COLORADO
Parks and Wildlife
Department of Natural Resources
Water Resources Section
6060 Broadway
Denver, CO 80216

January 14, 2019

Ms. Linda Bassi, Chief
Stream and Lake Protection Section
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
Denver CO 80203

Subject: Instream Flow Recommendations for Streams in Water Division 2, Huerfano County; Baker and Bonnett Creeks, to be Presented at the January 28-29, 2019 CWCB Meeting

Dear Ms. Bassi:

The information contained in and referred to in this letter forms the scientific and biological basis for instream flow (ISF) recommendations for Baker and Bonnett Creeks in Water Division 2. These flow recommendations will be presented for consideration by the Colorado Water Conservation Board (CWCB or Board) at their January 2019 regular meeting. The field investigations relating to these ISF recommendations were conducted by US Forest Service (USFS) personnel in 1992 and by Division of Wildlife (DOW) personnel in 2006. Supplementary information was collected by Colorado Parks and Wildlife (CPW) personnel in 2016. These stream reaches were first presented to the Board in 2009. At the January 2009 meeting, the Board declared its intent to appropriate on these streams, Cucharas Creek, Chaparral Creek, Dodgeton Creek, and two segments of the Huerfano River. Because of opposition from Huerfano County Water Conservancy District and other interests, the ISF appropriations were put on hold to allow the opposing parties to complete a study establishing their water needs and file for necessary additional water rights. A stipulation was signed by the parties that postponed a formal hearing of the appropriations. Per the terms of the stipulation, the Board took action to move forward the Huerfano River and Cucharas Creek appropriations in 2010 and the Dodgeton Creek and Chaparral Creek appropriations in 2011. The opposers requested the Baker Creek appropriation be made after January 2013. The postponement period has concluded, and it is now CPW staff's opinion that the information contained in this letter is sufficient to recommend ISF appropriations on Baker and Bonnett Creeks to the Board and to specifically address the findings required in Rule 5(i) of the Instream Flow Program Rules.

CPW participates in the ISF Program and develops instream flow recommendations for the Board's consideration in an effort to address CPW's legislative declarations "... that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.), and "... that the natural, scenic, scientific, and outdoor recreation areas ... protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and (its) visitors ... and that, to carry out such program and policy, there shall be a continuous operation of acquisition, development, and management of ... lands, waters, and facilities." (See §33-10-101 (1) C.R.S.).

In addition to these broad statutory guidelines, CPW's current strategic planning document (CPW Strategic Plan, 2015) explains current agency goals to, "[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems." In order to, "protect and enhance water resources for fish and wildlife populations," by pursuing, "partnerships and agreements to enhance instream flows, protect reservoir levels, and influence water management activities," and to, "[a]dvocate for water quality and quantities to conserve aquatic resources." In addition to the CPW strategic plan, the agency's fish and wildlife conservation activities are also directed by the State Wildlife Action Plan (2002, Revised 2015). The goals and priorities from these documents direct CPW to advocate for the preservation of the state's fish and wildlife resources and natural environment, and therefore link CPW's mission to the goals and priorities of CWCB's ISF/NLL Program.

Recommended Segments

CPW is proposing ISF recommendations on Baker Creek from its headwaters to the USFS boundary and on Bonnett Creek from its headwaters to the confluence with the Cucharas River.

Natural Environment

As stated above, Baker and Bonnett Creeks were first proposed by DOW in 2009. DOW's interest was based on the fact that the streams contain suitable habitat for brook trout and observations by CPW staff indicate the stream supports brook trout. CPW is of the opinion that there are flow dependent natural environments in Baker and Bonnett Creeks that can be preserved to a reasonable degree by ISF appropriations.

Flows Necessary to Preserve the Natural Environment

In 2006 and 2016, CPW (DOW) personnel collected stream cross-section data to be used as input into the R2CROSS model. Initial biological instream flow recommendations were developed utilizing the standard application of the R2CROSS methodology (Espegren 1996). R2CROSS uses field data that has been collected in a riffle habitat types; riffles are typically the limiting habitat type in streams during low flow events. The field data includes a survey of stream channel geometry, a longitudinal slope of the water surface, and a streamflow measurement at the designated cross-section. After processing this data with R2CROSS, winter and summer flow recommendations were developed utilizing the standard R2CROSS criteria described in Nehring

(1979) and Espergren (1996); the R2CROSS hydraulic criteria of interest are average depth, average velocity, and wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types will also maintain aquatic habitat in pools and runs for most life stages of fish and aquatic invertebrates (Nehring 1979).

Cross-section data sets were collected on the reaches identified above. The field data sheets and resulting R2CROSS outputs are attached. The results of the R2CROSS analysis are summarized on the attached recommendation summary reports. R2CROSS biological recommendations were further refined with a preliminary water availability analysis. CPW conducted a preliminary evaluation of the hydrology in these streams to determine if water is physically available for an ISF appropriation. Representative hydrographs for each of these reaches are based on USGS StreamStats, a software product that estimates mean monthly flow statistics. Winter water availability reduced the baseflow recommendations on both reaches. CPW determined that the reduced winter flow rates should be sufficient for overwintering fish. Final detailed water availability analyses will be performed by CWCB staff and presented in the Executive Summaries provided to the Board prior to the January 2019 meeting.

The proposed flow recommendations below should be sufficient to preserve the natural environment to a reasonable degree:

- Baker Creek
  - 2.1 cfs is recommended from May 1 through June 30;
  - 1.4 cfs is recommended from July 1 through August 31;
  - 0.5 cfs is recommended from September 1 through March 31;
  - 1.0 cfs is recommended April 1 through April 30.
- Bonnett Creek
  - 1.0 cfs is recommended from April 1 through June 30;
  - 0.6 cfs is recommended from July 1 through August 31;
  - 0.4 cfs is recommended from September 1 through March 31.

As stated above, the purpose of this letter is to formally transmit these ISF recommendations from CPW to CWCB for the Board's consideration for the 2019 appropriation year. Please refer to the attached recommendation summary reports and supporting documentation for additional information. If CWCB staff has any further questions or needs clarification regarding these flow recommendations, please contact us.

CPW personnel will be present at the January 2019 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Katie Birch
CPW Instream Flow Program Coordinator
Attachments (as stated)

<u>Stream</u>: Bonnett Creek

Colorado Parks and Wildlife
Recommendation Summary

Water Division: 2
Water District: 16
CPW Watercode: 29202

<u>Segment</u>: Headwaters to the confluence with the Cucharas River

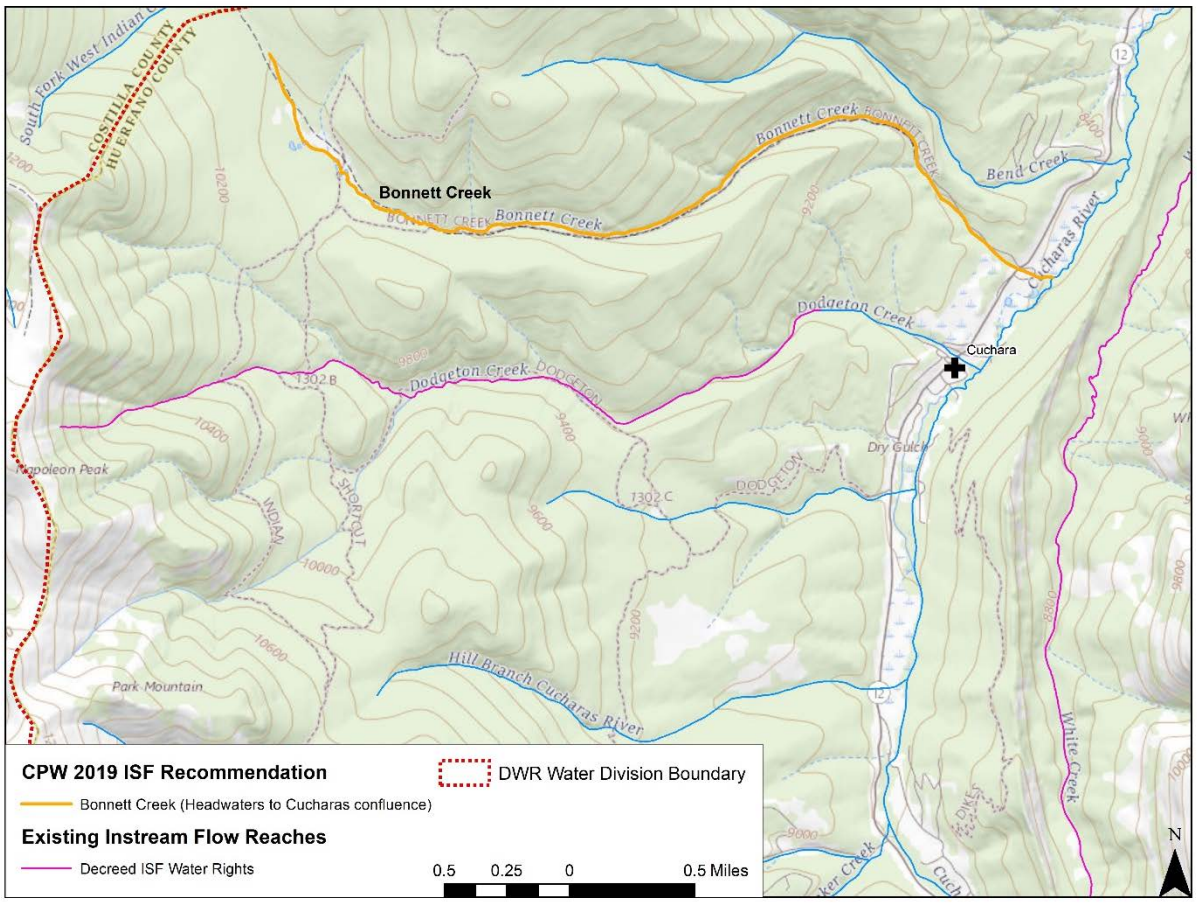
Upper Terminus: Headwaters

13S 486695.74 4138962.59 UTM

Lower Terminus: The confluence with the Cucharas River

13S 491728.78 4137528.63 UTM

ISF Recommendation: 1.0 cfs (4/1 – 6/30)
0.6 cfs (7/1 – 8/31)
0.4 cfs (9/1 – 3/31)



Introduction

The information contained in this report and the associated supporting documents form the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is Colorado Parks and Wildlife (CPW) staff's opinion that the information contained in this report is sufficient for the Board's staff to begin the investigations required to support the findings required in Rule 5(i) of the Instream Flow Rules.

CPW is sending this instream flow recommendation to the Board to meet CPW's legislative declaration, "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S., and, "… that the natural, scenic, scientific, and outdoor recreation areas of this state are to be protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and visitors of this state… and that to carry such program and policy there shall be a continuous operation of acquisition, development, and management of outdoor recreation lands, waters, and facilities (C.R.S. §33-10-101 (1))."

In addition to these broad statutory guidelines, CPW's current strategic planning document (CPW Strategic Plan, 2015) explains current agency goals to, "[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems." In order to, "protect and enhance water resources for fish and wildlife populations," by pursuing, "partnerships and agreements to enhance instream flows, protect reservoir levels, and influence water management activities," and to, "[a]dvocate for water quality and quantities to conserve aquatic resources." In addition to the CPW strategic plan, the agency's fish and wildlife conservation activities are also directed by the State Wildlife Action Plan (2002, Revised 2015). The goals and priorities from these documents direct CPW to advocate for the preservation of the state's fish and wildlife resources and natural environment, and therefore link CPW's mission to the goals and priorities of CWCB's ISF/NLL Program.

Instream Flow Recommendation

The subject of this report is a segment of Bonnett Creek beginning at its headwaters and extending downstream to the confluence with the Cucharas River. The proposed segment is located southwest of the Town of Cuchara. The majority of the reach is located on public lands managed by the US Forest Service (USFS) in the Pike and San Isabel National Forests.

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Headwaters	Confluence with the Cucharas River	4.05	18%	82%

Natural Environment

Bonnett Creek is a first order, high-gradient stream with a somewhat confined channel. Substrate ranges from boulder to cobble. Observations by CPW staff indicate the stream environment of

Bonnett Creek supports brook trout (*Salvelinus fontinalis*).

Biological Flow Quantification

Methodology

CPW staff used the R2CROSS methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge. Copies of field data collected for this proposed segment are included as an attachment.

Field data is processed in the R2CROSS model to develop these initial recommendations. The recommendations are designed to address the unique biologic requirements of each stream without regard to water availability. The R2CROSS method utilizes three hydraulic parameters, average depth, percent wetted perimeter, and average velocity to develop biologic instream flow recommendations. CPW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

Results

The USFS, in July of 1992, collected stream cross-section information, flow data, and natural environment observations to quantify the instream flow needs for this reach of the Bonnett Creek using R2CROSS. In 2016, CPW collected additional cross-section and flow data.

For this segment of stream, three data sets were collected with the results shown in Table 1 above. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's equation (240% and 40% of Q), the hydraulic equation that was used, and the corresponding summer flow recommendation meeting all 3 hydraulic criteria and the winter flow recommendation meeting 2 of 3 hydraulic criteria.

Table 1. Results of R2CROSS transect measurements and the resulting flow recommendations.

	Party	Date Measured	Q measured	40%-250%	Hydraulic Equation	Flow Meeting Two Criteria	Flow Meeting Three Criteria
1	USFS	7/15/1992	0.42 cfs	0.2 – 1.1 cfs	Manning's	0.48 cfs	Out of confidence interval
2	CPW	6/16/2016	1.1 cfs	0.4 – 2.8 cfs	Manning's	0.66 cfs	1.22 cfs
3	CPW	6/16/2016	0.84 cfs	0.3 – 2.1 cfs	Manning's	0.58 cfs	0.69 cfs
				Mean		**0.6 cfs**	**1.0 cfs**

the Manning's modeled range for this cross-section, **1.1 cfs**.

Based on these results, CPW's initial recommendation is 1.0 cfs, summer, and 0.6 cfs, winter, based on USFS and CPW data collection efforts. This recommendation is based on the physical and

biological data collected to date and does not incorporate any water availability constraints.

Hydrologic Data

CPW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. The hydrograph is based on USGS StreamStats, a software product that estimates mean monthly flow statistics for the contributing basin. Figure 1 below displays the StreamStats hydrograph, the initial R2CROSS recommendations, and the proposed ISF recommendations refined by preliminary water availability.

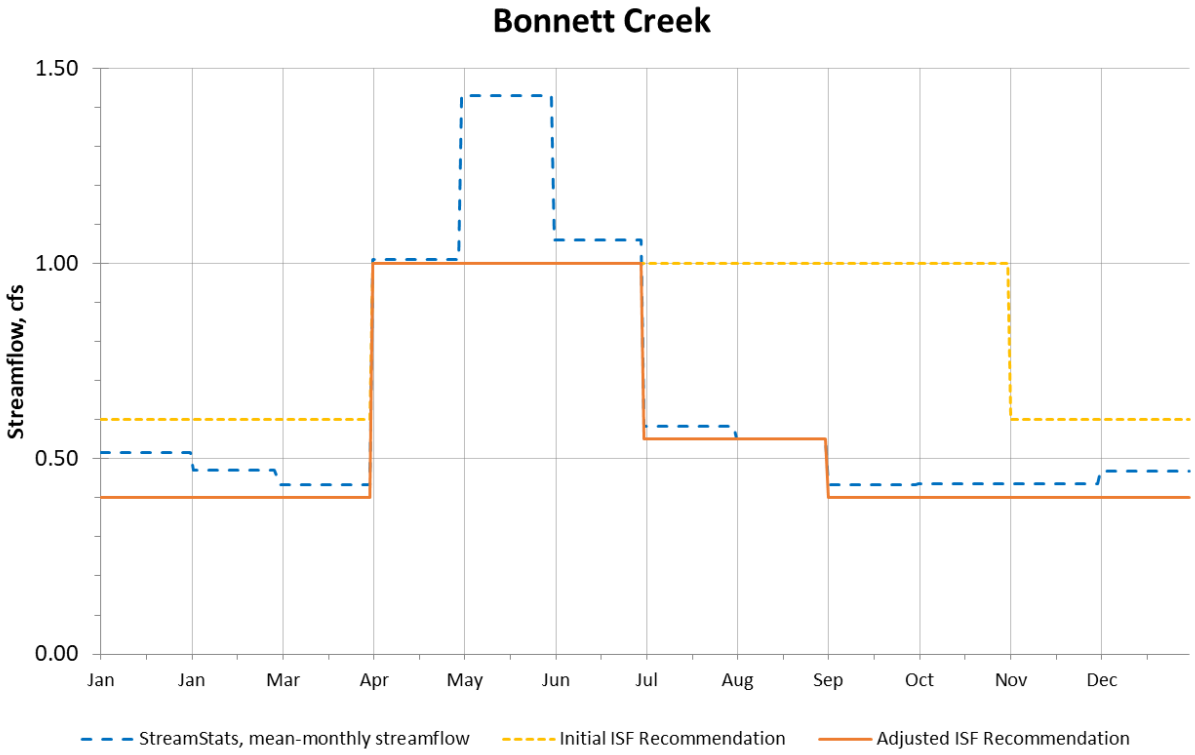


Figure 1. Hydrograph showing the USGS StreamStats monthly mean flow estimates for Bonnett Creek, and initial and adjusted, final CPW winter and summer seasonal recommended flows.

Recommended Flow Rates

After incorporating the preliminary water availability information, the original instream flow recommendation was modified. During the baseflow period, the proposed winter flow recommendation was reduced from 0.6 cfs to 0.4 cfs. This reduced base flow rate is needed for fish overwintering; it will achieve the percent wetted perimeter criteria across the reach and velocities and depths that are suitable at microhabitats within the reach. The proposed summer flow recommendation will preserve the natural environment by achieving all three instream flow criteria during the snowmelt runoff period between April and the end of June. CPW recommends protection of the receding limb of the hydrograph in order to achieve suitable velocities and wetted perimeter during the late summer. This combination will support fish spawning, development, and rearing. The proposed flows below are sufficient to preserve the natural environment to a reasonable degree in this reach of Bonnett Creek:

- 1.0 cfs is recommended from April 1 through June 30;

- 0.6 cfs is recommended from July 1 through August 31;
- 0.4 cfs is recommended from September 1 through March 31.

If additional water is determined to be available in further investigations, CPW would recommend appropriating the additional water up to the initial, biological recommended flow amounts to preserve the natural environment to a reasonable degree.

Existing Water Right Information

CPW staff has analyzed the water rights tabulation and consulted with the Division of Water Resources (DWR) Water Commissioner to identify any potential water availability problems due to existing diversions. Records indicate that there are no surface water diversions located within this reach of Bonnett Creek.

CPW and CWCB staff have met with the Cucharas Collaborative and Huerfano County Water Conservancy District water users; they have been made aware of these proposed ISF recommendations and have expressed no major issues or concerns.

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO WATER CONSERVATION BOARD

COLORADO DIVISION OF WILDLIFE

20

P92A2

LOCATION INFORMATION

STREAM NAME: BONNETT CREEK 93C

CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: LOCATION APPROXIMATELY 1 MILE F.S. BOUNDARY FENCE OFF DIRT ROAD 40'

DATE: 7-15-92 OBSERVERS: LEWIN / MURPHY

LEGAL DESCRIPTION: ¼ SECTION: SE SECTION: 33 TOWNSHIP: 30 N/S RANGE: 69 E/W (W circled) PM:

COUNTY: Huefano WATERSHED: 93C WATER DIVISION: II DOW WATER CODE: 29202

MAP(S): USGS:

USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO

METER TYPE:

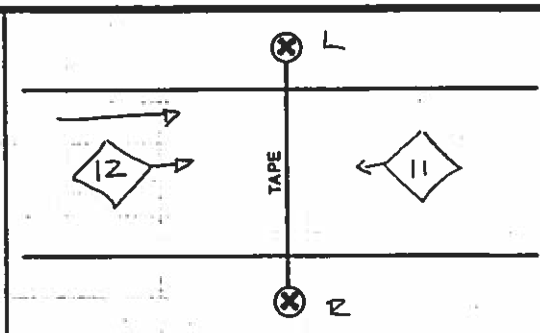
METER NUMBER: DATE RATED: CALIB/SPIN: 86/94 sec TAPE WEIGHT: ____ lbs/foot TAPE TENSION: ____ lbs

CHANNEL BED MATERIAL SIZE RANGE: PHOTOGRAPHS TAKEN: YES/NO NUMBER OF PHOTOGRAPHS:

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	21	5.73
③ WS Downstream	19	7.96
SLOPE	2.23/40 = 0.0558 ✓	

SKETCH



LEGEND: Stake ⊗ Station ① Photo ◇→ 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:

COMMENTS

COPIED FROM HIGH FLOW DATA

FORM #ISF FD 1-85

BONNETT CREEK 93C

7-15-92

Darryl Murphy — level/notes

Paul Lewin — rod

Warm, sunny, some clouds. Water is clear.
Location approximantly 1 mile from highway, at F.S. boundary fince line off dirt road 40'.
etc,
time start:
Time Start: 9:00AM — Spin Test Before: 86
Time Stop: 9:45AM — Spin Test After: 94
Photo #11 upstream. Photo #12 downstream.

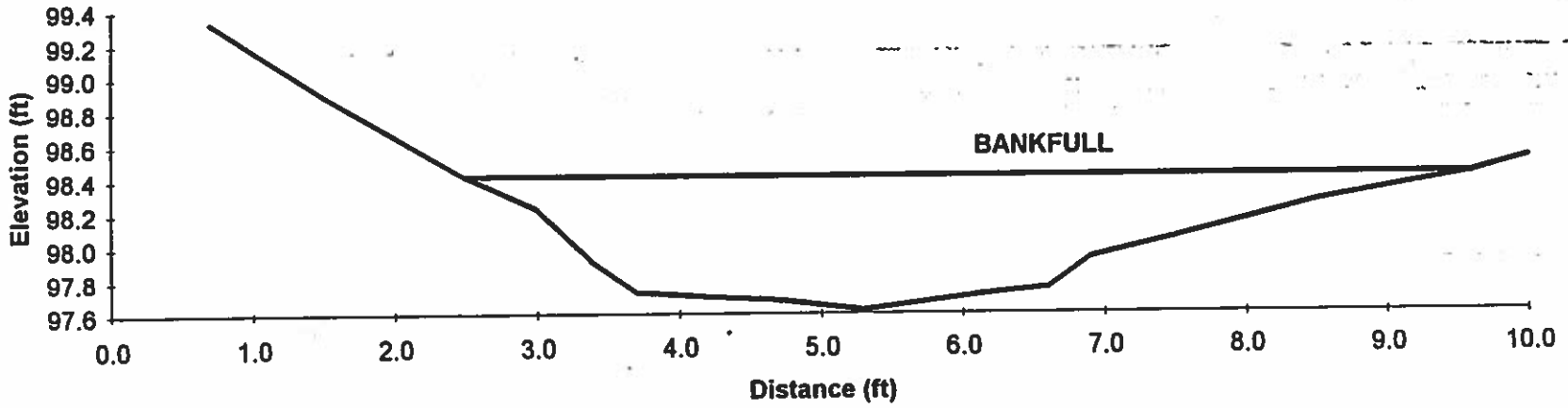
Station (ft)	Width (ft)	Depth (ft)	Area (Ft2)	Velocity (ft/sec)	Discharge (cfs)
0 + 3.3	0.15	0.00	0.00	0.0	0.00
0 + 3.6	0.30	0.20	0.06	0.3	0.02
0 + 3.9	0.35	0.20	0.07	0.3	0.02
0 + 4.3	0.35	0.20	0.07	0.4	0.03
0 + 4.6	0.30	0.30	0.09	0.3	0.03
0 + 4.9	0.30	0.35	0.11	0.6	0.06
0 + 5.2	0.30	0.30	0.09	0.4	0.04
0 + 5.5	0.30	0.30	0.09	1.1	0.10
0 + 5.8	0.30	0.20	0.06	0.8	0.05
0 + 6.1	0.35	0.20	0.07	0.5	0.04
0 + 6.5	0.25	0.15	0.04	0.8	0.03
0 + 6.8	0.05	0.00	0.00	0.0	0.00
3.3	3.30		0.74		0.41

Total Dicharge (cfs)	0.41
Total Area (ft2)	0.74
Width (ft)	3.30
Average Depth (ft)	0.23
Average Velocity (ft/sec)	0.55

Bankfull Width (ft)	Cross-Sectional Area (Sq.ft)	Mean Depth (ft)	Maximum Depth (ft)	Wetted Perimeter (ft)	Hydraulic Radius (ft)
7.10	3.28	0.46	0.80	7.40	0.44

STREAM NAME: BONNETT CREEK
ID NUMBER: 93C
DATE JULY 15, 1992
CREW: LEWIN AND MURPHY

Identifier	Distance (ft)	Elevation (ft)	Identifier	Distance (ft)	Elevation (ft)
BEGIN	0.7	99.33	END	10.0	98.51
	1.5	98.90			
LBF	2.5	98.42			
	3.0	98.23			
	3.4	97.91			
	3.7	97.73			
	4.2	97.70			
	4.7	97.68			
	5.3	97.62			
	6.2	97.72			
	6.6	97.75			
	6.9	97.93			
	7.5	98.05			
	8.5	98.26			
RBF	9.6	98.42			



ARKANSAS2 FILENAME: X_93C.XLS ENTERED: 9/29/92 mm

STA	BS	HI	FS	Elev	Description
BM	4^{34}				
		104^{34}			
0+07			5^{01}	99.33	L Pin
0+15			5^{44}	98.90	
$0+2^{5}$			5^{92}	98.42	LBF
$0+3^{0}$			6^{11}	98.23	
$0+3^{4}$			6^{43}	97.91	LEW
$0+3^{7}$			6^{61}	97.73	
$0+4^{2}$			6^{64}	97.70	
$0+4^{7}$			6^{66}	97.68	
$0+5^{3}$			6^{72}	97.62	
$0+6^{2}$			6^{62}	97.72	
$0+6^{6}$			6^{57}	97.75	
$0+6^{9}$			6^{41}	97.93	REW
$0+7^{5}$			6^{29}	98.05	
$0+8^{5}$			6^{08}	98.26	
$0+9^{6}$			5^{92}	98.42	RBF
$0+10^{0}$			5^{83}	98.51	R PIN
BM			4^{34}	100.00	

$Width_{BF} = 9.6 - 2.5 = 7.10$

ARKANSAS2 B:\93C\X93C.XLS

Bonnett Creek 7-15-92 93C

T 30S. R69W sec. 33 NESE

location approx. 1 mile from highway. right at F.S. boundary fence line, off of dirt road approx. 40'

Conditions warm, sunny, some clouds. Water is clear.

BM is 100' from R Pin & 6'.

Murphy / Lewis

T [illegible] ϕ

picture # 11 up stream

12 down stream

Confinement

5.92 bankfull

6.72 compared depth

.80 x 2

1.60

4.32 - bankfull

reducing to distance

18.5' distance

Ratio = 18.5' ÷ 7.1 = 2.61

slope surface	bottom	distance	location
5.73	6.46	21'	upstream
7.96	8.94	19'	downstream

H2O Surface 7.96 - 5.73 = 2.23 ÷ 40 = .0558

Bed Slope 8.94 - 6.46 = 2.48 ÷ 40 = .0620

spin test

start 86 time 9.1M

stop 94 time 9.45M

STA	Width	Depth	Area	Velocity	Q
0+03^3	.15	0	0	0	0
0+03^6	.3	.2	.06	.3	.02
0+03^9	.35	.2	.07	.3	.02
0+04^3	.35	.2	.07	.4	.03
0+46	.3	.3	.09	.3	.031
0+4^9	.3	.35	.11	.6	.06
0+5^3	.3	.3	.09	.4	.04
0+5^5	.3	.3	.09	1.1	.10
0+5^8	.3	.2	.06	.8	.05
0+6^1	.35	.2	.07	.5	.04
0+6^3	.2	.15	.03	.8	.02
0+6^6	.05	0	0	0	0
					.41

Bonnett Creek 7-15-92 93C 19

Pebble Count

1	2	3	4	5	6	7	8	9	10

Size Range mm - mm	Count	total	% Total	CUM
.0035 - .062		0	0	0
.062 - .125		0	0	0
.125 - .5	☐	8	8	0
.5 - 1		0	0	8
1 - 2	::	5	5	8
2 - 4	::	4	4	13
4 - 8	[:	5	5	17
8 - 16	☐	8	8	22
16 - 32	⊠ :	13	13	30
32 - 64	☐	7	7	43
64 - 128	⊠ ⊓	17	17	50
128 - 256	⊠ ⊠	19	19	67
256 - 512	⊠ ::	14	14	86
512 - 1024		0	0	0
1024 - 2048		0	0	0
2048 - 4096		0	0	0
	Total	100	100	100

[illegible] 31\93C\P93C.WKS

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Bonnett Creek, 93C
XS LOCATION:	1 Mile u/s of USFS Boundary
XS NUMBER:	1
DATE:	15-Jul-92
OBSERVERS:	Lewin, Murphy
1/4 SEC:	SE
SECTION:	33
TWP:	30 S
RANGE:	69 W
PM:	6
COUNTY:	HUERFANO
WATERSHED:	CUCHARAS RIVER
DIVISION:	2
DOW CODE:	29202
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

CHANNEL PROFILE DATA

SLOPE: 0.05575

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: .....DATE.....

STREAM NAME: Bonnett Creek, 93C
XS LOCATION: 1 Mile u/s of USFS Boundary
XS NUMBER: 1

DATA POINTS= 20

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	S	0.70	5.01			0.00		0.00	0.00	0.0%
		1.50	5.44			0.00		0.00	0.00	0.0%
1	G	2.50	5.92			0.00		0.00	0.00	0.0%
		3.00	6.11			0.00		0.00	0.00	0.0%
	W	3.40	6.43	0.00	0.00	0.00		0.00	0.00	0.0%
		3.60	6.63	0.20	0.30	0.28	0.20	0.05	0.02	3.6%
		3.90	6.63	0.20	0.30	0.30	0.20	0.07	0.02	5.0%
		4.30	6.64	0.20	0.40	0.40	0.20	0.07	0.03	6.7%
		4.60	6.73	0.30	0.30	0.31	0.30	0.09	0.03	6.4%
		4.90	6.78	0.35	0.60	0.30	0.35	0.11	0.06	15.0%
		5.20	6.74	0.30	0.40	0.30	0.30	0.09	0.04	8.6%
		5.50	6.73	0.30	1.10	0.30	0.30	0.09	0.10	23.6%
		5.80	6.63	0.20	0.80	0.32	0.20	0.06	0.05	11.4%
		6.10	6.63	0.20	0.50	0.30	0.20	0.07	0.04	8.3%
		6.50	6.59	0.15	0.80	0.40	0.15	0.06	0.05	11.4%
	W	6.90	6.41	0.00	0.00	0.44		0.00	0.00	0.0%
		7.50	6.29			0.00		0.00	0.00	0.0%
		8.50	6.08			0.00		0.00	0.00	0.0%
1	G	9.60	5.92			0.00		0.00	0.00	0.0%
	S	10.00	5.83			0.00		0.00	0.00	0.0%
	TOTALS ----------					3.66	0.35 (Max.)	0.76	0.42	100.0%

Manning's n = 0.2202
Hydraulic Radius= 0.20628451

STREAM NAME: Bonnett Creek, 93C
XS LOCATION: 1 Mile u/s of USFS Boundary
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.76	0.80	5.5%
6.17	0.76	1.86	145.8%
6.19	0.76	1.76	132.8%
6.21	0.76	1.66	120.0%
6.23	0.76	1.57	107.6%
6.25	0.76	1.48	95.4%
6.27	0.76	1.39	83.6%
6.29	0.76	1.30	72.2%
6.31	0.76	1.22	61.0%
6.33	0.76	1.13	50.2%
6.35	0.76	1.05	39.7%
6.37	0.76	0.98	29.5%
6.38	0.76	0.94	24.5%
6.39	0.76	0.90	19.7%
6.40	0.76	0.87	14.9%
6.41	0.76	0.83	10.2%
6.42	0.76	0.80	5.5%
6.43	0.76	0.76	0.9%
6.44	0.76	0.73	-3.6%
6.45	0.76	0.69	-8.1%
6.46	0.76	0.66	-12.6%
6.47	0.76	0.63	-17.0%
6.49	0.76	0.56	-25.8%
6.51	0.76	0.50	-34.3%
6.53	0.76	0.43	-42.7%
6.55	0.76	0.37	-50.9%
6.57	0.76	0.31	-59.0%
6.59	0.76	0.25	-66.8%
6.61	0.76	0.19	-74.3%
6.63	0.76	0.14	-81.3%
6.65	0.76	0.11	-85.4%
6.67	0.76	0.08	-89.0%

WATERLINE AT ZERO
AREA ERROR = 6.432

STREAM NAME: Bonnett Creek, 93C
XS LOCATION: 1 Mile u/s of USFS Boundary
XS NUMBER: 1

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

STAGING TABLE

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.92	7.10	0.47	0.86	3.35	7.45	100.0%	0.45	3.12	0.93
	5.93	6.99	0.47	0.85	3.26	7.34	98.4%	0.44	3.03	0.93
	5.98	6.51	0.45	0.80	2.92	6.85	91.9%	0.43	2.64	0.90
	6.03	6.04	0.43	0.75	2.61	6.36	85.3%	0.41	2.30	0.88
	6.08	5.56	0.42	0.70	2.32	5.87	78.8%	0.39	1.99	0.86
	6.13	5.22	0.39	0.65	2.05	5.52	74.0%	0.37	1.69	0.82
	6.18	4.92	0.36	0.60	1.80	5.19	69.7%	0.35	1.41	0.79
	6.23	4.62	0.34	0.55	1.56	4.87	65.4%	0.32	1.16	0.75
	6.28	4.32	0.31	0.50	1.33	4.55	61.0%	0.29	0.94	0.70
	6.33	4.01	0.28	0.45	1.13	4.21	56.6%	0.27	0.74	0.66
	6.38	3.70	0.25	0.40	0.93	3.88	52.1%	0.24	0.57	0.62
WL	6.43	3.45	0.22	0.35	0.75	3.60	48.4%	0.21	0.42	0.56
	6.48	3.29	0.18	0.30	0.59	3.41	45.8%	0.17	0.29	0.49
	6.53	3.13	0.14	0.25	0.43	3.22	43.2%	0.13	0.18	0.41
	6.58	2.97	0.09	0.20	0.27	3.03	40.6%	0.09	0.09	0.32
	6.63	1.81	0.08	0.15	0.14	1.85	24.8%	0.07	0.04	0.28
	6.68	1.20	0.06	0.10	0.07	1.23	16.4%	0.06	0.02	0.23
	6.73	0.83	0.02	0.05	0.02	0.83	11.2%	0.02	0.00	0.12

3/3 = ?
2/3 = 0.5

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO WATER CONSERVATION BOARD

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Bonnett ~~Upstream~~ Down stream of highway	CROSS-SECTION NO.:
CROSS-SECTION LOCATION: 60' East of highway 12; On ranch private property	
DATE: 6/16/16	OBSERVERS: Jay Skinner + Cody Tyler

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

COUNTY:	WATERSHED:	WATER DIVISION:	DOW WATER CODE:
Huerfano	Cucharas River	2	29202

MAP(S):	
USGS:	Lat = 37.384699 ; Long. = 105.095095
USFS:	

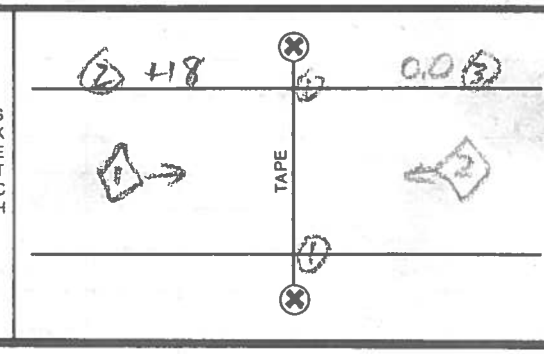
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) / NO	METER TYPE: Marsh McB
METER NUMBER: N/A	DATE RATED: —
CALIB/SPIN: ✓ sec	TAPE WEIGHT: — lbs/foot
TAPE TENSION: — lbs	CHANNEL BED MATERIAL SIZE RANGE:
PHOTOGRAPHS TAKEN: (YES) / NO	NUMBER OF PHOTOGRAPHS: 3

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	—
⊗ Tape @ Stake RB	0.0	—
① WS @ Tape LB/RB	0.0	11.34/11.36
② WS Upstream	~~18~~ 7.8	10.71
③ WS Downstream	7.8	11.68
SLOPE	.97 / 18 = 0.054	

SKETCH



LEGEND: Stake ⊗; Station ①; Photo ◇→; 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:

COMMENTS

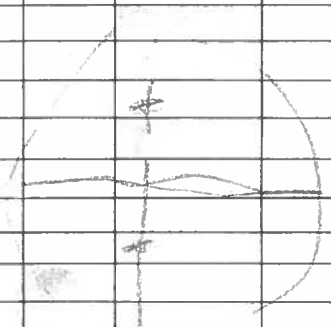
Clear water ; Warm + Clear Weather ; No recent precip

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE: 6/16/16	SHEET 1 OF 1

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)	LEFT / RIGHT	Gage Reading: _____ ft	TIME: 1630

Features (Stake (S) Grassline (G) Waterline (W) Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S BF	0		10.75								
	0.15		11.05								
WL	0.2		11.34	0							
	.5		11.55	0.2					.18		
	.8		11.60	0.25					.91		
	1.1		11.65	0.25					.55		
	.4		11.60	0.25					1.12		
	.7		11.70	0.30					1.28		
	2		11.60	0.30					1.06		
	2.3		11.60	0.25					1.25		
	.6		11.55	0.25					1.85		
	.9		11.60	0.25					2.14		
	3.2		11.55	0.15					2.34		
	.5		11.55	0.10					1.02		
	.8		11.55	0.15					1.78		
	4.1		11.50	0.10					0.71		
	.4		11.50	0.10					1.09		
	.7		11.55	0.10					0.84		
	5		11.55	0.10					0.58		
WL	5		11.36	0							
	5.3		11.15								
BF	.4		10.75								
S	9.8		10.60								
TOTALS:											



End of Measurement	Time: 1657	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

Data Input & Proofing

STREAM NAME:	Bonnett Creek
XS LOCATION:	60' East of highway downstream
XS NUMBER:	Lat.= 37.384699 ; Long.= 105.095095
DATE:	6/16/2016
OBSERVERS:	Cody Tyler and Jay Skinner (CPW)
1/4 SEC:	
SECTION:	
TWP:	
RANGE:	
PM:	
COUNTY:	Huerfano
WATERSHED:	Cucharas
DIVISION:	2
DOW CODE:	29202
USGS MAP:	
USFS MAP:	Pike- San Isabel
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.054 ft / ft

CHECKED BY:.....DATE.....

ASSIGNED TO: .....DATE.....

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
			Total Data Points = 23					
1	GL	0.00	10.75			0.00	0.00	0.00
		0.15	11.05			0.00	0.00	0.00
	WL	0.20	11.34	0.00	0.00	0.00	0.00	0.00
		0.50	11.55	0.20	0.18	0.06	0.01	11.35
		0.80	11.60	0.25	0.91	0.08	0.07	11.35
		1.10	11.65	0.25	0.55	0.08	0.04	11.40
		1.40	11.60	0.25	1.12	0.08	0.08	11.35
		1.70	11.70	0.30	1.28	0.09	0.12	11.40
		2.00	11.60	0.30	1.06	0.09	0.10	11.30
		2.30	11.60	0.25	1.25	0.08	0.09	11.35
		2.60	11.55	0.25	1.85	0.08	0.14	11.30
		2.90	11.60	0.25	2.14	0.08	0.16	11.35
		3.20	11.55	0.15	2.34	0.05	0.11	11.40
		3.50	11.55	0.10	1.02	0.03	0.03	11.45
		3.80	11.55	0.15	1.78	0.05	0.08	11.40
		4.10	11.50	0.10	0.71	0.03	0.02	11.40
		4.40	11.50	0.10	1.09	0.03	0.03	11.40
		4.70	11.55	0.10	0.84	0.03	0.03	11.45
		5.00	11.55	0.10	0.58	0.02	0.01	11.45
	WL	5.00	11.36	0.00	0.00	0.00	0.00	0.00
		5.30	11.15			0.00	0.00	0.00
1	GL	8.40	10.75			0.00	0.00	0.00
	S	9.80	10.60			0.00	0.00	0.00
	Totals					0.92	1.11	

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Bonnett Creek
XS LOCATION:	60" East of highway downstream
XS NUMBER:	Lat.= 37.384699 ; Long.= 105.095095
DATE:	16-Jun-16
OBSERVERS:	Cody Tyler and Jay Skinner
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	Huerfano
WATERSHED:	Cucharas
DIVISION:	2
DOW CODE:	29202
USGS MAP:	0
USFS MAP:	Pike- San Isabel

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.054

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: .....DATE.....

STREAM NAME: Bonnett Creek
XS LOCATION: 60" East of highway downstream
XS NUMBER: Lat.= 37.384699 ; Long.= 105.095095

DATA POINTS= 23

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	GL	0.00	10.75			0.00		0.00	0.00	0.0%
		0.15	11.05			0.00		0.00	0.00	0.0%
	WL	0.20	11.34	0.00	0.00	0.00		0.00	0.00	0.0%
		0.50	11.55	0.20	0.18	0.37	0.20	0.06	0.01	1.0%
		0.80	11.60	0.25	0.91	0.30	0.25	0.08	0.07	6.1%
		1.10	11.65	0.25	0.55	0.30	0.25	0.08	0.04	3.7%
		1.40	11.60	0.25	1.12	0.30	0.25	0.08	0.08	7.6%
		1.70	11.70	0.30	1.28	0.32	0.30	0.09	0.12	10.4%
		2.00	11.60	0.30	1.06	0.32	0.30	0.09	0.10	8.6%
		2.30	11.60	0.25	1.25	0.30	0.25	0.08	0.09	8.4%
		2.60	11.55	0.25	1.85	0.30	0.25	0.08	0.14	12.5%
		2.90	11.60	0.25	2.14	0.30	0.25	0.08	0.16	14.4%
		3.20	11.55	0.15	2.34	0.30	0.15	0.05	0.11	9.5%
		3.50	11.55	0.10	1.02	0.30	0.10	0.03	0.03	2.8%
		3.80	11.55	0.15	1.78	0.30	0.15	0.05	0.08	7.2%
		4.10	11.50	0.10	0.71	0.30	0.10	0.03	0.02	1.9%
		4.40	11.50	0.10	1.09	0.30	0.10	0.03	0.03	2.9%
		4.70	11.55	0.10	0.84	0.30	0.10	0.03	0.03	2.3%
		5.00	11.55	0.10	0.58	0.30	0.10	0.02	0.01	0.8%
	WL	5.00	11.36	0.00	0.00	0.19		0.00	0.00	0.0%
		5.30	11.15			0.00		0.00	0.00	0.0%
1	GL	8.40	10.75			0.00		0.00	0.00	0.0%
	S	9.80	10.60			0.00		0.00	0.00	0.0%
	TOTALS ----------					5.12	0.3 (Max.)	0.92	1.11	100.0%

Manning's n = 0.0901
Hydraulic Radius= 0.17864962

STREAM NAME: Bonnett Creek
XS LOCATION: 60" East of highway downstream
XS NUMBER: Lat.= 37.384699 ; Long.= 105.095095

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.92	1.05	14.6%
11.10	0.92	2.31	152.4%
11.12	0.92	2.20	140.5%
11.14	0.92	2.09	128.9%
11.16	0.92	1.99	117.7%
11.18	0.92	1.89	106.5%
11.20	0.92	1.79	95.5%
11.22	0.92	1.69	84.5%
11.24	0.92	1.59	73.5%
11.26	0.92	1.49	62.6%
11.28	0.92	1.39	51.8%
11.30	0.92	1.29	41.1%
11.31	0.92	1.24	35.8%
11.32	0.92	1.19	30.5%
11.33	0.92	1.15	25.2%
11.34	0.92	1.10	19.9%
11.35	0.92	1.05	14.6%
11.36	0.92	1.00	9.4%
11.37	0.92	0.95	4.2%
11.38	0.92	0.91	-1.0%
11.39	0.92	0.86	-6.2%
11.40	0.92	0.81	-11.4%
11.42	0.92	0.72	-21.6%
11.44	0.92	0.62	-31.8%
11.46	0.92	0.53	-42.0%
11.48	0.92	0.44	-52.1%
11.50	0.92	0.35	-62.1%
11.52	0.92	0.26	-71.1%
11.54	0.92	0.19	-79.6%
11.56	0.92	0.12	-86.4%
11.58	0.92	0.08	-91.3%
11.60	0.92	0.04	-95.1%

WATERLINE AT ZERO
AREA ERROR = 11.378

STREAM NAME: Bonnett Creek
XS LOCATION: 30" west of highway 12
XS NUMBER: Lat.= 37.385091, Long.= 105.096198 Constant Manning's n

STAGING TABLE
GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	9.70	4.16	1.36	1.90	5.67	6.97	100.0%	0.81	15.93	2.81
	10.06	3.79	1.12	1.54	4.23	6.15	88.2%	0.69	10.64	2.52
	10.11	3.73	1.08	1.49	4.04	6.04	86.6%	0.67	9.99	2.47
	10.16	3.69	1.05	1.44	3.86	5.93	85.0%	0.65	9.35	2.42
	10.21	3.65	1.01	1.39	3.67	5.82	83.5%	0.63	8.73	2.38
	10.26	3.61	0.97	1.34	3.49	5.72	82.0%	0.61	8.12	2.32
	10.31	3.58	0.93	1.29	3.31	5.61	80.4%	0.59	7.53	2.27
	10.36	3.54	0.88	1.24	3.14	5.50	78.9%	0.57	6.96	2.22
	10.41	3.51	0.84	1.19	2.96	5.40	77.4%	0.55	6.40	2.16
	10.46	3.49	0.80	1.14	2.78	5.29	75.9%	0.53	5.86	2.10
	10.51	3.46	0.75	1.09	2.61	5.19	74.4%	0.50	5.33	2.04
	10.56	3.44	0.71	1.04	2.44	5.09	73.0%	0.48	4.82	1.98
	10.61	3.41	0.66	0.99	2.27	4.99	71.5%	0.45	4.33	1.91
	10.66	3.39	0.62	0.94	2.10	4.88	70.0%	0.43	3.85	1.84
	10.71	3.36	0.57	0.89	1.93	4.78	68.5%	0.40	3.40	1.76
	10.76	3.34	0.53	0.84	1.76	4.68	67.0%	0.38	2.96	1.68
	10.81	3.32	0.48	0.79	1.59	4.57	65.6%	0.35	2.55	1.60
	10.86	3.29	0.43	0.74	1.43	4.47	64.1%	0.32	2.16	1.51
	10.91	3.27	0.39	0.69	1.26	4.37	62.6%	0.29	1.79	1.41
	10.96	3.24	0.34	0.64	1.10	4.26	61.1%	0.26	1.44	1.31
	11.01	3.22	0.29	0.59	0.94	4.16	59.6%	0.23	1.13	1.20
WL	11.06	3.20	0.24	0.54	0.78	4.06	58.2%	0.19	0.84	1.08
	11.11	3.17	0.20	0.49	0.62	3.94	56.6%	0.16	0.58	0.94
	11.16	2.99	0.15	0.44	0.46	3.70	53.0%	0.13	0.38	0.81
	11.21	2.39	0.14	0.39	0.33	3.01	43.1%	0.11	0.24	0.74
	11.26	1.63	0.14	0.34	0.23	2.16	31.0%	0.10	0.16	0.72
	11.31	1.30	0.12	0.29	0.15	1.74	25.0%	0.09	0.10	0.64
	11.36	1.01	0.09	0.24	0.09	1.36	19.5%	0.07	0.05	0.55
	11.41	0.73	0.07	0.19	0.05	0.98	14.0%	0.05	0.02	0.45
	11.46	0.43	0.05	0.14	0.02	0.60	8.6%	0.04	0.01	0.36
	11.51	0.18	0.04	0.09	0.01	0.29	4.1%	0.03	0.00	0.29
	11.56	0.08	0.02	0.04	0.00	0.13	1.8%	0.01	0.00	0.17

$2/3 = 0.58$ cfs
$3/3 = 0.70$ cfs

$\frac{1.08}{0.84} = \frac{1.00}{x}$ $\frac{0.94}{0.58} = \frac{1.00}{x}$

$\frac{1.08x}{1.08} = \frac{0.84}{1.08}$ $.94x = .58$

$x = 0.78$ $x = .58/.94$

$x = 0.62$

$\bar{x} = 0.70$ 0.67

STREAM NAME: Bonnett Creek
XS LOCATION: 30" west of highway 12
XS NUMBER: Lat.= 37.385091, Long.= 105.096198

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.84	cfs
CALCULATED FLOW (Qc)=	0.84	cfs
(Qm-Qc)/Qm * 100 =	-0.2	%
MEASURED WATERLINE (WLm)=	11.06	ft
CALCULATED WATERLINE (WLc)=	11.06	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.54	ft
(Dm-Dc)/Dm * 100	2.0	%
MEAN VELOCITY=	1.08	ft/sec
MANNING'S N=	0.021	
SLOPE=	0.002	ft/ft
.4 * Qm =	0.3	cfs
2.5 * Qm=	2.1	cfs

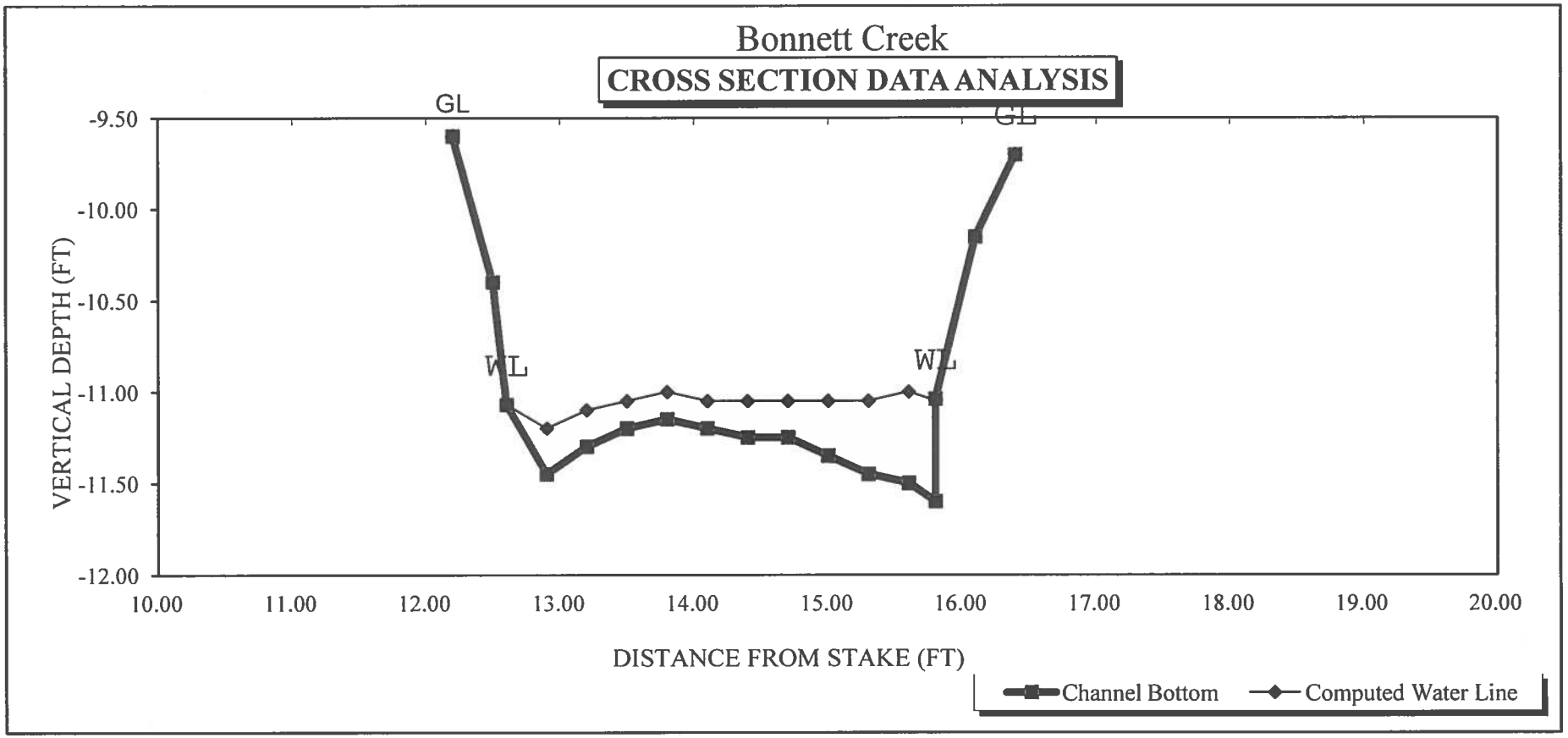
RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

RECOMMENDATION BY: ..... AGENCY..... DATE:.....

CWCB REVIEW BY: ..... DATE:.....


Bonnett Creek
CROSS SECTION DATA ANALYSIS
GL
GL
WL
WL
-9.50
-10.00
-10.50
-11.00
-11.50
-12.00
VERTICAL DEPTH (FT)
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
20.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Bonnett ~~[illegible]~~ stream of highway					CROSS-SECTION NO.:
CROSS-SECTION LOCATION: UP 30' west of Highway 12 upstream					
DATE: 6/16/16	OBSERVERS: Cody Tyler & Jay Skinner				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: Huerfano	WATERSHED: Kucharas River		WATER DIVISION: 2		DOW WATER CODE: 29202
MAP(S): USGS: Lat. = 37.385091 ; Long. = 105.096198					
USFS:					

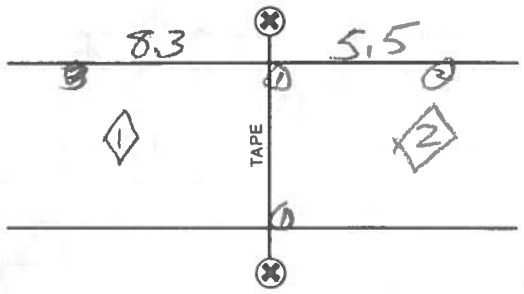
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: Marsh McB			
METER NUMBER: N/A	DATE RATED: —	CALIB/SPIN: ✓ sec	TAPE WEIGHT: — lbs/foot	TAPE TENSION: — lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	—
⊗ Tape @ Stake RB	0.0	—
① WS @ Tape LB/RB	0.0	11.07 / 11.04
② WS Upstream	5.5	11.06
③ WS Downstream	8.3	11.09
SLOPE	0.03/13.8 = 0.002	

SKETCH



AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: ____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

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

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

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

COMMENTS

Clear water. Warm & clear weather
No recent precip.

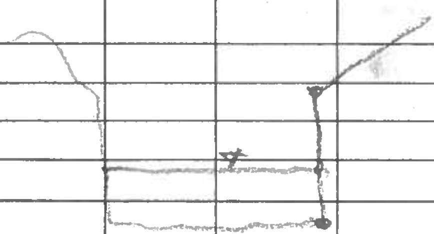
FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ______ ft	TIME: 1545

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 (ft²)	Discharge (cfs)
S BF	12.2		9.60								
	12.5		10.40								
WL	12.6		11.07	0							
	12.9		11.45	0.25					1.50		
	13.2		11.30	.2					1.17		
	.5		11.20	.15					.95		
	.8		11.15	.15					.95		
	14.1		11.20	.15					.98		
	.4		11.25	.2					1.09		
	.7		11.25	.2					1.12		
	15		11.35	.3					1.13		
	.3		11.45	.4					1.13		
	.6		11.50	.5					0.91		
WL	15.8 [illegible]		11.60	.55					0.75		
WL	15.8		11.04	0							
	16.1		10.15								
S BF	16.4		9.70								
TOTALS:											



End of Measurement	Time: 1607	Gage Reading: ______ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

Data Input & Proofing

STREAM NAME:	Bonnett Creek
XS LOCATION:	30' west of highway 12
XS NUMBER:	Lat.= 37.385091, Long.= 105.096198
DATE:	6/16/2016
OBSERVERS:	Cody Tyler and Jay Skinner (CPW)
1/4 SEC:	
SECTION:	
TWP:	
RANGE:	
PM:	
COUNTY:	Huerfano
WATERSHED:	Cucharas
DIVISION:	2
DOW CODE:	29202
USGS MAP:	
USFS MAP:	Pike- San Isabel
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.002 ft / ft

CHECKED BY:.....DATE.....

ASSIGNED TO: .....DATE.....

Total Data Points = 17

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
1	GL	12.20	9.60			0.00	0.00	0.00
		12.50	10.40			0.00	0.00	0.00
	WL	12.60	11.07	0.00	0.00	0.00	0.00	0.00
		12.90	11.45	0.25	1.50	0.08	0.11	11.20
		13.20	11.30	0.20	1.17	0.06	0.07	11.10
		13.50	11.20	0.15	0.95	0.05	0.04	11.05
		13.80	11.15	0.15	0.95	0.05	0.04	11.00
		14.10	11.20	0.15	0.98	0.05	0.04	11.05
		14.40	11.25	0.20	1.09	0.06	0.07	11.05
		14.70	11.25	0.20	1.12	0.06	0.07	11.05
		15.00	11.35	0.30	1.13	0.09	0.10	11.05
		15.30	11.45	0.40	1.13	0.12	0.14	11.05
		15.60	11.50	0.50	0.91	0.13	0.11	11.00
		15.80	11.60	0.55	0.75	0.06	0.04	11.05
	WL	15.80	11.04	0.00	0.00	0.00	0.00	0.00
		16.10	10.15			0.00	0.00	0.00
1	GL	16.40	9.70			0.00	0.00	0.00

Totals	0.78	0.84

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Bonnett Creek
XS LOCATION:	30" west of highway 12
XS NUMBER:	Lat.= 37.385091, Long.= 105.096198
DATE:	16-Jun-16
OBSERVERS:	Cody Tyler and Jay Skinner
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	Huerfano
WATERSHED:	Cucharas
DIVISION:	2
DOW CODE:	29202
USGS MAP:	0
USFS MAP:	Pike- San Isabel

SUPPLEMENTAL DATA

		*** NOTE *** Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod
TAPE WT:	0.0106	
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.002

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: .....DATE.....

STREAM NAME: Bonnett Creek
XS LOCATION: 30" west of highway 12
XS NUMBER: Lat.= 37.385091, Long.= 105.096198

DATA POINTS= 17

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 GL	12.20	9.60			0.00		0.00	0.00	0.0%
	12.50	10.40			0.00		0.00	0.00	0.0%
WL	12.60	11.07	0.00	0.00	0.00		0.00	0.00	0.0%
	12.90	11.45	0.25	1.50	0.48	0.25	0.08	0.11	13.4%
	13.20	11.30	0.20	1.17	0.34	0.20	0.06	0.07	8.4%
	13.50	11.20	0.15	0.95	0.32	0.15	0.05	0.04	5.1%
	13.80	11.15	0.15	0.95	0.30	0.15	0.05	0.04	5.1%
	14.10	11.20	0.15	0.98	0.30	0.15	0.05	0.04	5.3%
	14.40	11.25	0.20	1.09	0.30	0.20	0.06	0.07	7.8%
	14.70	11.25	0.20	1.12	0.30	0.20	0.06	0.07	8.0%
	15.00	11.35	0.30	1.13	0.32	0.30	0.09	0.10	12.1%
	15.30	11.45	0.40	1.13	0.32	0.40	0.12	0.14	16.2%
	15.60	11.50	0.50	0.91	0.30	0.50	0.13	0.11	13.6%
	15.80	11.60	0.55	0.75	0.22	0.55	0.06	0.04	4.9%
WL	15.80	11.04	0.00	0.00	0.56		0.00	0.00	0.0%
	16.10	10.15			0.00		0.00	0.00	0.0%
1 GL	16.40	9.70			0.00		0.00	0.00	0.0%
TOTALS ----------					4.07	0.55 (Max.)	0.78	0.84	100.0%

Manning's n = 0.0206
Hydraulic Radius= 0.19172149

STREAM NAME: Bonnett Creek
XS LOCATION: 30" west of highway 12
XS NUMBER: Lat.= 37.385091, Long.= 105.096198

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.78	0.80	2.5%
10.81	0.78	1.61	106.9%
10.83	0.78	1.55	98.4%
10.85	0.78	1.48	90.0%
10.87	0.78	1.42	81.5%
10.89	0.78	1.35	73.1%
10.91	0.78	1.28	64.7%
10.93	0.78	1.22	56.3%
10.95	0.78	1.15	48.0%
10.97	0.78	1.09	39.7%
10.99	0.78	1.02	31.4%
11.01	0.78	0.96	23.1%
11.02	0.78	0.93	19.0%
11.03	0.78	0.90	14.8%
11.04	0.78	0.86	10.7%
11.05	0.78	0.83	6.6%
11.06	0.78	0.80	2.5%
11.07	0.78	0.77	-1.6%
11.08	0.78	0.74	-5.7%
11.09	0.78	0.70	-9.8%
11.10	0.78	0.67	-13.9%
11.11	0.78	0.64	-18.0%
11.13	0.78	0.58	-26.1%
11.15	0.78	0.51	-34.1%
11.17	0.78	0.45	-42.0%
11.19	0.78	0.40	-49.2%
11.21	0.78	0.34	-55.8%
11.23	0.78	0.30	-61.8%
11.25	0.78	0.25	-67.3%
11.27	0.78	0.22	-71.8%
11.29	0.78	0.19	-75.8%
11.31	0.78	0.16	-79.4%

WATERLINE AT ZERO
AREA ERROR = 11.061

STREAM NAME: Bonnett Creek
XS LOCATION: 60" East of highway downstream
XS NUMBER: Lat.= 37.384699 ; Long.= 105.095095

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	10.75	8.40	0.56	0.95	4.74	9.24	100.0%	0.51	11.65	2.46
	10.78	8.17	0.55	0.92	4.51	8.99	97.3%	0.50	10.92	2.42
	10.83	7.76	0.53	0.87	4.11	8.55	92.5%	0.48	9.68	2.35
	10.88	7.34	0.51	0.82	3.74	8.10	87.6%	0.46	8.55	2.29
	10.93	6.93	0.49	0.77	3.38	7.65	82.8%	0.44	7.51	2.22
	10.98	6.52	0.47	0.72	3.04	7.21	78.0%	0.42	6.56	2.16
	11.03	6.11	0.45	0.67	2.73	6.76	73.1%	0.40	5.71	2.09
	11.08	5.70	0.43	0.62	2.43	6.32	68.3%	0.39	4.93	2.03
	11.13	5.31	0.41	0.57	2.16	5.87	63.6%	0.37	4.24	1.96
	11.18	5.09	0.37	0.52	1.90	5.60	60.6%	0.34	3.54	1.86
	11.23	5.01	0.33	0.47	1.65	5.47	59.1%	0.30	2.84	1.72
	11.28	4.93	0.28	0.42	1.40	5.33	57.6%	0.26	2.20	1.57
	11.33	4.85	0.24	0.37	1.15	5.19	56.1%	0.22	1.62	1.41
WL	11.38	4.75	0.19	0.32	0.91	5.04	54.5%	0.18	1.12	1.23
	11.43	4.67	0.15	0.27	0.68	4.90	53.0%	0.14	0.70	1.03
	11.48	4.60	0.10	0.22	0.45	4.76	51.5%	0.09	0.35	0.79
	11.53	3.90	0.06	0.17	0.23	3.98	43.1%	0.06	0.13	0.58
	11.58	2.03	0.04	0.12	0.08	2.08	22.5%	0.04	0.04	0.45
	11.63	0.70	0.03	0.07	0.02	0.72	7.8%	0.03	0.01	0.33
	11.68	0.13	0.01	0.02	0.00	0.14	1.5%	0.01	0.00	0.18

0.4

$\frac{1.03}{0.7} = \frac{1.00}{x}$; $\frac{0.79}{0.35} = \frac{1.00}{x}$

$1.03x = 0.7$; $0.79x = 0.35$

$x = 0.68$; $x = 0.44$

$\bar{x} = 0.56$

$2/3 = 0.56$

$\frac{.19}{1.12} = \frac{0.2}{x}$; $\frac{.24}{1.62} = \frac{0.2}{x}$

$.19x = (0.2)1.12$; $0.2(1.62) = .24x$

$\frac{.19}{.19}$; $\frac{}{.24}$

$x = 1.18$; $x = 1.35$

$\bar{x} = 1.27$

$3/3 = 1.27$

STREAM NAME: Bonnett Creek
XS LOCATION: 60" East of highway downstream
XS NUMBER: Lat.= 37.384699 ; Long.= 105.095095

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.11	cfs
CALCULATED FLOW (Qc)=	1.12	cfs
(Qm-Qc)/Qm * 100 =	-1.1	%
MEASURED WATERLINE (WLm)=	11.35	ft
CALCULATED WATERLINE (WLc)=	11.38	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.32	ft
(Dm-Dc)/Dm * 100	-7.3	%
MEAN VELOCITY=	1.23	ft/sec
MANNING'S N=	0.090	
SLOPE=	0.054	ft/ft
.4 * Qm =	0.4	cfs
2.5 * Qm=	2.8	cfs

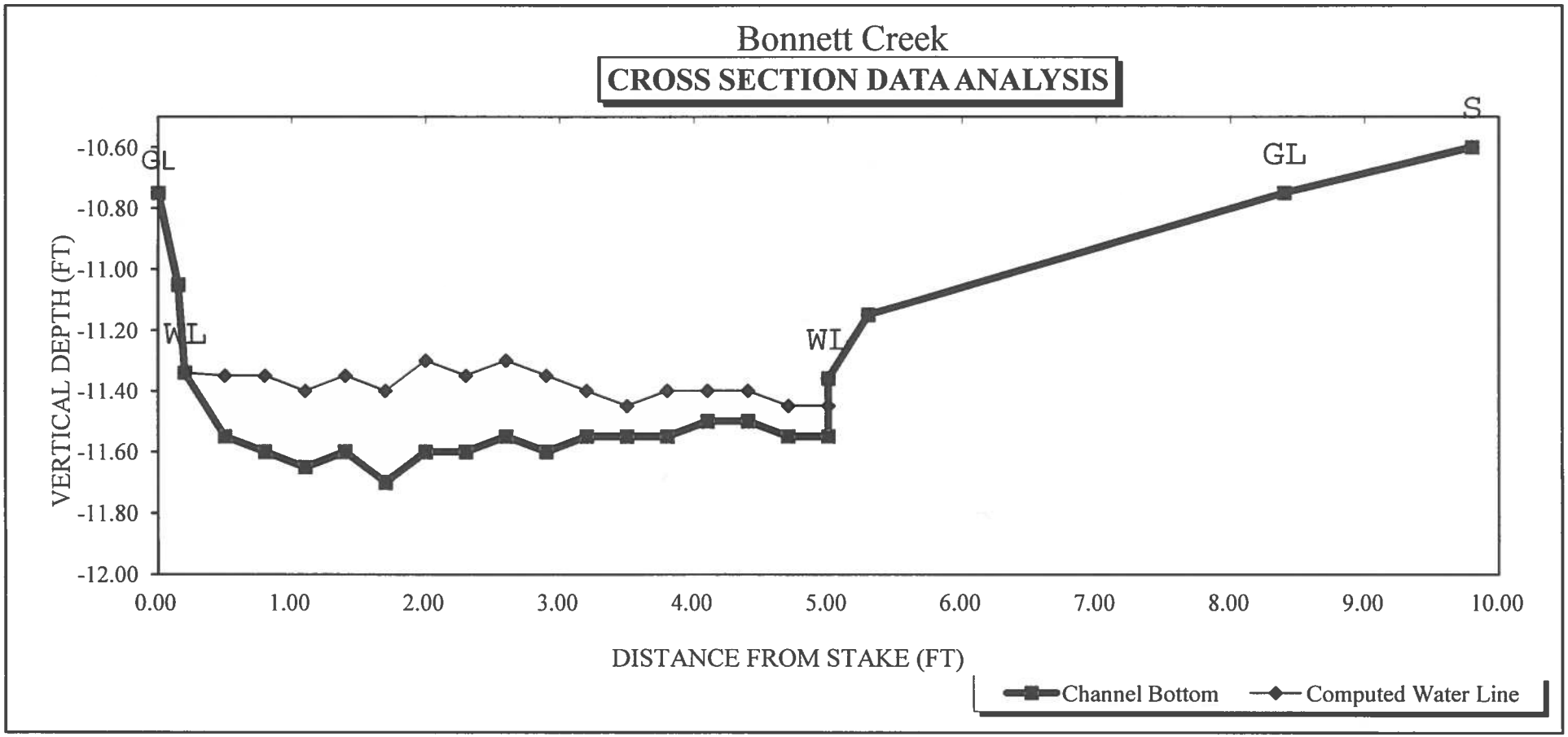
RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

RECOMMENDATION BY: ..... AGENCY..... DATE:.....

CWCB REVIEW BY: ..... DATE:.....


Bonnett Creek
CROSS SECTION DATA ANALYSIS
S
GL
GL
WL
WI
-10.60
-10.80
-11.00
-11.20
-11.40
-11.60
-11.80
-12.00
VERTICAL DEPTH (FT)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line

Abandoned Measurement because rapid change in weather conditions resulted in hypothermia concerns. -Brian Epstein

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information

File Name	20101025_BNT001.WAD
Start Date and Time	2010/10/25 15:43:37

Site Details

Site Name	
Operator(s)	BE

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.7
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	1.1%	0.0%
Velocity	8.3%	24.2%
Width	0.4%	0.4%
Method	5.4%	-
# Stations	32.0%	-
Overall	**33.5%**	**24.2%**

Summary

Averaging Int.	40	# Stations	7
Start Edge	LEW	Total Width	1.550
Mean SNR	38.2 dB	Total Area	0.230
Mean Temp	35.02 °F	Mean Depth	0.148
Disch. Equation	Mid-Section	Mean Velocity	0.1947
		Total Discharge	**0.0448**

Measurement Results

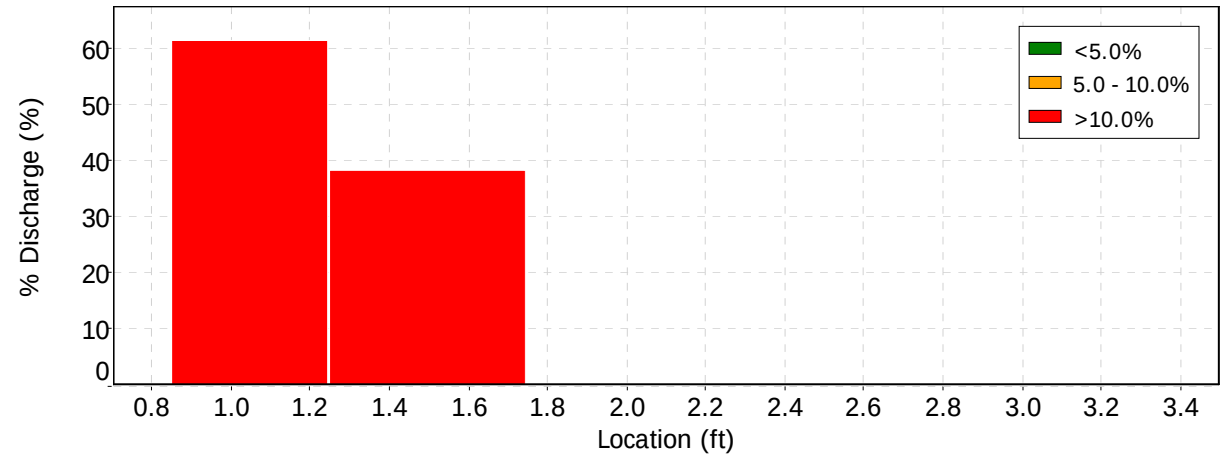
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:43	0.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	15:43	1.00	0.6	0.200	0.6	0.080	0.3445	1.00	0.3445	0.080	0.0276	61.5
2	15:43	1.50	None	0.200	0.0	0.0	0.0000	1.00	0.3445	0.050	0.0172	38.5
3	15:43	2.00	None	0.200	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
4	15:43	2.50	None	0.200	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
5	15:43	3.00	None	0.200	0.0	0.0	0.0000	1.00	0.0000	0.100	0.0000	0.0
6	15:43	3.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

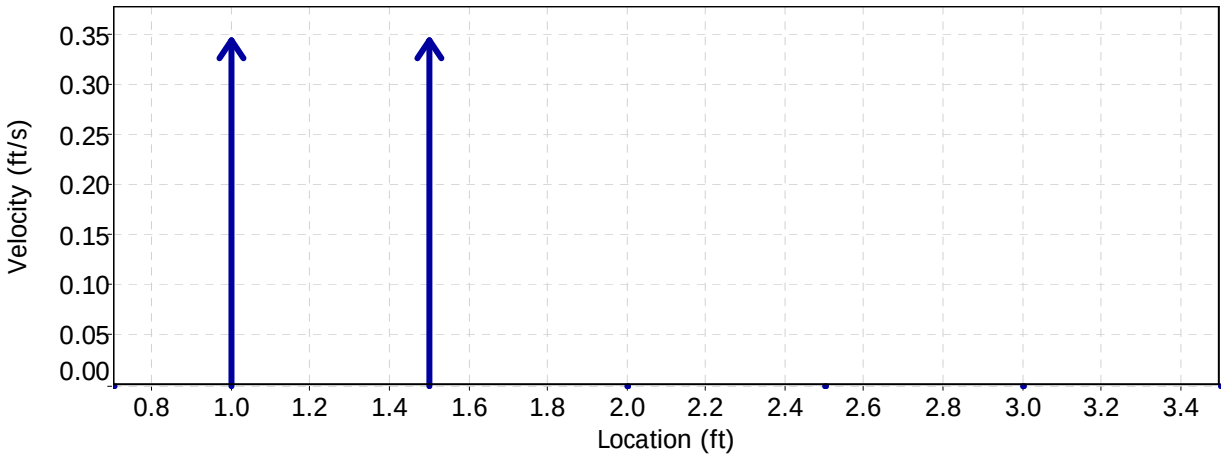
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

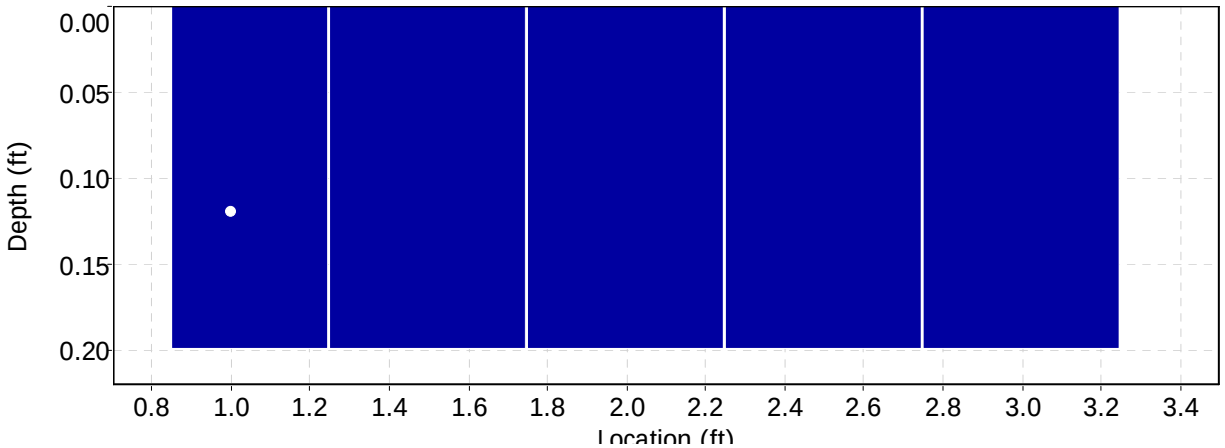
Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20101025_BNT001.WAD	Site Name	
Start Date and Time	2010/10/25 15:43:37	Operator(s)	BE







Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20101025_BNT001.WAD	Site Name	
Start Date and Time	2010/10/25 15:43:37	Operator(s)	BE

Quality Control

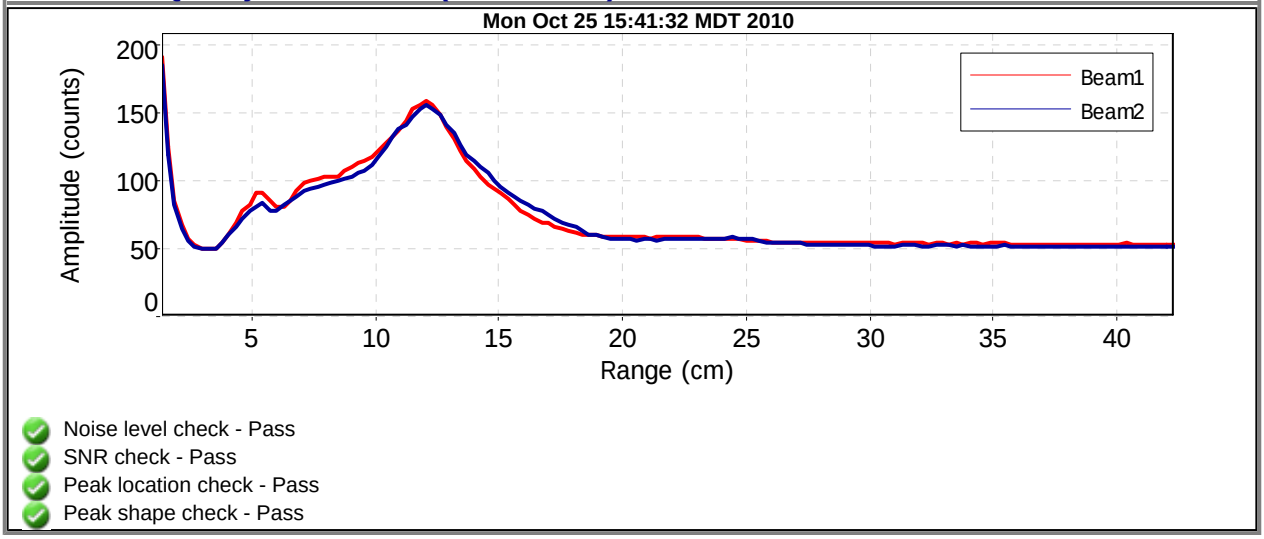
No Quality Control warnings

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20101025_BNT001.WAD	Site Name	
Start Date and Time	2010/10/25 15:43:37	Operator(s)	BE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Station Num.	State of Colorado **Colorado Water Conservation Board** ADV Discharge Measurement Notes	Meas. No.: 002 Comp. By: AJE Checked By:

Station Name: Bonnett

River (Creek, Canal, Ditch

At, Near, (Above) Below: Lower Terminus

Latitude: N 37° 23' 29.68" Longitude: W 105° 6' 11.54" NAD83

Date: 9/8/2011 Party: Brian Epstein

Conditions

Weather: Cloudy 52°F

Wind Spd / Dir: 0 mph 0° Water Temp: 48.6° F

X-Sec Desc: Sandy, Cobbles

Flow Conds: Laminar

Control Desc.:

Measurement Rate: Excelent (2%) / Good (5%) / Fair (8%) / (Poor (>8%)

[based on the above conditions]

Gage Reading

Time	Outside	Inside	Encoder	Recorder	Other
10:22	0.35	Temp Staff			
10:26	0.35				
10:46	0.35				
Weighted MGH					
GH Corr.					
Correct MGH					

LEW 2.5 - REW = W = 1.7'
0.8

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) P2355
Firmware:	3.7	Software:	2.20		
Diag Test File:	YES		Raw Data File:	BONTABLT.002	
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	
	7	(ft) or mi / (upstream) or downstream of gage		Temp Staff	
Start Edge:	REW	Total Width:	1.7'	# Sections:	9
Start Time:	10:23		End Time:	10:45	
Discharge:	0.099	Uncertainty:			
Mean v:	0.307	Width	1.7	Mean d:	0.19
Max v:	0.587	Area:	0.323	Max d:	0.24
Mean SNR:	30.2	cv:	0.011	Mean Temp:	48.4°F

Remarks:

Remarks (continued):

Location (ft)	H_2O Depth (ft)	Comment
0.80	0.00	REW
0.95	0.22	
1.00	0.23	
1.10	0.24	
1.20	0.24	
1.30	0.26	
1.40	0.26	
1.50	0.23	
1.60	0.20	
1.70	0.20	
1.80	0.20	
1.90	0.20	
2.00	0.22	
2.10	0.15	
2.20	0.15	
2.30	0.16	
2.35	0.16	
2.50	0.00	LEW

Picture	Content
715	Bonnett Cr abv LT
716	" " " " Video
717	" " " " X-section
718	" " " " "
719	invertebrate
720	fish

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information

File Name	20110908_BONTABLT002.WAD
Start Date and Time	2011/09/08 10:28:36

Site Details

Site Name	BONNETT ABV LOW TERM
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.7
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.6%	1.4%
Velocity	1.5%	6.0%
Width	0.2%	0.2%
Method	3.1%	-
# Stations	5.8%	-
Overall	**6.8%**	**6.3%**

Summary

Averaging Int.	40	# Stations	9
Start Edge	REW	Total Width	1.700
Mean SNR	30.2 dB	Total Area	0.323
Mean Temp	48.38 °F	Mean Depth	0.190
Disch. Equation	Mid-Section	Mean Velocity	0.3068
		Total Discharge	**0.0990**

Supplemental Data (Gauge Height Change = 0.000ft)

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Thu Sep 8 10:24:30 MDT 2011	0.000	0.350		TEMP STAFF
2	Thu Sep 8 10:32:14 MDT 2011	1.400	0.350		
3	Thu Sep 8 10:46:22 MDT 2011	2.500	0.350		

Measurement Results

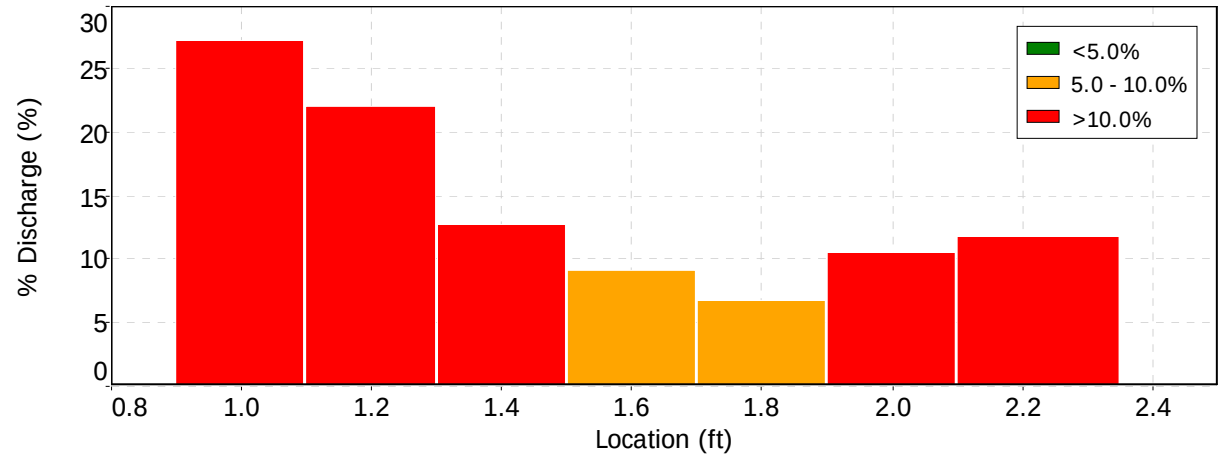
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:28	0.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	10:28	1.00	0.6	0.230	0.6	0.092	0.5866	1.00	0.5866	0.046	0.0270	27.3
2	10:29	1.20	0.6	0.230	0.6	0.092	0.4724	1.00	0.4724	0.046	0.0217	22.0
3	10:32	1.40	0.6	0.240	0.6	0.096	0.2612	1.00	0.2612	0.048	0.0126	12.7
4	10:34	1.60	0.6	0.220	0.6	0.088	0.2044	1.00	0.2044	0.044	0.0090	9.1
5	10:35	1.80	0.6	0.220	0.6	0.088	0.1506	1.00	0.1506	0.044	0.0066	6.7
6	*10:43*	*2.00*	*0.6*	*0.210*	*0.6*	*0.084*	*-0.2480*	*-1.00*	*0.2480*	*0.042*	*0.0104*	*10.5*
7	*10:39*	*2.20*	*0.6*	*0.210*	*0.6*	*0.084*	*-0.2218*	*-1.00*	*0.2218*	*0.052*	*0.0116*	*11.8*
8	10:39	2.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

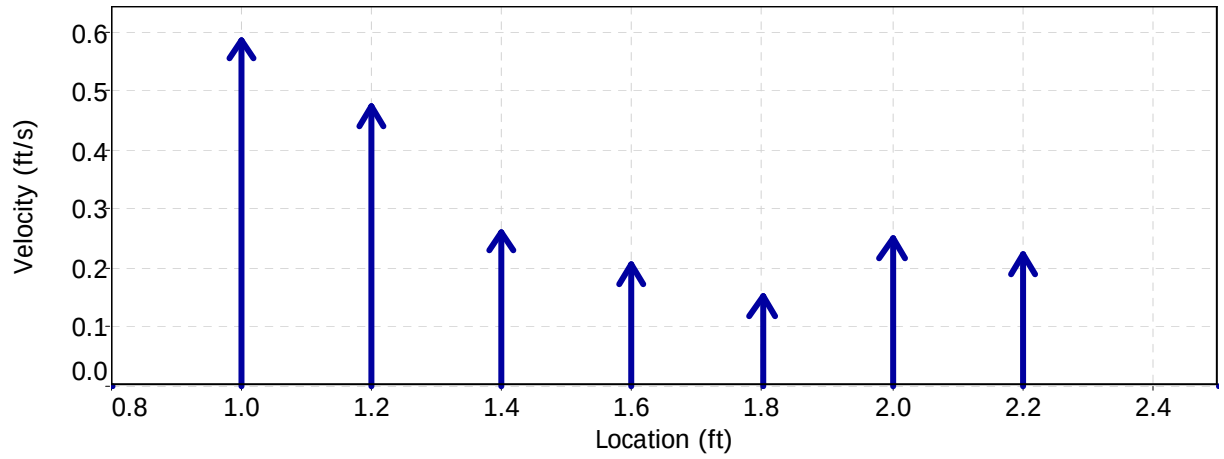
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

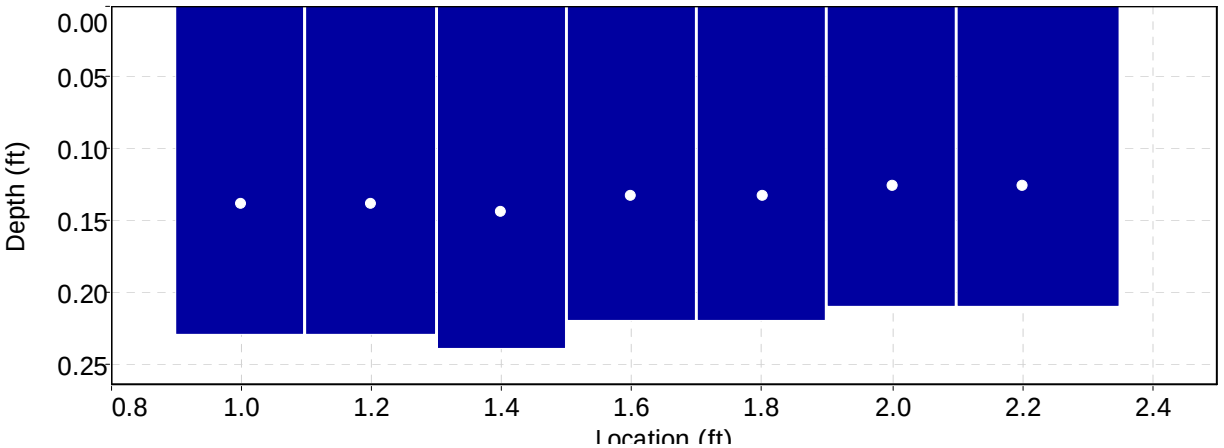
Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20110908_BONTABLT002.WAD	Site Name	BONNETT ABV LOW TERM
Start Date and Time	2011/09/08 10:28:36	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20110908_BONTABLT002.WAD	Site Name	BONNETT ABV LOW TERM
Start Date and Time	2011/09/08 10:28:36	Operator(s)	BJE

Quality Control

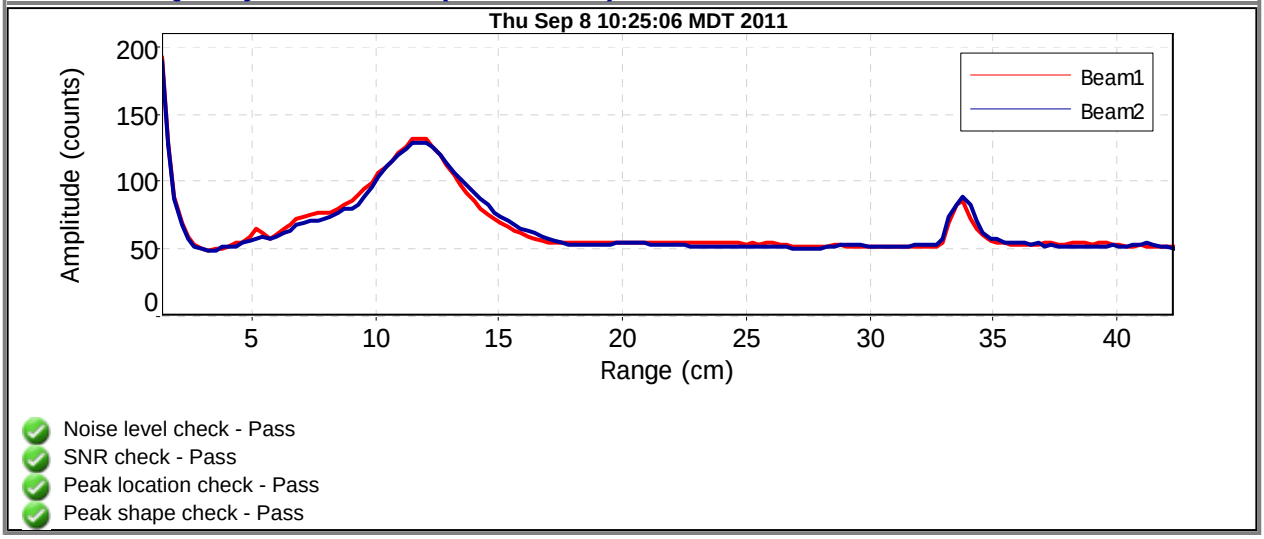
St	Loc	%Dep	Message
6	2.00	0.6	High angle: -177
7	2.20	0.6	High angle: -172

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20110908_BONTABLT002.WAD	Site Name	BONNETT ABV LOW TERM
Start Date and Time	2011/09/08 10:28:36	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Page 1 of 2	State of Colorado	Meas. No.: 001
YYYY: 2012	**Colorado Water Conservation Board**	Division: 2
MM-DD: 06-29	ADV Discharge Measurement Notes	District: 16

Station Name: Bonnett

River, (Creek), Canal, Ditch

At, Near, Above, (Below) CO-12 near Cuchara

Latitude: N 37°23'5.09" Longitude: W105°05'43.71" (NAD83)

Party: Brian Epstein

Conditions

Weather: Sunny ~85°F a few scattered clouds

Wind Spd / Dir: 0mph / 0° Water Temp:

X-Sec Desc: boulders + cobbles w/ sum sand

Flow Conds: slightly turbulent

Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / (Poor (>8%)) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download		Weighted MGH	
File Name:		GH Corr.	
Time:		Correct MGH	

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) / P2355
Firmware:	3.7	Software:	2.20		
Diag Test File:	Yes or No	Raw Data File:	BONTCR23.001		
Meas Type:	(Wading) Boat / Bridge / Cableway			Method:	0.6
	N/A		ft. or mi / upstream or downstream of gage		
Start Edge:	REW	Total Width:	1.6	# Stations:	7
Start Time:	13:02		End Time:	13:14	
Discharge:	0.220	Unsertainty:	13.5%		
Mean v:	0.950	Width	1.600	Mean d:	0.14
Max v:	1.548	Area:	0.232	Max d:	0.31
Mean SNR:	37.9	σv:	0.069	Mean Temp:	65.1

REV 22.5

24.1

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

- Got permission from woman at Lodge to take measurement on her land
  → She said later in the season the creek will go dry then be running and then go dry again asked if anyone was dumping it up. (I said, I didn't know)

GPS Point: BonnetCrQ3

13:18 Pic Bonnett Cr at Cross Section
13:18 Vid Bonnett Cr at Cross Section

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information

File Name	20120629_BONTCRQ3001.WAD
Start Date and Time	2012/06/29 13:05:33

Site Details

Site Name	BONNETT CR AT RD
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.7
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.8%	14.2%
Velocity	3.9%	25.9%
Width	0.3%	0.3%
Method	4.1%	-
# Stations	12.2%	-
Overall	**13.5%**	**29.6%**

Summary

Averaging Int.	40	# Stations	7
Start Edge	REW	Total Width	1.600
Mean SNR	37.9 dB	Total Area	0.232
Mean Temp	65.08 °F	Mean Depth	0.145
Disch. Equation	Mid-Section	Mean Velocity	0.9498
		Total Discharge	**0.2202**

Measurement Results

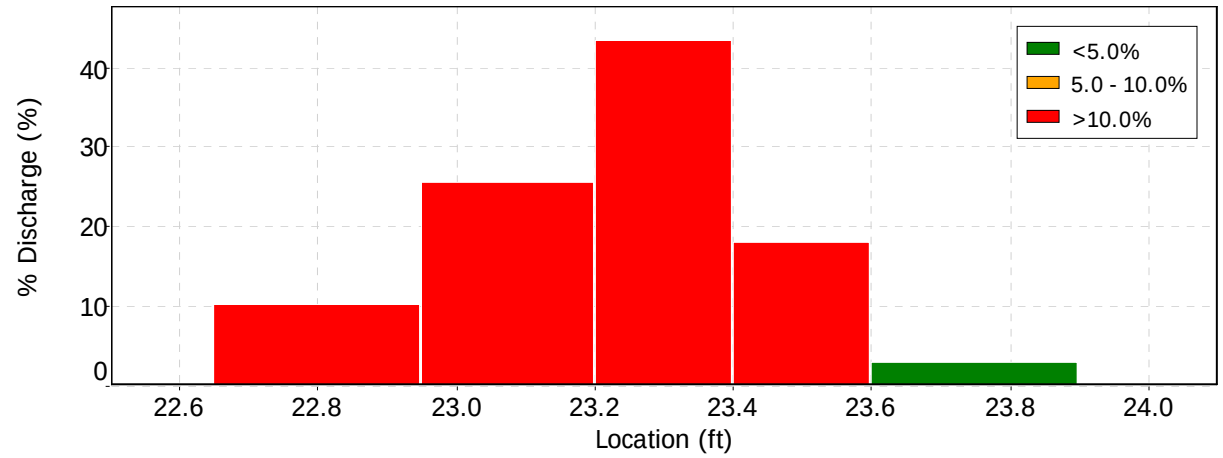
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:05	22.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:05	22.80	None	0.100	0.0	0.0	0.0000	1.00	0.7480	0.030	0.0225	10.2
2	13:06	23.10	0.6	0.300	0.6	0.120	0.7480	1.00	0.7480	0.075	0.0561	25.5
3	13:08	23.30	0.6	0.310	0.6	0.124	1.5476	1.00	1.5476	0.062	0.0959	43.5
4	*13:10*	*23.50*	*0.6*	*0.280*	*0.6*	*0.112*	*-0.7057*	*-1.00*	*0.7057*	*0.056*	*0.0395*	*17.9*
5	13:10	23.70	None	0.030	0.0	0.0	0.0000	1.00	0.7057	0.009	0.0063	2.9
6	13:10	24.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

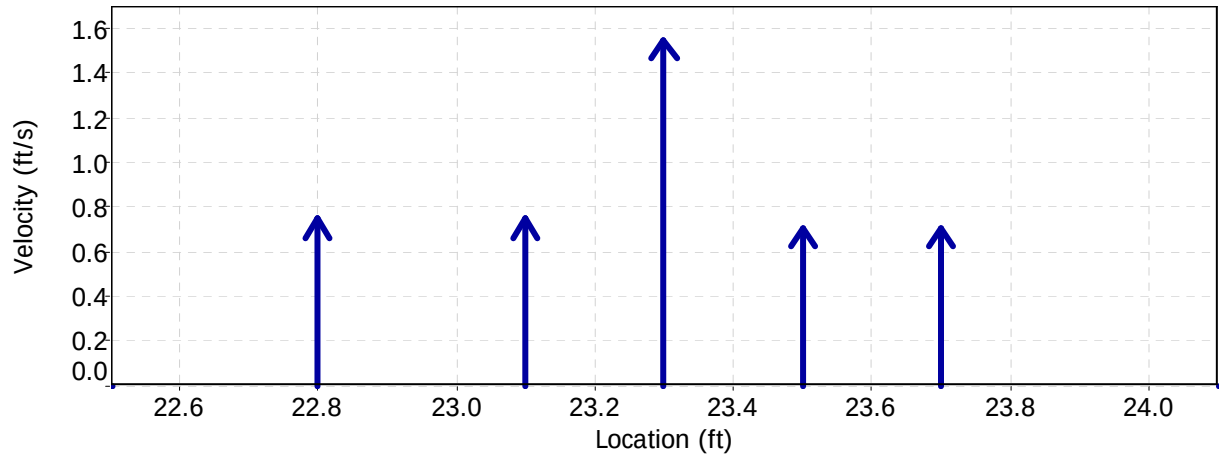
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

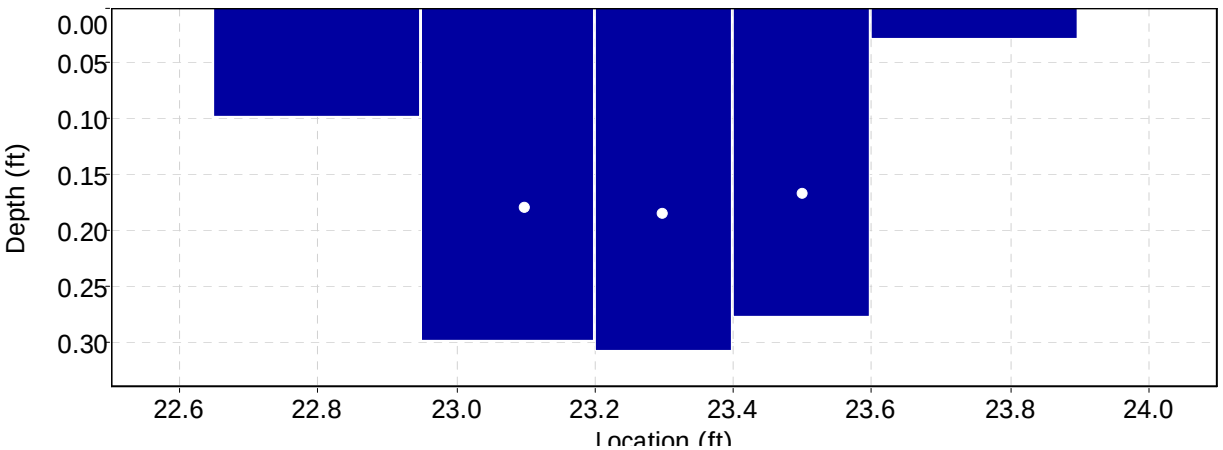
Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20120629_BONTCRQ3001.WAD	Site Name	BONNETT CR AT RD
Start Date and Time	2012/06/29 13:05:33	Operator(s)	BRIAN EPSTEIN







Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20120629_BONTCRQ3001.WAD	Site Name	BONNETT CR AT RD
Start Date and Time	2012/06/29 13:05:33	Operator(s)	BRIAN EPSTEIN

Quality Control

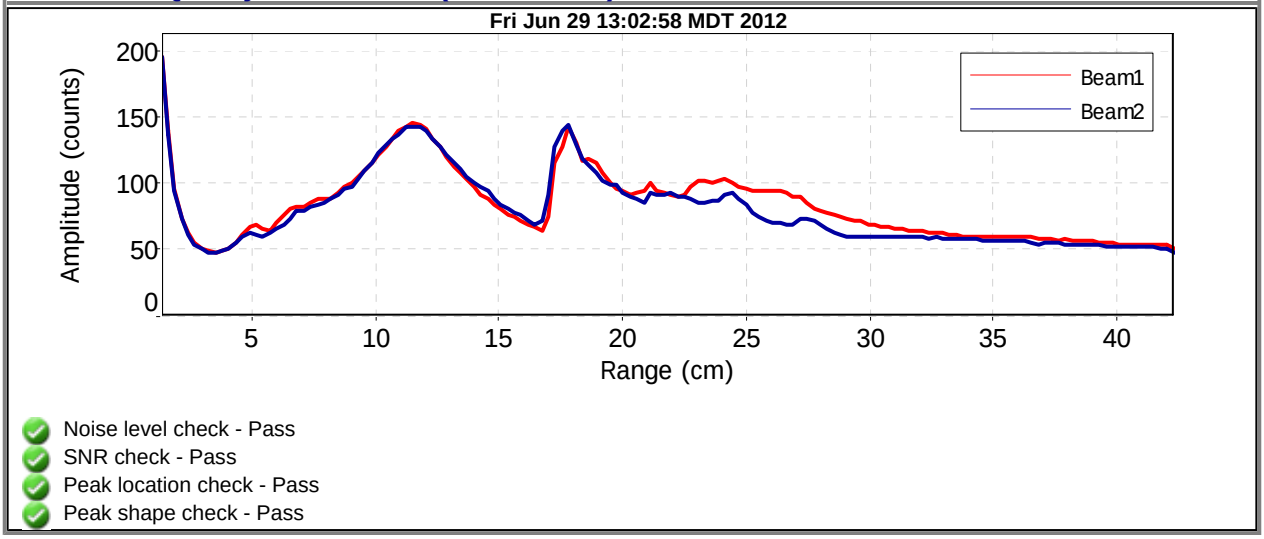
St	Loc	%Dep	Message
4	23.50	0.6	High angle: 178

Discharge Measurement Summary

Date Generated: Wed Jul 24 2013

File Information		Site Details	
File Name	20120629_BONTCRQ3001.WAD	Site Name	BONNETT CR AT RD
Start Date and Time	2012/06/29 13:05:33	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Page 1 of 2	State of Colorado	Meas. No.: 002
YYYY: 2014	**Colorado Water Conservation Board**	Division: 2
MM-DD: 08-07	ADV Discharge Measurement Notes	District:

Station Name: GPS Point: BONTCRQ3

Bonnett — River, (Creek), Canal, Ditch

(At) Near, Above, Below CO-12

Latitude: Longitude:

Party: Brian Eakin

Conditions

Weather: Partly Cloudy ~ 68°F

Wind Spd / Dir: variable Water Temp:

X-Sec Desc: ~40 feet below CO-12

Flow Conds: steady mostly laminar

Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / (Poor (>8%)) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download		Weighted MGH		
File Name:	N/A	GH Corr.		
Time:		Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BONTCRQ3.002		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
	N/A ft. or mi / upstream or downstream of gage				
Start Edge:	REW 0.9	End Edge:	LEW 3.6	Total Width:	2.7
Start Time:	14:32	End Time:	14:46		
Discharge:	0.363	Unsertainty:	6.6	# Stations:	10
Mean v:	0.429	Width	2.701	Mean d:	0.31
Max v:	0.720	Area:	0.847	Max d:	0.40
Mean SNR:	40.2	σv:	0.031	Mean Temp:	57.8

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

Bonnett Creek
- measured at Yellow Pine Ranch slightly upstream from office building
- owner permission granted ✓ (YPR)
- they are hopeful for protection (YPR)
- used to be on spring water from right access CO-12, now on Cucharas water (YPR)
- owner said Bonnett dried up in 2002 and almost dried 2012
- 1424 Ri 444 Bonnett Cr at X-section from downstream
- 1424 Ri 445 Bonnett Cr at X-section from REW

Measurement Packed Rear because: not enough flow for staining, depth very shallow, not uniform above and below

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	BONTCRQ3.002.WAD
Start Date and Time	2014/08/07 14:34:21

Site Details

Site Name	BONNETT CR AT CO12
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.6%	3.2%
Velocity	2.7%	17.3%
Width	0.2%	0.2%
Method	2.9%	-
# Stations	5.1%	-
Overall	**6.6%**	**17.6%**

Summary

Averaging Int.	40	# Stations	10
Start Edge	REW	Total Width	2.702
Mean SNR	40.2 dB	Total Area	0.847
Mean Temp	57.80 °F	Mean Depth	0.313
Disch. Equation	Mid-Section	Mean Velocity	0.4289
		Total Discharge	**0.3631**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:34	0.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:34	1.20	0.6	0.350	0.6	0.140	0.3543	1.00	0.3543	0.105	0.0372	10.3
2	14:35	1.50	0.6	0.330	0.6	0.132	0.4163	1.00	0.4163	0.099	0.0413	11.4
3	14:36	1.80	0.6	0.310	0.6	0.124	0.5118	1.00	0.5118	0.093	0.0476	13.1
4	14:38	2.10	0.6	0.370	0.6	0.148	0.3212	1.00	0.3212	0.111	0.0357	9.8
5	14:41	2.40	0.6	0.400	0.6	0.160	0.0656	1.00	0.0656	0.120	0.0079	2.2
6	14:42	2.70	0.6	0.390	0.6	0.156	0.7198	1.00	0.7198	0.117	0.0843	23.2
7	14:43	3.00	0.6	0.310	0.6	0.124	0.5705	1.00	0.5705	0.093	0.0531	14.6
8	14:44	3.30	0.6	0.360	0.6	0.144	0.5187	1.00	0.5187	0.108	0.0560	15.4
9	14:44	3.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

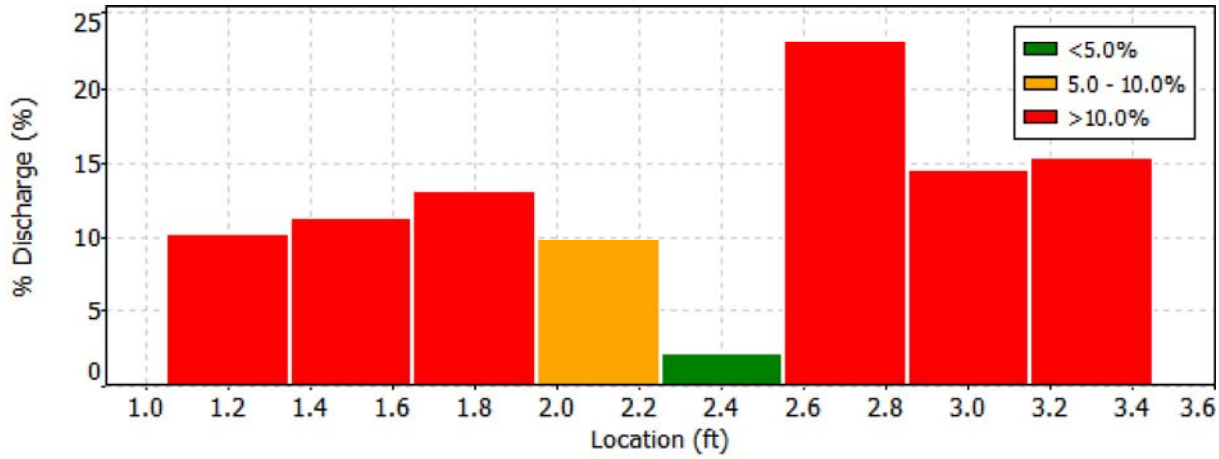
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

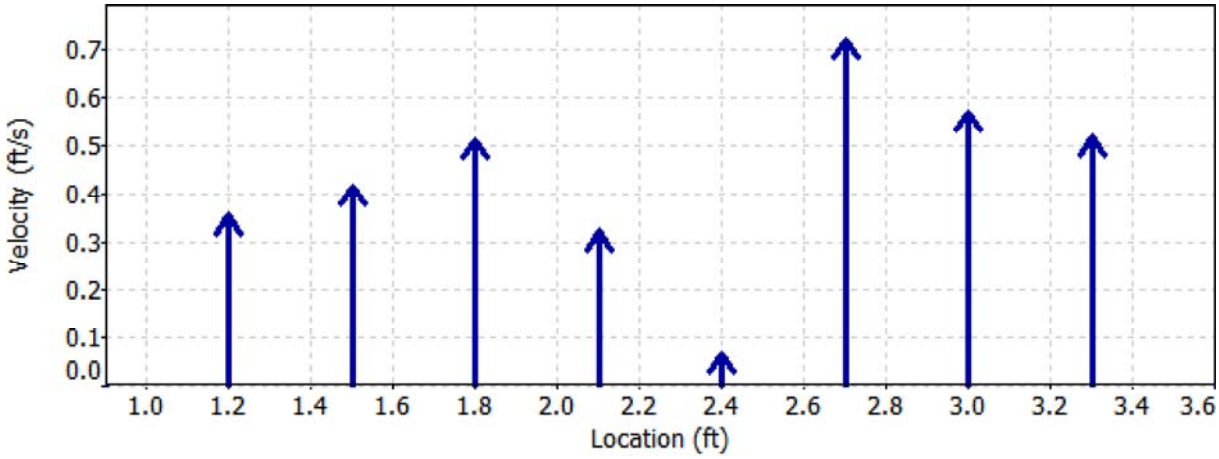
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

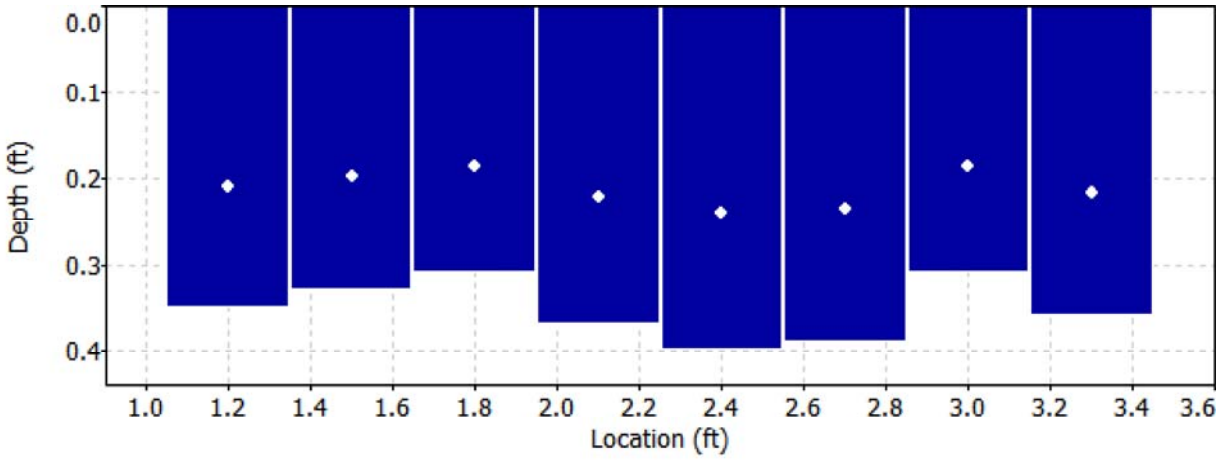
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	BONTCRQ3.002.WAD	Site Name	BONNETT CR AT CO12
Start Date and Time	2014/08/07 14:34:21	Operator(s)	BJE







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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	BONTCRQ3.002.WAD	Site Name	BONNETT CR AT CO12
Start Date and Time	2014/08/07 14:34:21	Operator(s)	BJE

Quality Control

No Quality Control warnings

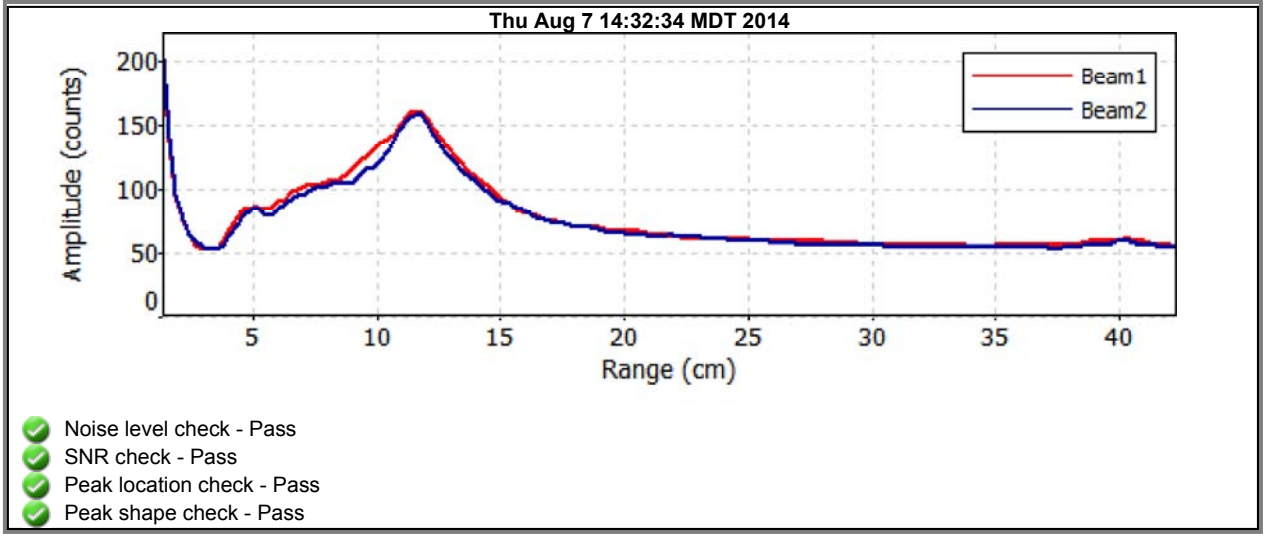
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	BONTCRQ3.002.WAD	Site Name	BONNETT CR AT CO12
Start Date and Time	2014/08/07 14:34:21	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

STATE OF COLORADO

Epstein - DNR, Brian <brian.epstein@state.co.us>

20150911_BonnettCreek_FieldNotes

1 message

Brian Epstein - DNR <brian.epstein@state.co.us> Tue, Nov 10, 2015 at 12:07 PM
To: Brian Epstein <Brian.Epstein@state.co.us>

Bonnett Creek Field Notes 20150911

•using Timble GPS Hunt, camera, and notes apps on iPhone

BonnettCr150911Pic01

BonnettCr150911Vid01

BonnettCr150911Pic02

BonnettCr150911Pic03

BonnettCr150911Pic04

BonnettCr150911Pic05

Discharge Measurement

- File name: BNTCAR12.021

- Location Bonnett Creek below Road 12

- Conditions:

• 65 deg F, light variable breeze, scattered clouds

• x-section bed fines/sand dominated

• flow lines mostly parallel and normal to tag line

• FlowTracker meter s/n p2354

• start edge/time: REW 3.7 / 14:31

• end edge/time: LEW 5.2 / 14:42

• W =

• Q = 0.10

• Uncertainty = 9.0%

• Stations 7

• V mean = 0.36

• V max = 0.62

• W = 1.5

• A = 0.27

• D mean = 0.18

• D max = 0.25

• SNR mean = 33.5

• V mean std error = 0.017

• Temp 59.3 deg F

• Measurement Rating: poor (narrow, shallow, flow lines direction shifted left to right)

Brian Epstein
Hydrologist, Stream and Lake Protection Section

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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