwork Date: 07/14/2020
Cross-section: 2
Observers: R Smith, A Williams
Coordinate System: UTM Zone 13
X (easting): 379038
Y (northing): 4417445
Date Processed: 12/02/2021
Slope: 0.0299
Computation method: Manning's n
R2Cross data filename: Erams_Spruce Creek 7-14-20 #2.xlsx
R2Cross version: 1.3.4

LOCATION

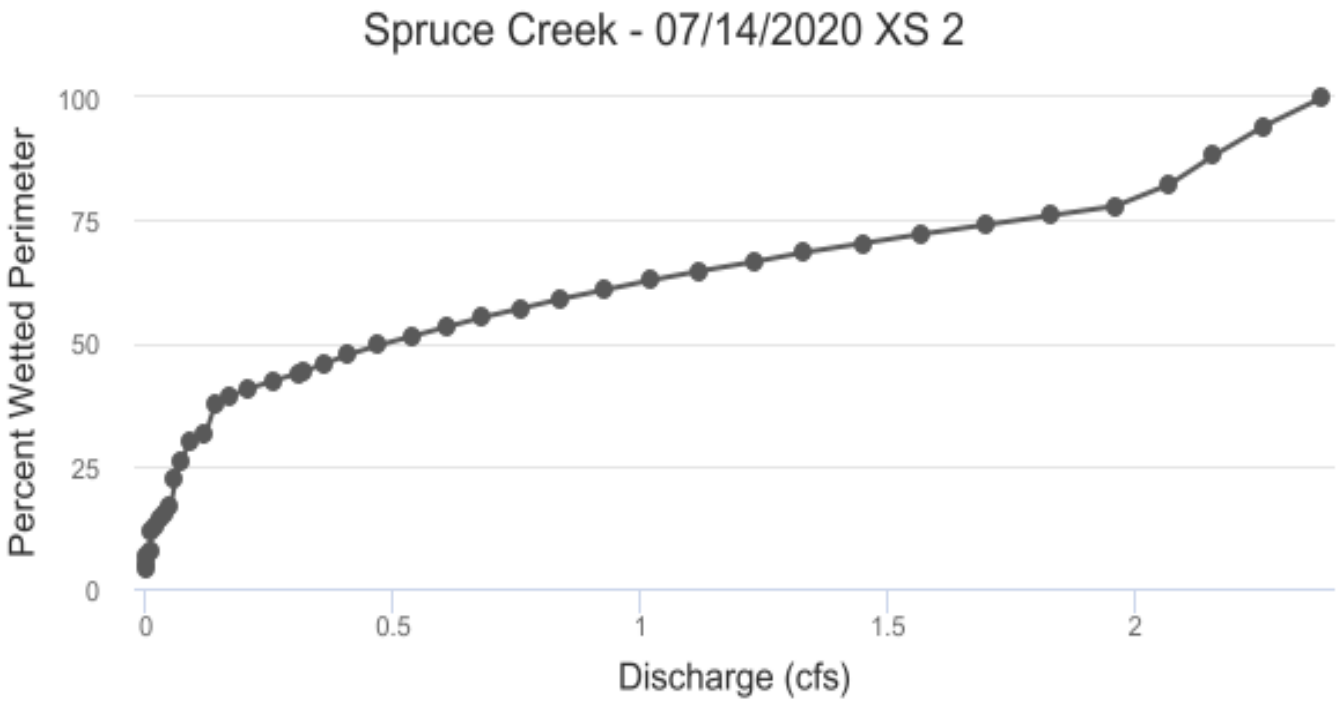


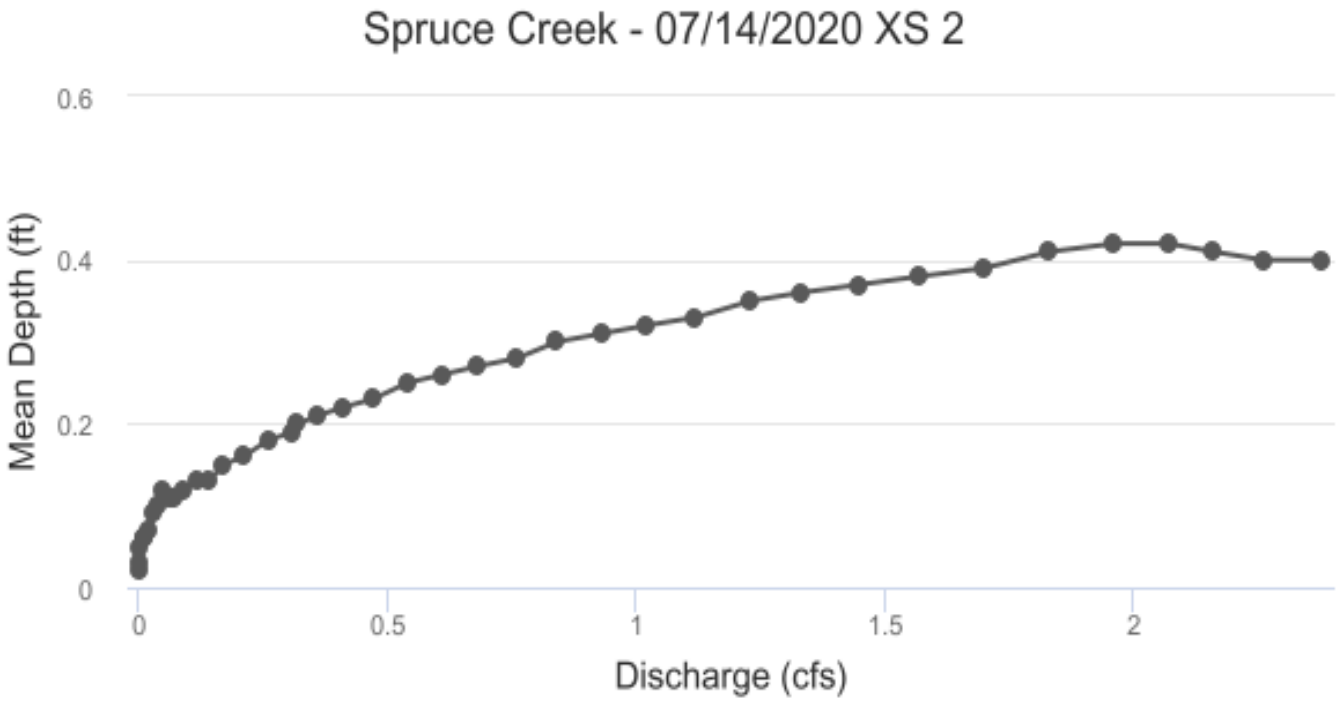
ANALYSIS RESULTS

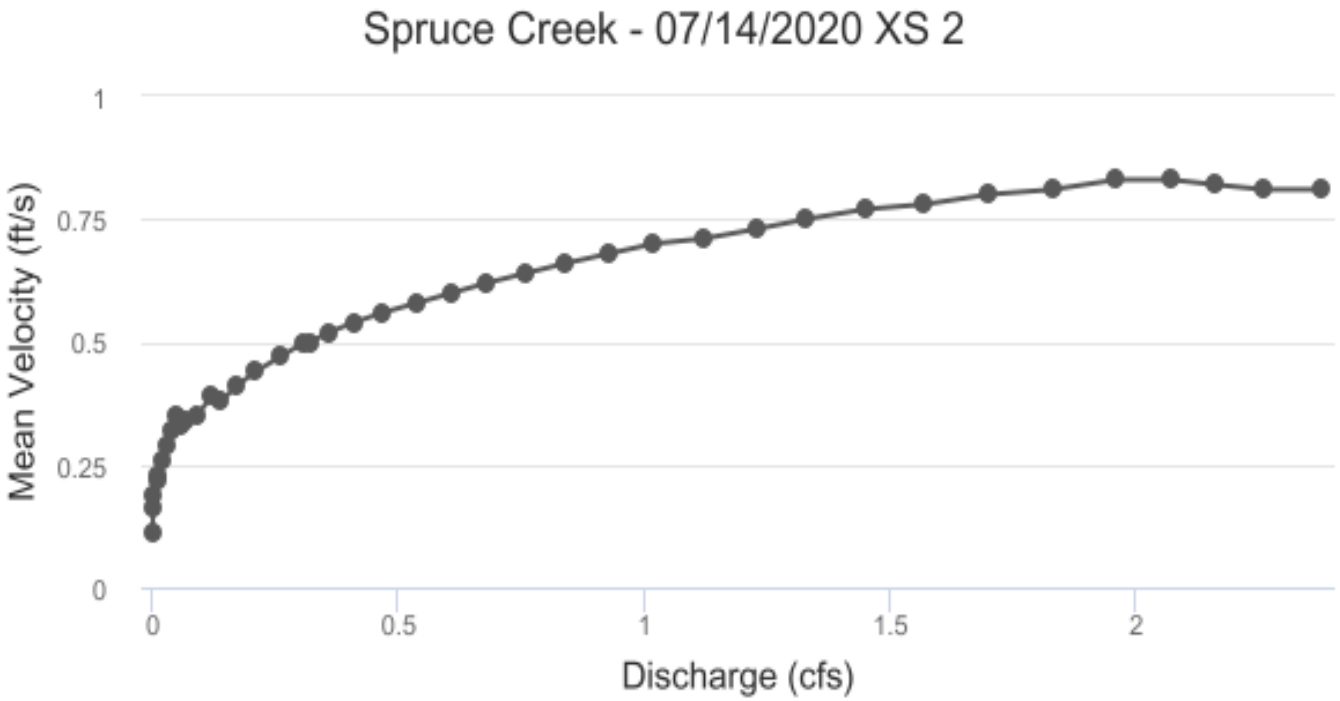
Habitat Criteria Results

Bankfull top width (ft) = 7.36

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.328
Percent Wetted Perimeter (%)	50.0	0.49
Mean Velocity (ft/s)	1.0	NA




Spruce Creek - 07/14/2020 XS 2
Mean Depth (ft)
0.6
0.4
0.2
0
0
0.5
1
1.5
2
Discharge (cfs)


Spruce Creek - 07/14/2020 XS 2
Mean Velocity (ft/s)
1
0.75
0.5
0.25
0
0
0.5
1
1.5
2
Discharge (cfs)

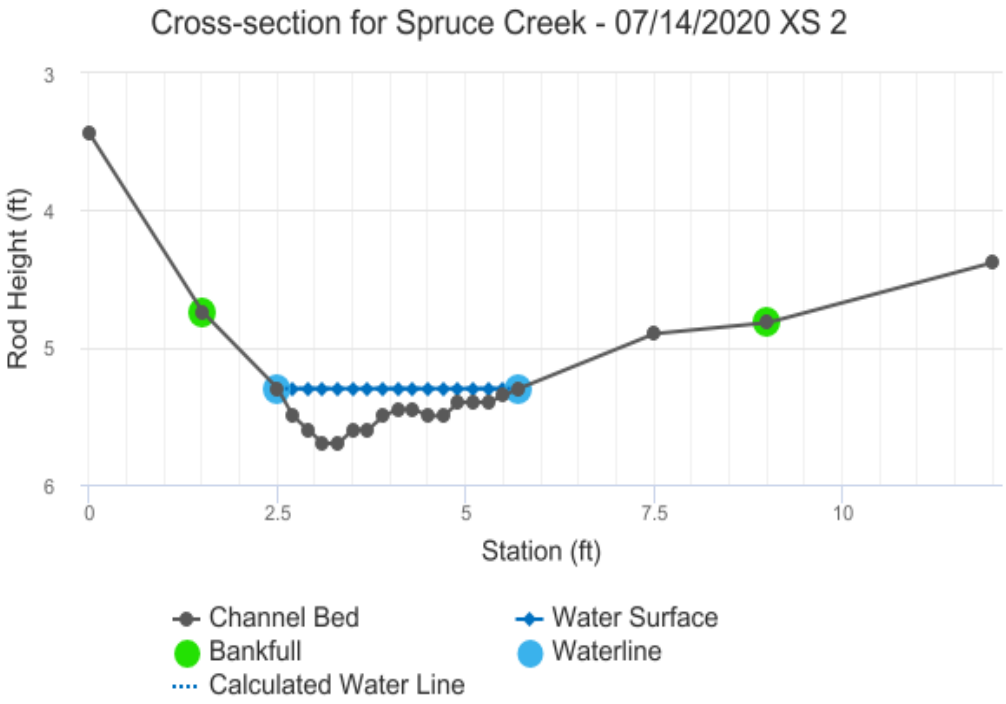
STAGING TABLE

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)	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	4.82	7.36	0.4	0.88	2.94	7.75	100.00%	0.38	0.81	2.38
	4.84	6.91	0.4	0.86	2.78	7.3	94.09%	0.38	0.81	2.26
	4.86	6.45	0.41	0.84	2.63	6.84	88.18%	0.38	0.82	2.16
	4.89	6.0	0.42	0.81	2.49	6.38	82.28%	0.39	0.83	2.07
	4.91	5.66	0.42	0.79	2.37	6.03	77.83%	0.39	0.83	1.96
	4.93	5.53	0.41	0.77	2.24	5.89	75.94%	0.38	0.81	1.83
	4.95	5.39	0.39	0.75	2.12	5.74	74.05%	0.37	0.8	1.7
	4.97	5.25	0.38	0.73	2.01	5.6	72.16%	0.36	0.78	1.57
	5.0	5.11	0.37	0.7	1.89	5.45	70.27%	0.35	0.77	1.45
	5.02	4.97	0.36	0.68	1.78	5.3	68.39%	0.34	0.75	1.33
	5.04	4.83	0.35	0.66	1.67	5.16	66.50%	0.32	0.73	1.23
	5.06	4.7	0.33	0.64	1.57	5.01	64.61%	0.31	0.71	1.12
	5.08	4.56	0.32	0.62	1.47	4.86	62.72%	0.3	0.7	1.02
	5.11	4.42	0.31	0.59	1.37	4.72	60.83%	0.29	0.68	0.93
	5.13	4.28	0.3	0.57	1.27	4.57	58.94%	0.28	0.66	0.84
	5.15	4.14	0.28	0.55	1.18	4.42	57.05%	0.27	0.64	0.76
	5.17	4.0	0.27	0.53	1.09	4.28	55.17%	0.26	0.62	0.68
	5.19	3.87	0.26	0.51	1.0	4.13	53.28%	0.24	0.6	0.61
	5.22	3.73	0.25	0.48	0.92	3.98	51.39%	0.23	0.58	0.54
	5.24	3.59	0.23	0.46	0.84	3.84	49.50%	0.22	0.56	0.47
	5.26	3.45	0.22	0.44	0.76	3.69	47.61%	0.21	0.54	0.41
	5.28	3.31	0.21	0.42	0.69	3.55	45.72%	0.19	0.52	0.36
Waterline	5.3	3.2	0.2	0.4	0.63	3.43	44.18%	0.18	0.5	0.32
	5.3	3.18	0.19	0.4	0.62	3.4	43.89%	0.18	0.5	0.31
	5.33	3.07	0.18	0.37	0.55	3.28	42.32%	0.17	0.47	0.26

	5.35	2.96	0.16	0.35	0.48	3.16	40.75%	0.15	0.44	0.21
	5.37	2.85	0.15	0.33	0.42	3.04	39.18%	0.14	0.41	0.17
	5.39	2.74	0.13	0.31	0.36	2.92	37.61%	0.12	0.38	0.14
	5.41	2.26	0.13	0.29	0.3	2.42	31.22%	0.13	0.39	0.12
	5.44	2.19	0.12	0.26	0.25	2.34	30.18%	0.11	0.35	0.09
	5.46	1.86	0.11	0.24	0.21	1.99	25.72%	0.1	0.34	0.07
	5.48	1.62	0.11	0.22	0.17	1.73	22.34%	0.1	0.33	0.06
	5.5	1.19	0.12	0.2	0.14	1.29	16.58%	0.11	0.35	0.05
	5.52	1.1	0.1	0.18	0.11	1.19	15.31%	0.09	0.32	0.04
	5.55	1.02	0.09	0.15	0.09	1.09	14.04%	0.08	0.29	0.03
	5.57	0.93	0.07	0.13	0.07	0.99	12.77%	0.07	0.26	0.02
	5.59	0.84	0.06	0.11	0.05	0.89	11.50%	0.05	0.22	0.01
	5.61	0.55	0.06	0.09	0.03	0.59	7.65%	0.06	0.23	0.01
	5.63	0.46	0.05	0.07	0.02	0.5	6.39%	0.04	0.19	0.0
	5.66	0.38	0.03	0.04	0.01	0.4	5.12%	0.03	0.16	0.0
	5.68	0.29	0.02	0.02	0.01	0.3	3.85%	0.02	0.11	0.0

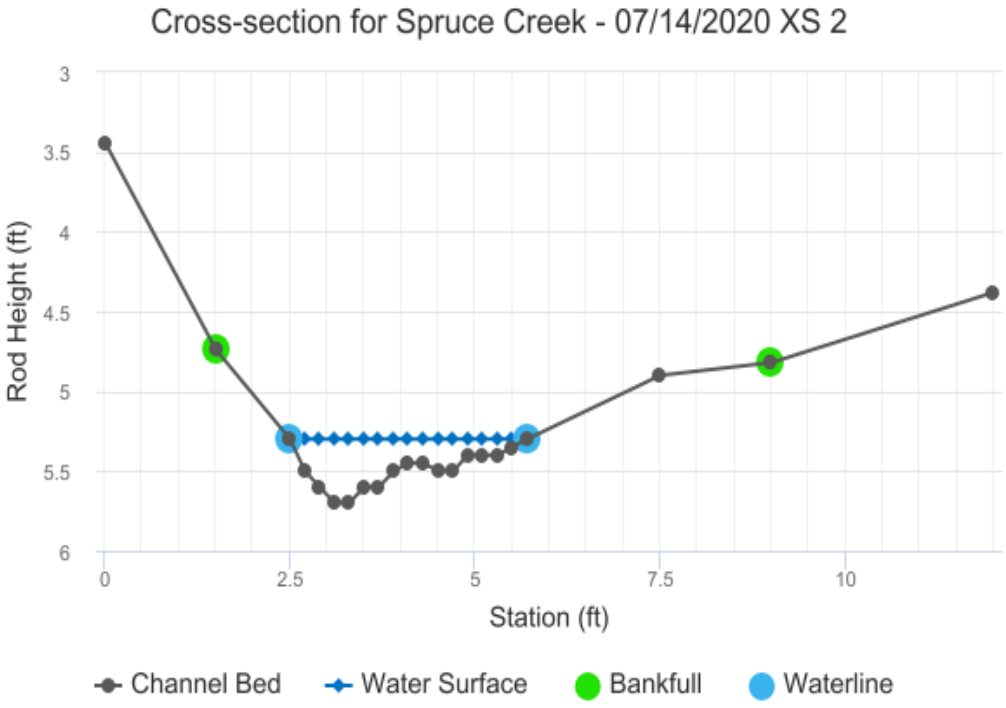
MODEL SUMMARY

Measured Flow (Qm) =	0.32
Calculated Flow (Qc) =	0.32
(Qm-Qc)/Qm * 100 =	0.01%
Measured Waterline (WLm) =	5.3
Calculated Waterline (WLc) =	5.3
(WLm-WLc)/WLm * 100 =	-0.00%
Max Measured Depth (Dm) =	0.4
Max Calculated Depth (Dc) =	0.4
(Dm-Dc)/Dm * 100 =	0.00%
Mean Velocity =	0.5
Manning's n =	0.166
0.4 * Qm =	0.13
2.5 * Qm =	0.79



FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	3.44		
Bankfull	1.5	4.74		
Waterline	2.5	5.3	0	0
	2.7	5.5	0.2	0.3
	2.9	5.6	0.3	0.37
	3.1	5.7	0.4	0.48
	3.3	5.7	0.4	0.6
	3.5	5.6	0.3	0.63
	3.7	5.6	0.3	0.6
	3.9	5.5	0.2	0.56
	4.1	5.45	0.15	0.5
	4.3	5.45	0.15	0.49
	4.5	5.5	0.2	0.46
	4.7	5.5	0.2	0.49
	4.9	5.4	0.1	0.58
	5.1	5.4	0.1	0.53
	5.3	5.4	0.1	0.36
	5.5	5.35	0.05	0.16
Waterline	5.7	5.3	0	0
	7.5	4.9		
Bankfull	9	4.82		
	12	4.38		


Cross-section for Spruce Creek - 07/14/2020 XS 2
Rod Height (ft)
3
3.5
4
4.5
5
5.5
6
0
2.5
5
7.5
10
Station (ft)
Channel Bed
Water Surface
Bankfull
Waterline

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (SQ ft)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.28	0.2	0.04	0.01	3.8
0.22	0.3	0.06	0.02	7.04
0.22	0.4	0.08	0.04	12.17
0.2	0.4	0.08	0.05	15.21
0.22	0.3	0.06	0.04	11.98
0.2	0.3	0.06	0.04	11.41
0.22	0.2	0.04	0.02	7.1
0.21	0.15	0.03	0.01	4.75
0.2	0.15	0.03	0.01	4.66
0.21	0.2	0.04	0.02	5.83
0.2	0.2	0.04	0.02	6.21
0.22	0.1	0.02	0.01	3.68
0.2	0.1	0.02	0.01	3.36
0.2	0.1	0.02	0.01	2.28
0.21	0.05	0.01	0	0.51
0.21	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.

Discharge Measurement Summary

Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

Start time	6/15/2021 11:43 AM
End time	6/15/2021 12:01 PM
Start location latitude	39.984
Start location longitude	-106.520
Calculations engine	FlowTracker2

Sensor type	Top Setting
Handheld serial number	FT2H2104006
Probe serial number	FT2P2103011
Probe firmware	1.30
Handheld software	1.6.4

# Stations	Avg interval (s)	Total discharge (ft³/s)
17	40	0.6762

Total width (ft)	Total area (ft²)	Wetted Perimeter (ft)
4.600	2.0120	4.993

Mean SNR (dB)	Mean depth (ft)	Mean velocity (ft/s)
41	0.437	0.3361

Mean temp (°F)	Max depth (ft)	Max velocity (ft/s)
47.036	0.600	0.7852

Discharge Uncertainty		
Category	**ISO**	**IVE**
Accuracy	1.0%	1.0%
Depth	0.5%	5.5%
Velocity	1.4%	6.9%
Width	0.2%	0.2%
Method	2.3%	
# Stations	3.0%	
Overall	**4.1%**	**8.8%**

Discharge equation	Mid Section
Discharge uncertainty	IVE
Discharge reference	Rated

Data Collection Settings	
Salinity	0.000 PSS-78
Temperature	-
Sound speed	-
Mounting correction	0.000 %

Summary overview

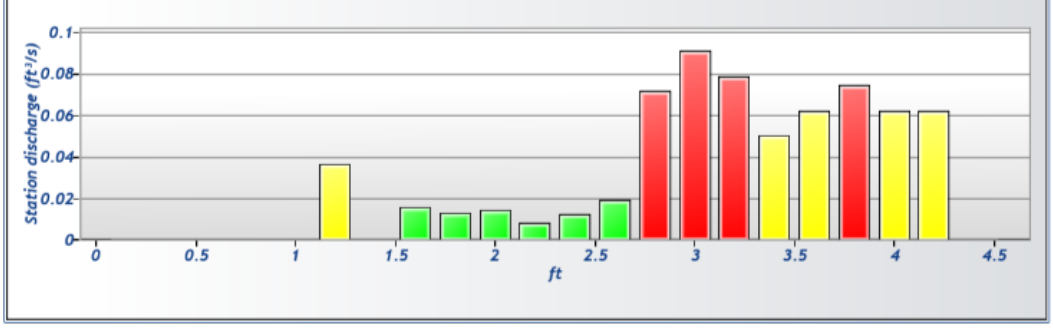
No changes were made to this file
Quality control warnings

Discharge Measurement Summary

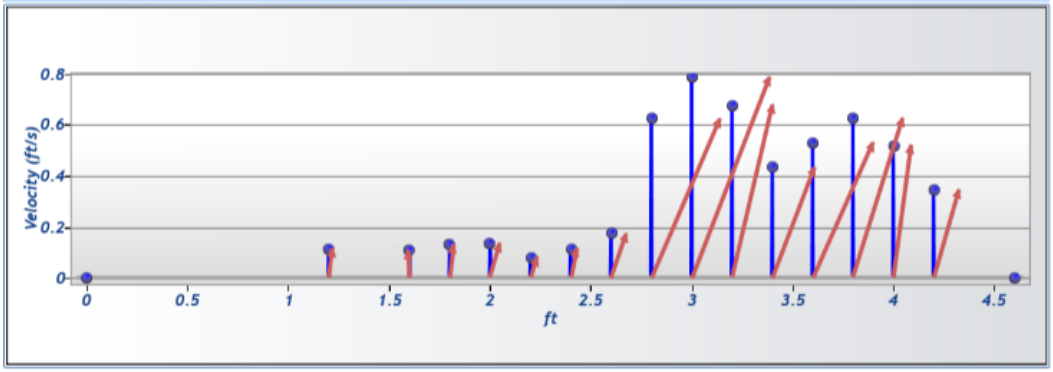
Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

Station Warning Settings		
Station discharge OK	Station discharge < 5.00%	
Station discharge caution	5.00% >= Station discharge < 10.00%	
Station discharge warning	Station discharge >= 10.00%	

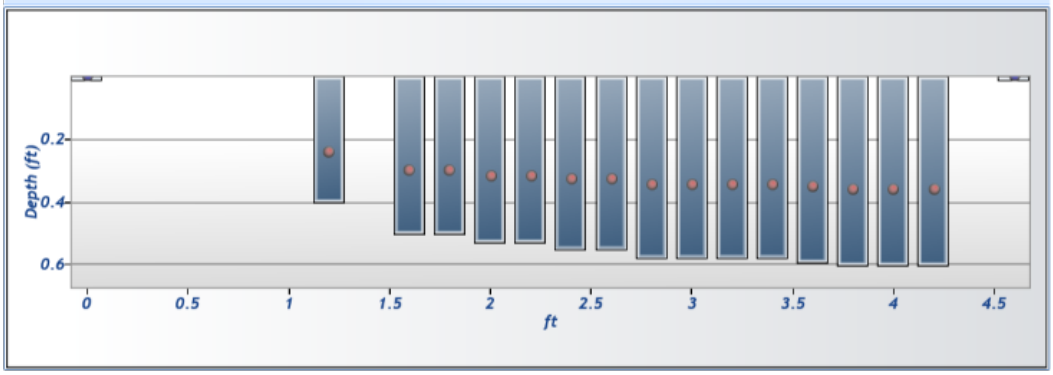
Discharge chart



Velocity chart



Depth chart



Discharge Measurement Summary

Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

Measurement results

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Samples	Velocity (ft/s)	Correction	Mean Velocity (ft/s)	Area (ft²)	Flow (ft³/s)	%Q	
0	11:43 AM	0.000	None	0.010	0.0000	0.000	0	0.0000	1.0000	0.1154	0.0060	0.0007	0.10	✓
1	11:44 AM	1.200	0.6	0.400	0.6000	0.240	80	0.1154	1.0000	0.1154	0.3200	0.0369	5.46	✓
2	11:45 AM	1.600	0.6	0.500	0.6000	0.300	80	0.1076	1.0000	0.1076	0.1500	0.0161	2.39	✓
3	11:46 AM	1.800	0.6	0.500	0.6000	0.300	80	0.1305	1.0000	0.1305	0.1000	0.0131	1.93	✓
4	11:48 AM	2.000	0.6	0.530	0.6000	0.318	80	0.1352	1.0000	0.1352	0.1060	0.0143	2.12	✓
5	11:49 AM	2.200	0.6	0.530	0.6000	0.318	80	0.0811	1.0000	0.0811	0.1060	0.0086	1.27	✓
6	11:50 AM	2.400	0.6	0.550	0.6000	0.330	80	0.1157	1.0000	0.1157	0.1100	0.0127	1.88	✓
7	11:51 AM	2.600	0.6	0.550	0.6000	0.330	80	0.1744	1.0000	0.1744	0.1100	0.0192	2.84	✓
8	11:52 AM	2.800	0.6	0.580	0.6000	0.348	80	0.6224	1.0000	0.6224	0.1160	0.0722	10.68	✓
9	11:54 AM	3.000	0.6	0.580	0.6000	0.348	80	0.7852	1.0000	0.7852	0.1160	0.0911	13.47	✓
10	11:55 AM	3.200	0.6	0.580	0.6000	0.348	80	0.6773	1.0000	0.6773	0.1160	0.0786	11.62	✓
11	11:56 AM	3.400	0.6	0.580	0.6000	0.348	80	0.4332	1.0000	0.4332	0.1160	0.0502	7.43	✓
12	11:57 AM	3.600	0.6	0.590	0.6000	0.354	80	0.5298	1.0000	0.5298	0.1180	0.0625	9.25	✓
13	11:58 AM	3.800	0.6	0.600	0.6000	0.360	80	0.6246	1.0000	0.6246	0.1200	0.0750	11.09	✓
14	11:59 AM	4.000	0.6	0.600	0.6000	0.360	80	0.5199	1.0000	0.5199	0.1200	0.0624	9.23	✓
15	12:01 PM	4.200	0.6	0.600	0.6000	0.360	80	0.3439	1.0000	0.3439	0.1800	0.0619	9.15	✓
16	12:00 PM	4.600	None	0.010	0.0000	0.000	0	0.0000	1.0000	0.3439	0.0020	0.0007	0.10	✓

Discharge Measurement Summary

Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

Quality Control Settings	
Maximum depth change	50.00%
Maximum spacing change	100.00%
SNR threshold	10 dB
Standard error threshold	0.0328 ft/s
Spike threshold	10.00%
Maximum velocity angle	20.0 deg
Maximum tilt angle	5.0 deg

Quality control warnings

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Warnings
4	11:48 AM	2.000	0.6	0.530	0.6000	0.318	Velocity Angle > QC
5	11:49 AM	2.200	0.6	0.530	0.6000	0.318	Velocity Angle > QC
7	11:51 AM	2.600	0.6	0.550	0.6000	0.330	Velocity Angle > QC
8	11:52 AM	2.800	0.6	0.580	0.6000	0.348	Velocity Angle > QC,High Stn % Discharge
9	11:54 AM	3.000	0.6	0.580	0.6000	0.348	Standard Error > QC,Velocity Angle > QC,High Stn % Discharge
10	11:55 AM	3.200	0.6	0.580	0.6000	0.348	High Stn % Discharge
11	11:56 AM	3.400	0.6	0.580	0.6000	0.348	Velocity Angle > QC
12	11:57 AM	3.600	0.6	0.590	0.6000	0.354	Velocity Angle > QC
13	11:58 AM	3.800	0.6	0.600	0.6000	0.360	Velocity Angle > QC,High Stn % Discharge

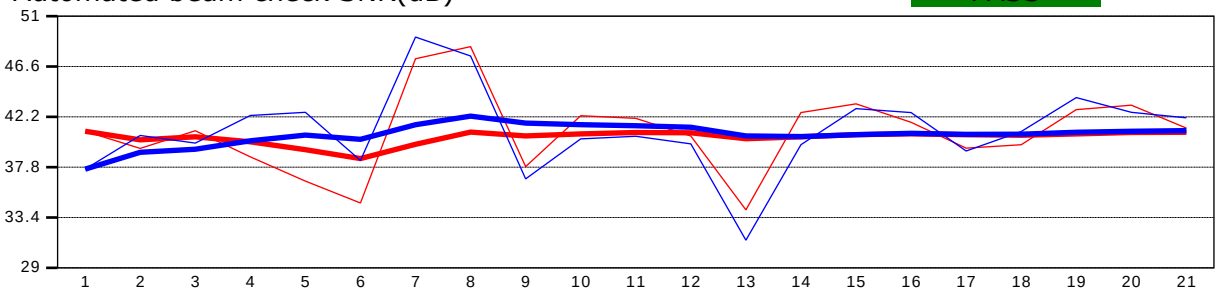
Discharge Measurement Summary

Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

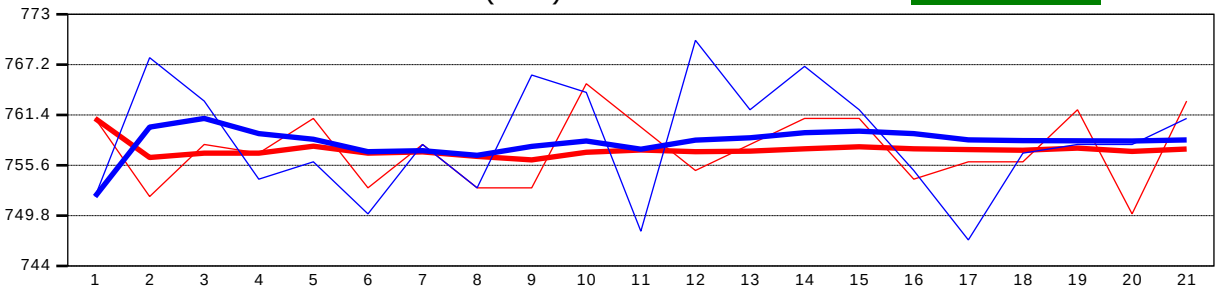
Beam 1	
Beam 2	

Automated beam check Start time 6/15/2021 11:43:17 AM

Automated beam check SNR(dB) PASS



Automated beam check Noise level(cnts) PASS



Automated beam check Quality control warnings

No quality control warnings

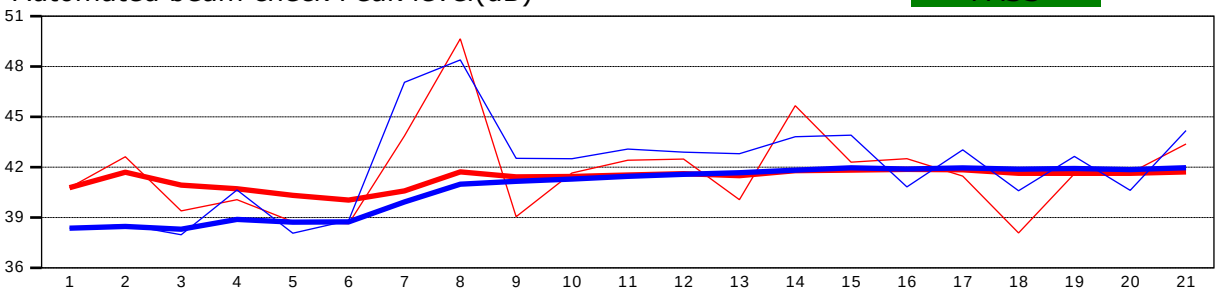
Discharge Measurement Summary

Site name	Spruceup
Site number	6152021B
Operator(s)	Lfs
File name	Spruceup_20210615-120647.ft
Comment	

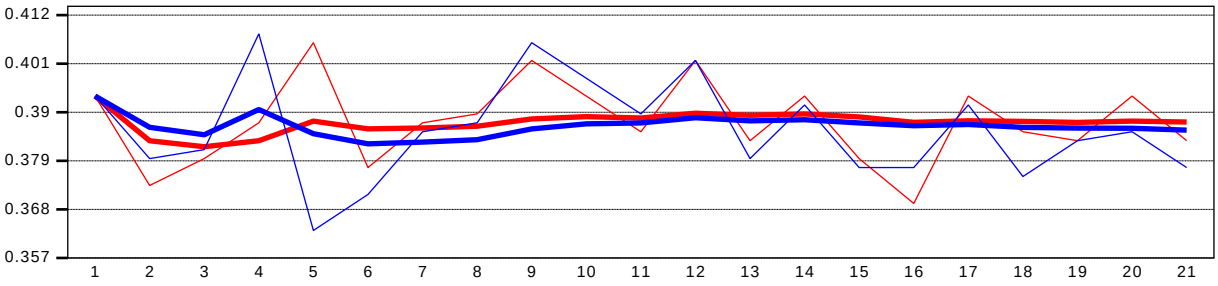
Beam 1	
Beam 2	

Automated beam check Start time 6/15/2021 11:43:17 AM

Automated beam check Peak level(dB) PASS



Automated beam check Peak position(ft) PASS



Automated beam check Quality control warnings

No quality control warnings

Discharge Measurement Summary

Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

Start time	6/15/2021 12:59 PM
End time	6/15/2021 1:21 PM
Start location latitude	39.923
Start location longitude	-106.409
Calculations engine	FlowTracker2

Sensor type	Top Setting
Handheld serial number	FT2H2104006
Probe serial number	FT2P2103011
Probe firmware	1.30
Handheld software	1.6.4

# Stations	Avg interval (s)	Total discharge (ft³/s)
19	40	0.9297

Total width (ft)	Total area (ft²)	Wetted Perimeter (ft)
3.800	1.1260	4.018

Mean SNR (dB)	Mean depth (ft)	Mean velocity (ft/s)
46	0.296	0.8257

Mean temp (°F)	Max depth (ft)	Max velocity (ft/s)
60.921	0.400	1.6754

Discharge Uncertainty		
Category	**ISO**	**IVE**
Accuracy	1.0%	1.0%
Depth	0.5%	9.9%
Velocity	1.0%	6.7%
Width	0.2%	0.2%
Method	2.4%	
# Stations	2.6%	
Overall	**3.8%**	**12.0%**

Discharge equation	Mid Section
Discharge uncertainty	IVE
Discharge reference	Rated

Data Collection Settings	
Salinity	0.000 PSS-78
Temperature	-
Sound speed	-
Mounting correction	0.000 %

Summary overview

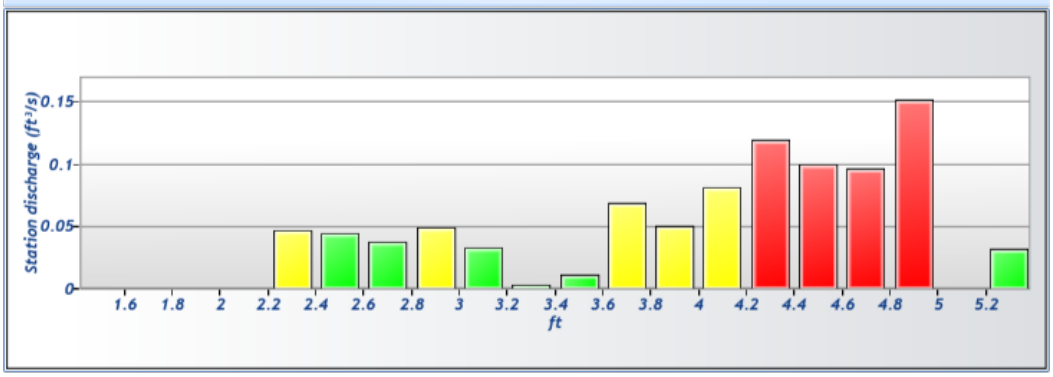
No changes were made to this file
Quality control warnings

Discharge Measurement Summary

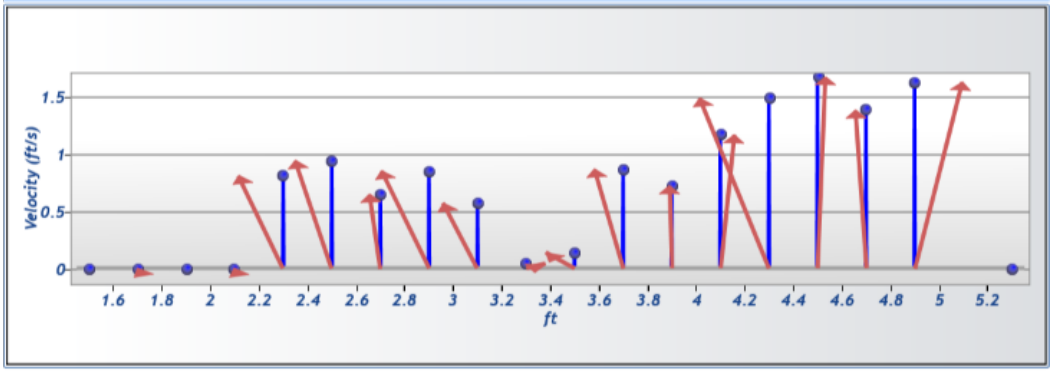
Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

Station Warning Settings	
Station discharge OK	Station discharge < 5.00%
Station discharge caution	5.00% >= Station discharge < 10.00%
Station discharge warning	Station discharge >= 10.00%

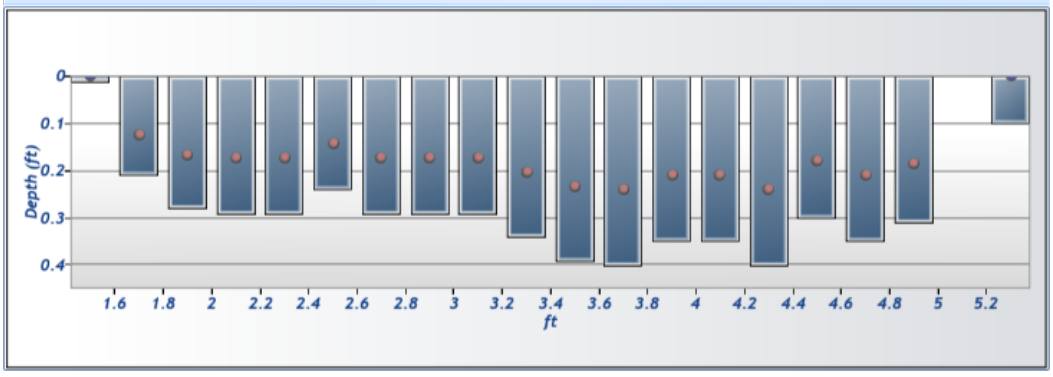
Discharge chart



Velocity chart



Depth chart



Discharge Measurement Summary

Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

Measurement results

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Samples	Velocity (ft/s)	Correction	Mean Velocity (ft/s)	Area (ft²)	Flow (ft³/s)	%Q	
0	12:59 PM	1.500	None	0.010	0.0000	0.000	0	0.0000	1.0000	0.0026	0.0010	0.0000	0.00	✓
1	12:59 PM	1.700	0.6	0.210	0.6000	0.126	80	0.0026	1.0000	0.0026	0.0420	0.0001	0.01	✓
2	1:01 PM	1.900	0.6	0.280	0.6000	0.168	80	0.0004	1.0000	0.0004	0.0560	0.0000	0.00	✓
3	1:02 PM	2.100	0.6	0.290	0.6000	0.174	80	0.0029	1.0000	0.0029	0.0580	0.0002	0.02	✓
4	1:03 PM	2.300	0.6	0.290	0.6000	0.174	80	0.8092	1.0000	0.8092	0.0580	0.0469	5.05	✓
5	1:05 PM	2.500	0.6	0.240	0.6000	0.144	80	0.9444	1.0000	0.9444	0.0480	0.0453	4.88	✓
6	1:06 PM	2.700	0.6	0.290	0.6000	0.174	80	0.6489	1.0000	0.6489	0.0580	0.0376	4.05	✓
7	1:07 PM	2.900	0.6	0.290	0.6000	0.174	80	0.8540	1.0000	0.8540	0.0580	0.0495	5.33	✓
8	1:08 PM	3.100	0.6	0.290	0.6000	0.174	80	0.5728	1.0000	0.5728	0.0580	0.0332	3.57	✓
9	1:09 PM	3.300	0.6	0.340	0.6000	0.204	80	0.0420	1.0000	0.0420	0.0680	0.0029	0.31	✓
10	1:10 PM	3.500	0.6	0.390	0.6000	0.234	80	0.1408	1.0000	0.1408	0.0780	0.0110	1.18	✓
11	1:12 PM	3.700	0.6	0.400	0.6000	0.240	80	0.8684	1.0000	0.8684	0.0800	0.0695	7.47	✓
12	1:13 PM	3.900	0.6	0.350	0.6000	0.210	80	0.7211	1.0000	0.7211	0.0700	0.0505	5.43	✓
13	1:14 PM	4.100	0.6	0.350	0.6000	0.210	80	1.1710	1.0000	1.1710	0.0700	0.0820	8.82	✓
14	1:16 PM	4.300	0.6	0.400	0.6000	0.240	80	1.4909	1.0000	1.4909	0.0800	0.1193	12.83	✓
15	1:18 PM	4.500	0.6	0.300	0.6000	0.180	80	1.6754	1.0000	1.6754	0.0600	0.1005	10.81	✓
16	1:19 PM	4.700	0.6	0.350	0.6000	0.210	80	1.3848	1.0000	1.3848	0.0700	0.0969	10.43	✓
17	1:20 PM	4.900	0.6	0.310	0.6000	0.186	80	1.6309	1.0000	1.6309	0.0930	0.1517	16.31	✓
18	1:21 PM	5.300	None	0.100	0.0000	0.000	0	0.0000	1.0000	1.6309	0.0200	0.0326	3.51	✓

Discharge Measurement Summary

Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

Quality Control Settings	
Maximum depth change	50.00%
Maximum spacing change	100.00%
SNR threshold	10 dB
Standard error threshold	0.0328 ft/s
Spike threshold	10.00%
Maximum velocity angle	20.0 deg
Maximum tilt angle	5.0 deg

Quality control warnings

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Warnings
1	12:59 PM	1.700	0.6	0.210	0.6000	0.126	Boundary Interference,Large SNR Variation,SNR Threshold Variation,High % Spikes
2	1:01 PM	1.900	0.6	0.280	0.6000	0.168	Boundary Interference,Beam SNRs Not Similar
3	1:02 PM	2.100	0.6	0.290	0.6000	0.174	Boundary Interference,Beam SNRs Not Similar
6	1:06 PM	2.700	0.6	0.290	0.6000	0.174	Beam SNRs Not Similar
7	1:07 PM	2.900	0.6	0.290	0.6000	0.174	Standard Error > QC
10	1:10 PM	3.500	0.6	0.390	0.6000	0.234	Standard Error > QC,Velocity Angle > QC
11	1:12 PM	3.700	0.6	0.400	0.6000	0.240	Standard Error > QC
12	1:13 PM	3.900	0.6	0.350	0.6000	0.210	Standard Error > QC
13	1:14 PM	4.100	0.6	0.350	0.6000	0.210	Standard Error > QC
14	1:16 PM	4.300	0.6	0.400	0.6000	0.240	Standard Error > QC,High Stn % Discharge
15	1:18 PM	4.500	0.6	0.300	0.6000	0.180	Standard Error > QC,High Stn % Discharge
16	1:19 PM	4.700	0.6	0.350	0.6000	0.210	Standard Error > QC,High Stn % Discharge
17	1:20 PM	4.900	0.6	0.310	0.6000	0.186	Standard Error > QC,High Stn % Discharge

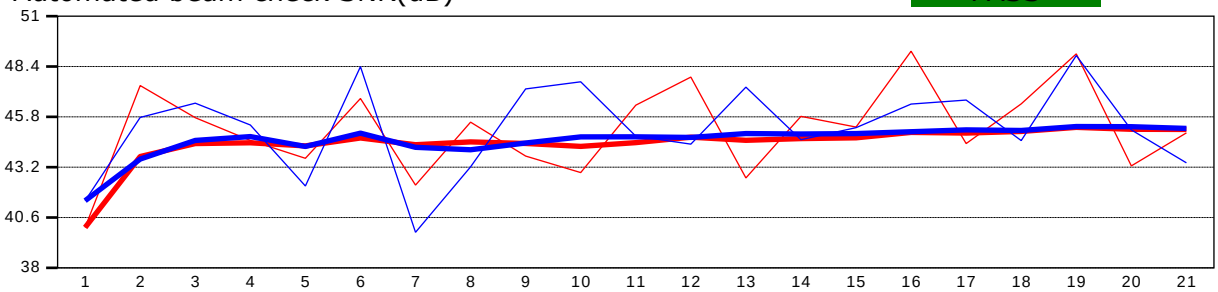
Discharge Measurement Summary

Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

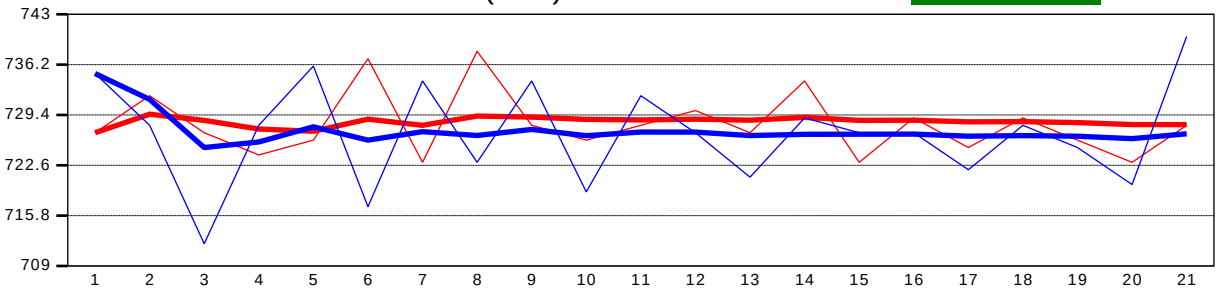
Beam 1	
Beam 2	

Automated beam check Start time 6/15/2021 12:58:25 PM

Automated beam check SNR(dB) PASS



Automated beam check Noise level(cnts) PASS



Automated beam check Quality control warnings

No quality control warnings

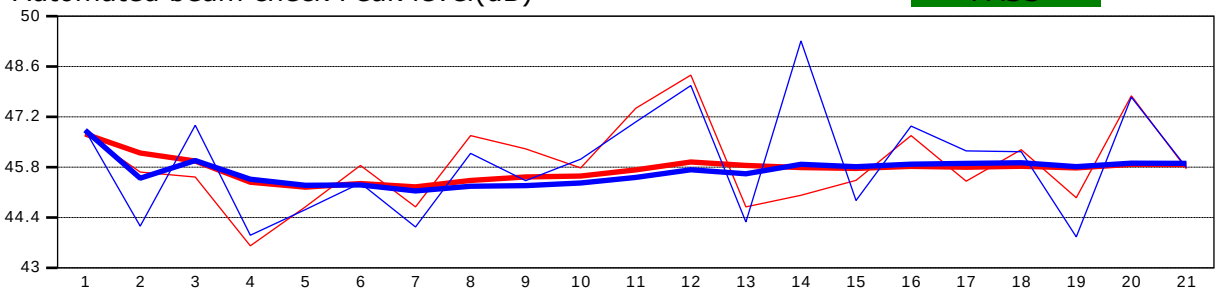
Discharge Measurement Summary

Site name	Sprucelo
Site number	5112021C
Operator(s)	Lfs
File name	Sprucelo_20210615-132420.ft
Comment	

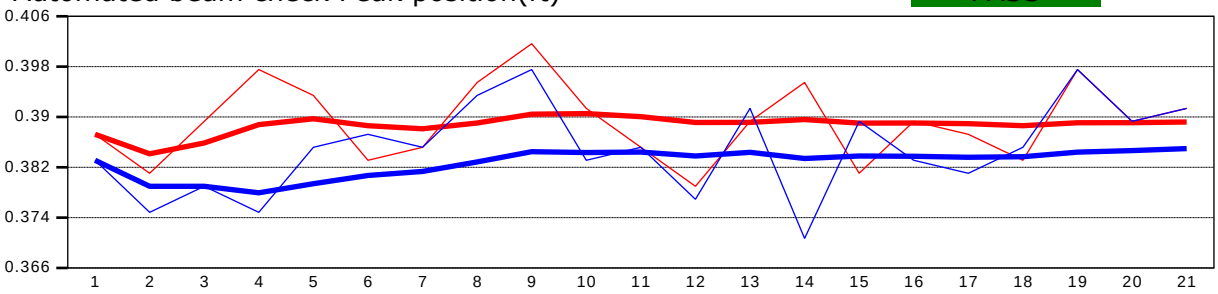
Beam 1	
Beam 2	

Automated beam check Start time 6/15/2021 12:58:25 PM

Automated beam check Peak level(dB) PASS



Automated beam check Peak position(ft) PASS



Automated beam check Quality control warnings

No quality control warnings

Discharge Measurment Field Visit Data Report *(Filters: Name begins with Spruce; Division = 5;)*

Div	Name	CWCB Case Number	Segment ID	Meas. Date	UTM	Location	Flow Amount (cfs)	Meas #	Rating	Station ID
5	Spruce Creek		22/5/A-003	06/15/2021	UTMx: 379014 UTMy: 4417395	Discharge measurements taken near prior R2Cross measurements on BLM land.	0.68	1	fair	
5	Spruce Creek		22/5/A-003	06/15/2021	UTMx: 379587 UTMy: 4420210	Discharge measurements taken near prior R2Cross measurements on BLM land.	0.93	2	fair	


ROAD
CLOSED