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

January 16, 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 3, Saguache County; Carnero Creek, 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 an instream flow (ISF) recommendation for Carnero Creek in Water Division 3. This flow recommendation 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 this ISF recommendation were conducted by Colorado Parks and Wildlife (CPW) personnel in 2018. This stream reach was first presented to interested parties at the ISF Workshop in January 2017. It is the CPW staff's opinion that the information contained in this letter is sufficient to recommend an ISF appropriation on Carnero Creek 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

As shown in Figure 1, CPW is proposing ISF protection on Carnero Creek from the confluence of South and Middle Fork Carnero Creeks to the confluence with Mogotas Arroyo.

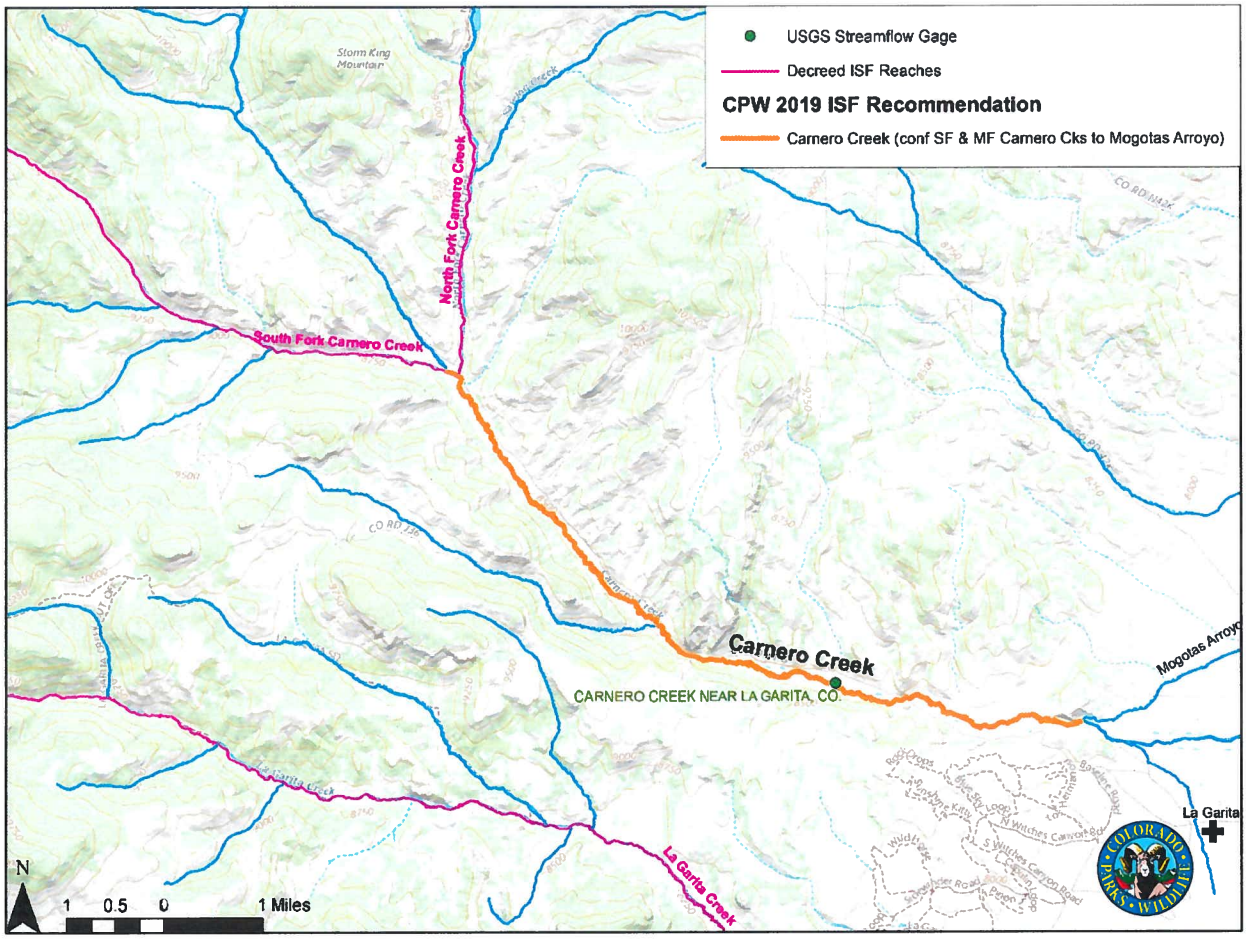


Figure 1. Vicinity map of Carnero Creek 2019 ISF Recommendations

Natural Environment

As stated above, Carnero Creek was presented by CPW at the January 2017 CWCB ISF workshop. CPW's interest was based on the fact that the reach contains suitable habitat for populations of Rio Grande cutthroat trout (RGCT). RGCT are a Tier 1 species in the 2015 State Wildlife Action Plan, meaning they have high conservation priority. RGCT is classified as a state "species of special concern" and is considered "sensitive" by the US Forest Service (USFS) and Bureau of Land Management (BLM). CPW is also part of the Rio Grande Cutthroat Trout Team, whose goal is to assure the "long-term viability of RGCT throughout its historic range by minimizing or removing threats to the species and promoting conservation." Recent genetic testing of the fish in certain creeks in the Rio Grande Basin has resulted in a genetic re-categorization due to a slight introgression with Yellowstone cutthroat trout. This relatively recent development has resulted the removal of a "Core Conservation Population" designation of some streams and lakes in the Rio Grande basin (Conservation Agreement and Strategy, 2013). The re-assessment of RGCT populations is an on-going process by CPW biologists and researchers. The documents dealing with cutthroat trout management in Colorado can be found on CPW's website (see http://cpw.state.co.us/learn/Pages/Conservation-Trout.aspx).

RGCT populations in tributaries of Carnero Creek are of critical importance to CPW and to the overall range-wide conservation effort. Many of these tributaries are within the Rio Grande National Forest and have federal instream flow protection; mainstem Carnero Creek is largely on private lands and does not have instream flow protection. Although the fishery in Carnero Creek is not currently identified as a core conservation population of RGCT, it is important to CPW to protect other aquatic resources in the reach and maintain habitat connectivity to tributaries of Carnero Creek, especially those with RGCT conservation populations, via an instream flow water right.

CPW fish survey data (attached) indicates the presence of self-sustaining populations of brown trout and white sucker, and small numbers of RGCT in Carnero Creek. Additionally, Carnero Creek's natural environment supports a significant macroinvertebrate community, and diverse riffle, pool, and glide habitat for the fish species listed above. In summary, CPW is of the opinion that there is a flow dependent natural environment in Carnero Creek that can be preserved to a reasonable degree.

Flows Necessary to Preserve the Natural Environment

In 2018, CPW 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 typical 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).

When flows meeting two and three of the hydraulic criteria fall out of the range for accuracy (40 to 250 percent) of applying Manning's roughness coefficient, the Thorne and Zevenbergen (T&Z) subroutine in R2CROSS is relied upon. The Thorne and Zevenbergen method uses several hydraulic equations depending on relative roughness to calculate velocity within the R2CROSS staging table. This subroutine relies on user-supplied D84 particle size from pebble count data collected at each cross-section location.

Two cross-section data sets were collected on the reach identified above. The field data sheets and resulting R2CROSS outputs are attached. The results of the R2CROSS analysis are summarized on the attached Fact Sheet.

R2CROSS biological recommendations were further refined with a preliminary water availability analysis. The only gage available in the Carnero Basin is the USGS gage, Carnero Creek near La Garita, CO. This gage was used to determine preliminary water availability and to determine seasonality for the winter and summer flow recommendations. The mean daily flows for the gage indicate that water is available for the proposed R2CROSS-based flow recommendation. 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 for Carnero Creek are 2.2 cfs from December 1 to February 28 and 2.6 cfs from March 1 to November 30.

As stated above, the purpose of this letter is to formally transmit this ISF recommendation from CPW to CWCB for the Board's consideration for the 2019 appropriation year. Please refer to the attached Fact Sheet 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)

FACT SHEET

Carnero Creek

Water Division 3, Saguache County

Upper Terminus: The confluence of South and Middle Fork Carnero Creeks at a point located at 13S 377513.93 4196212.69 UTM.

Lower Terminus: The confluence with Mogotas Arroyo located at 13S 387851.17 4190411.28 UTM.

Approximate Length: 6.3 miles

ISF Recommendation: 2.2 cfs (12/1 to 2/28)
2.6 (3/1 to 11/30)

Natural Environment:

Carnero Creek has a natural environment consisting of self-sustaining populations of brown trout and white sucker, and small numbers of Rio Grande cutthroat trout (RGCT). RGCT is classified as a Tier 1 priority species in the 2015 State Wildlife Action Plan, meaning the species has the highest conservation priority in the state. RGN is classified as a state "species of special concern" and is considered "sensitive" by the US Forest Service (USFS) and Bureau of Land Management (BLM). CPW fish survey data (attached) indicates self-sustaining populations of RGCT, brown trout, and white sucker. Carnero Creek was originally identified in the Rio Grande Cutthroat Trout Conservation Plan as having conservation populations of RGCT with essentially pure genetics. Since then, genetic analyses in the Rio Grande basin have shed light on introgression associated with the Yellowstone cutthroat trout. Although the importance of mainstem Carnero Creek in cutthroat conservation is currently being reassessed, this reach has a valuable natural environment consisting of multiple different species of fish, a significant macroinvertebrate community, and diverse riffle, pool, and glide habitat for the fish species listed above.

R2CROSS Results:

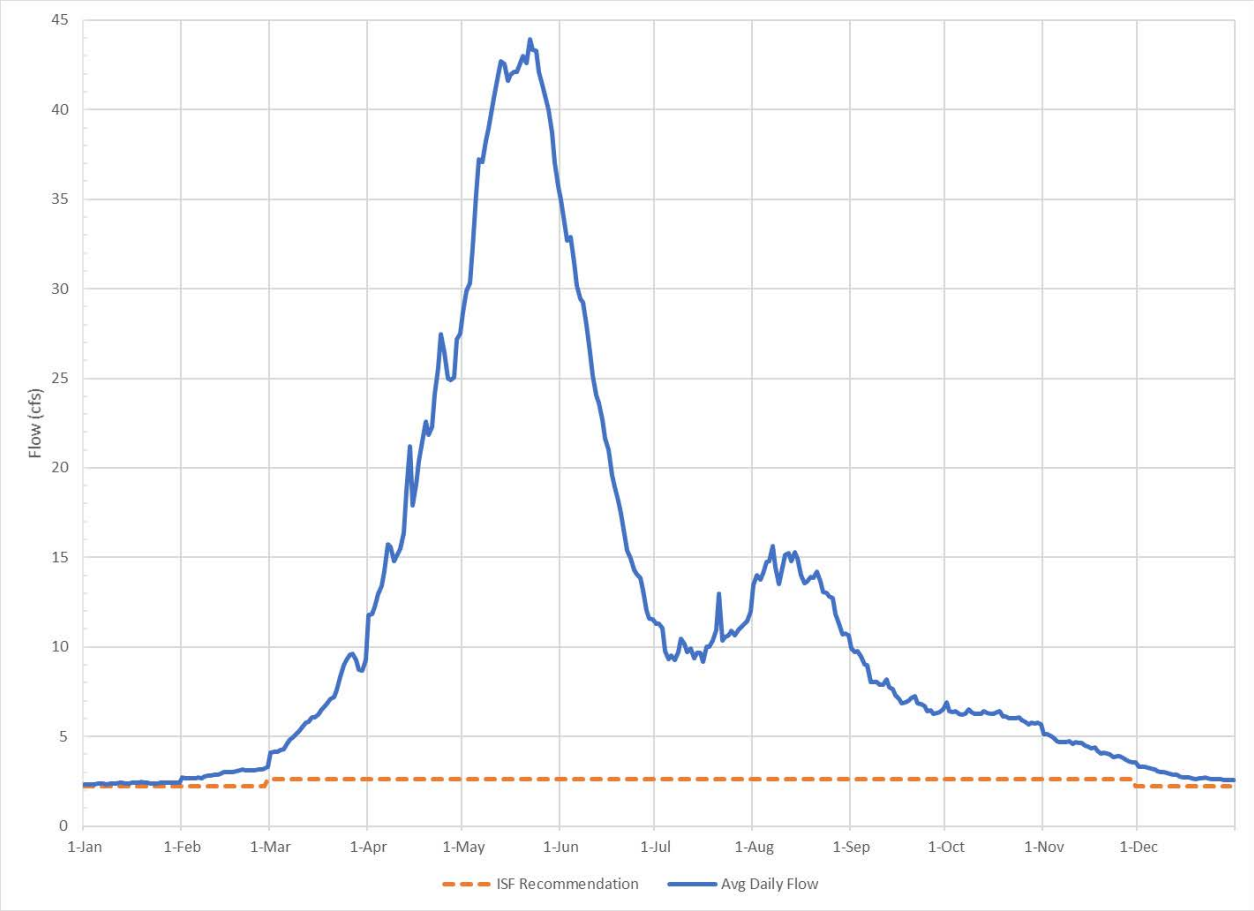
In 2018, CPW and CWCB personnel collected R2CROSS data at 2 sites within the proposed ISF segment. The results of the R2CROSS modeling are summarized in the following table:

	Entity	Date Measured	Q measured	40%-250%	Hydraulic Equation	Flow Meeting Two Criteria	Flow Meeting Three Criteria
1	CPW/CWCB	6/25/2018	1.8 cfs	0.7 – 4.6 cfs	T&Z[1]	3.3 cfs	3.4 cfs
2	CPW/CWCB	6/25/2018	1.8 cfs	0.7 – 4.6 cfs	T&Z[1]	1.0 cfs	1.8 cfs
				Mean		**2.2 cfs**	**2.6 cfs**

1= Flow recommendation falls outside the range of accuracy for R2CROSS's use of the Manning's equation (40%-250%); Thorne and Zevenbergen (T&Z) equations and user-supplied D84 were utilized.

Preliminary Water Availability:

CPW relied upon the USGS gage, Carnero Creek near La Garita (08230500), to make a preliminary water availability determination and to determine seasonality of recommendations. The gage has a period of record beginning in 1919 to present. Intermittent data gaps were not included in analysis. Mean daily flows over this period were used to make an initial water availability determination. Based on this information, it appears that water availability is not a limiting factor for the proposed winter and summer flow rates. Average daily flows and the R2CROSS-based ISF recommendations refined with preliminary water availability information are shown in the following figure:



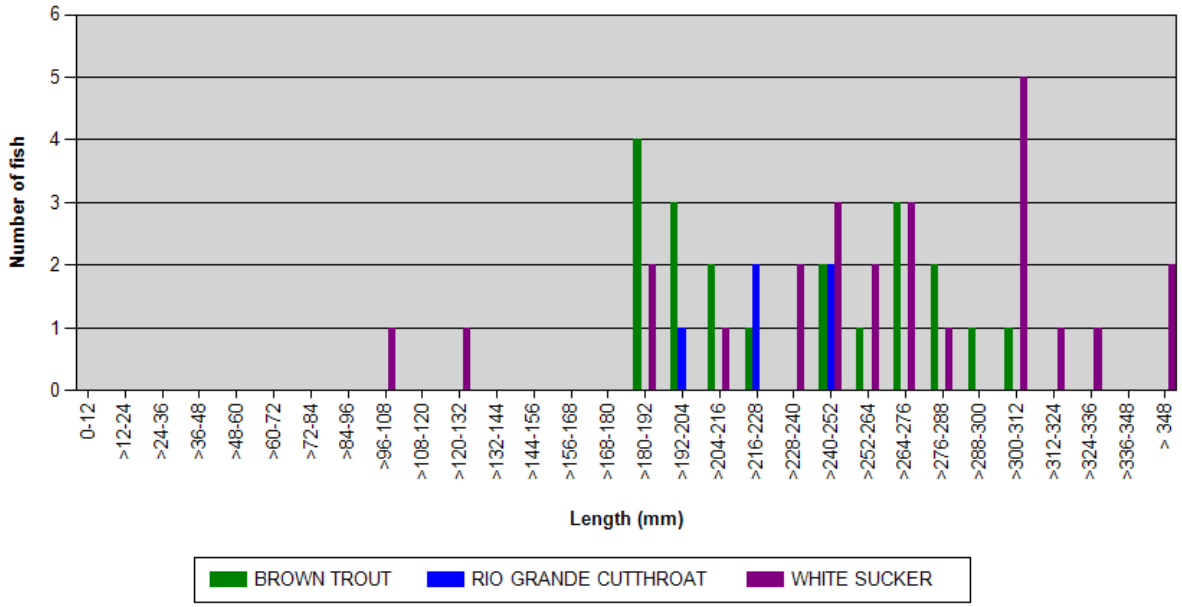
CPW is aware of the following active ditches in this reach: Espinosa Ditch (ID: 2700514), Torres Ditch (2700549), Cascias Ditch (2700566), Wilson Ditch (2700554), Susanna Ditch (2700548), Biehl Ditch (2700505), and Holland Ditch (2700521). Because these ditches all divert above the gage used for water availability, we believe these depletions are already captured in the water availability analysis.

Conclusion:

CPW recommends the following instream flows; we believe that these flows are necessary to preserve the Carnero Creek natural environment to a reasonable degree:

- 2.2 cfs (12/1 to 2/28)
- 2.6 (3/1 to 11/30)

Carnero Creek (38770)
Sampled at Station RG1972 on 10/28/1998



COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Carnero Ck, #1					CROSS-SECTION NO.: #1-upper-18	
CROSS-SECTION LOCATION: @ Public lands / private lands checker board						
DATE: 06/26/18	OBSERVERS: JS, RB, KB, H. Dutton					
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:	
COUNTY:	WATERSHED:	WATER DIVISION: 3	DOW WATER CODE:			
MAP(S): USGS:						
USFS:						

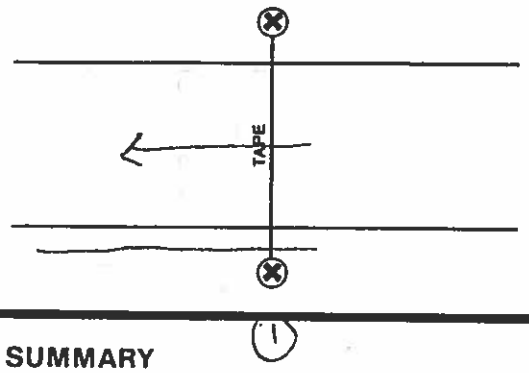
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES/NO)	METER TYPE: Marsh McB			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN (YES/NO)	NUMBER OF PHOTOGRAPHS: R.V. 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	7.18 / 7.14
② WS Upstream	7.4'	7.12
③ WS Downstream	7.6'	7.50
SLOPE		

SKETCH



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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
Sucker & other fish observed																	

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

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.: 1	DATE: 06/26/18	SHEET ___ OF ___

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

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	0		5.70								
	4		5.75								
	6		5.95								
G	7		6.30								
W	7.1		7.14	0							
	7.1		7.30	0.05				0.0			
	7.5		7.35	0.2				0.03			
	8.0		7.40	0.25				0.15			
	8.5		7.50	0.30				0.85			
	9.0		7.50	0.30				1.27			
	9.5		7.50	0.35				1.07			
	10.0		7.50	0.30				0.09			
	10.5		7.45	0.30				0.93			
	11.0		7.40	0.20				0.38			
	11.5		7.40	0.20				0.21			
	12.0		7.40	0.20				0.04			
	12.5		7.40	0.20				0.07			
	13.0		7.40	0.20				0.31			
	13.5		7.50	0.25				0.09			
	14.0		7.45	0.25				0.12			
	14.5		7.45	0.30				0.91			
	15.0		7.50	0.30				0.25			
	15.5		7.50	0.30				0.70			
	16.0		7.45	0.25				0.38			
	16.5		7.40	0.20				1.14			
	17.0		7.60	0.40				0.56			
	17.5		7.50	0.30				0.69			
	18.0		7.50	0.25				0.04			
	18.5		7.50	0.25				0.40			
	19.0		7.45	0.20				0.79			
	19.5		7.45	0.20				0.17			
	20.0		7.40	0.15				0.57			
	20.5		7.35	0.10				0.86			
	21.0		7.40	0.20				0.50			
	21.5		7.40	0.20				0.56			
	22.0		7.40	0.20				2.19			
	22.5		7.35	0.15				0.02			
	23.0		7.35	0.15				0.13			
	23.5		7.25	0.05				0			
W	23.5		7.18	0							
G	24.0		6.4				S	29.0		5.4	
	27.0		5.85								
TOTALS:											

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

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

LOCATION INFORMATION

STREAM NAME:	Carnero Creek
XS LOCATION:	13S 380682 4192263 UTM
XS NUMBER:	1 Upper
DATE:	26-Jun-18
OBSERVERS:	Skinner, Viehl, Birch, Dutton
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	Saguache
WATERSHED:	Carnero Creek
DIVISION:	3
DOW CODE:	38770
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:	0.02533333

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

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

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380682 4192263 UTM
XS NUMBER: 1 Upper

DATA POINTS= 43

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	0.00	5.70			0.00		0.00	0.00	0.0%
	4.00	5.50			0.00		0.00	0.00	0.0%
	6.00	5.95			0.00		0.00	0.00	0.0%
1 GL	7.00	6.30			0.00		0.00	0.00	0.0%
WL	7.10	7.14	0.00		0.00		0.00	0.00	0.0%
	7.10	7.30	0.05	0.00	0.16	0.05	0.01	0.00	0.0%
	7.50	7.35	0.20	0.03	0.40	0.20	0.09	0.00	0.1%
	8.00	7.40	0.25	0.15	0.50	0.25	0.13	0.02	1.0%
	8.50	7.50	0.30	0.85	0.51	0.30	0.15	0.13	6.9%
	9.00	7.50	0.30	1.27	0.50	0.30	0.15	0.19	10.4%
	9.50	7.50	0.35	1.07	0.50	0.35	0.18	0.19	10.2%
	10.00	7.50	0.30	0.09	0.50	0.30	0.15	0.01	0.7%
	10.50	7.45	0.30	0.93	0.50	0.30	0.15	0.14	7.6%
	11.00	7.40	0.20	0.38	0.50	0.20	0.10	0.04	2.1%
	11.50	7.40	0.20	0.21	0.50	0.20	0.10	0.02	1.1%
	12.00	7.40	0.20	0.04	0.50	0.20	0.10	0.00	0.2%
	12.50	7.40	0.20	0.07	0.50	0.20	0.10	0.01	0.4%
	13.00	7.40	0.20	0.31	0.50	0.20	0.10	0.03	1.7%
	13.50	7.50	0.25	0.09	0.51	0.25	0.13	0.01	0.6%
	14.00	7.45	0.25	0.12	0.50	0.25	0.13	0.02	0.8%
	14.50	7.45	0.30	0.91	0.50	0.30	0.15	0.14	7.4%
	15.00	7.50	0.30	0.25	0.50	0.30	0.15	0.04	2.0%
	15.50	7.50	0.30	0.70	0.50	0.30	0.15	0.11	5.7%
	16.00	7.45	0.25	0.38	0.50	0.25	0.13	0.05	2.6%
	16.50	7.40	0.20	1.14	0.50	0.20	0.10	0.11	6.2%
	17.00	7.60	0.40	0.56	0.54	0.40	0.20	0.11	6.1%
	17.50	7.50	0.30	0.69	0.51	0.30	0.15	0.10	5.6%
	18.00	7.50	0.25	0.04	0.50	0.25	0.13	0.01	0.3%
	18.50	7.50	0.25	0.40	0.50	0.25	0.13	0.05	2.7%
	19.00	7.45	0.20	0.79	0.50	0.20	0.10	0.08	4.3%
	19.50	7.45	0.20	0.17	0.50	0.20	0.10	0.02	0.9%
	20.00	7.40	0.15	0.57	0.50	0.15	0.08	0.04	2.3%
	20.50	7.35	0.10	0.86	0.50	0.10	0.05	0.04	2.3%
	21.00	7.40	0.20	0.50	0.50	0.20	0.10	0.05	2.7%
	21.50	7.40	0.20	0.56	0.50	0.20	0.10	0.06	3.1%
	22.00	7.40	0.20	0.19	0.50	0.20	0.10	0.02	1.0%
	22.50	7.35	0.15	0.02	0.50	0.15	0.08	0.00	0.1%
	23.00	7.35	0.15	0.13	0.50	0.15	0.08	0.01	0.5%
	23.50	7.25	0.05	0.00	0.51	0.05	0.01	0.00	0.0%
WL	23.50	7.18	0.00		0.07		0.00	0.00	0.0%
1 GL	24.00	6.40			0.00		0.00	0.00	0.0%
	27.00	5.85			0.00		0.00	0.00	0.0%
	29.00	5.40			0.00		0.00	0.00	0.0%
TOTALS ----------					16.74	0.4 (Max.)	3.81	1.84	100.0%

Manning's n = 0.1832
Hydraulic Radius= 0.22773209

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380682 4192263 UTM
XS NUMBER: 1 Upper

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.81	4.53	18.9%
6.91	3.81	8.66	127.1%
6.93	3.81	8.33	118.4%
6.95	3.81	7.99	109.7%
6.97	3.81	7.66	101.0%
6.99	3.81	7.33	92.3%
7.01	3.81	7.00	83.6%
7.03	3.81	6.67	75.0%
7.05	3.81	6.34	66.3%
7.07	3.81	6.01	57.7%
7.09	3.81	5.68	49.0%
7.11	3.81	5.35	40.4%
7.12	3.81	5.19	36.1%
7.13	3.81	5.02	31.8%
7.14	3.81	4.86	27.5%
7.15	3.81	4.70	23.2%
7.16	3.81	4.53	18.9%
7.17	3.81	4.37	14.5%
7.18	3.81	4.20	10.2%
7.19	3.81	4.04	5.9%
7.20	3.81	3.88	1.6%
7.21	3.81	3.71	-2.7%
7.23	3.81	3.38	-11.3%
7.25	3.81	3.06	-19.9%
7.27	3.81	2.73	-28.4%
7.29	3.81	2.40	-37.0%
7.31	3.81	2.08	-45.4%
7.33	3.81	1.76	-53.8%
7.35	3.81	1.45	-62.0%
7.37	3.81	1.16	-69.6%
7.39	3.81	0.88	-76.9%
7.41	3.81	0.65	-82.9%

WATERLINE AT ZERO
AREA ERROR = 7.204

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380682 4192263 UTM
XS NUMBER: 1 Upper

Thorne-Zevenbergen D84 Correction Applied
User Supplied D84 = 0.31

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

Velocity based on test of R/D84>1

	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	6.40	16.99	1.01	1.20	17.22	18.41	100.0%	0.94	86.63	5.03
	6.40	16.99	1.01	1.20	17.16	18.40	100.0%	0.93	86.04	5.01
	6.45	16.95	0.96	1.15	16.31	18.29	99.4%	0.89	78.46	4.81
	6.50	16.91	0.91	1.10	15.46	18.19	98.8%	0.85	71.17	4.60
	6.55	16.87	0.87	1.05	14.62	18.08	98.2%	0.81	64.18	4.39
	6.60	16.83	0.82	1.00	13.78	17.97	97.6%	0.77	57.49	4.17
	6.65	16.80	0.77	0.95	12.94	17.86	97.0%	0.72	51.11	3.95
	6.70	16.76	0.72	0.90	12.10	17.75	96.4%	0.68	45.05	3.72
	6.75	16.72	0.67	0.85	11.26	17.64	95.8%	0.64	39.32	3.49
	6.80	16.68	0.62	0.80	10.42	17.53	95.2%	0.59	33.92	3.25
	6.85	16.64	0.58	0.75	9.59	17.42	94.6%	0.55	28.86	3.01
	6.90	16.61	0.53	0.70	8.76	17.31	94.0%	0.51	24.16	2.76
	6.95	16.57	0.48	0.65	7.93	17.20	93.4%	0.46	19.83	2.50
	7.00	16.53	0.43	0.60	7.10	17.09	92.8%	0.42	15.87	2.23
	7.05	16.49	0.38	0.55	6.28	16.98	92.2%	0.37	12.31	1.96
	7.10	16.45	0.33	0.50	5.45	16.87	91.6%	0.32	9.16	1.68
	7.15	16.42	0.28	0.45	4.63	16.76	91.0%	0.28	6.80	1.47
WL	7.20	16.40	0.23	0.40	3.81	16.65	90.4%	0.23	4.39	1.15
	7.25	16.38	0.18	0.35	2.99	16.54	89.8%	0.18	2.66	0.89
	7.30	16.10	0.14	0.30	2.18	16.21	88.0%	0.13	1.50	0.69
	7.35	14.85	0.09	0.25	1.39	14.94	81.2%	0.09	0.76	0.54
	7.40	9.84	0.07	0.20	0.71	9.92	53.9%	0.07	0.31	0.43
	7.45	6.64	0.04	0.15	0.28	6.70	36.4%	0.04	0.09	0.31
	7.50	0.72	0.05	0.10	0.03	0.75	4.1%	0.05	0.00	0.10
	7.55	0.35	0.02	0.05	0.01	0.36	2.0%	0.02	0.00	0.03

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380682 4192263 UTM
XS NUMBER: 1 Upper

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.84	cfs
CALCULATED FLOW (Qc)=	1.84	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	7.16	ft
CALCULATED WATERLINE (WLc)=	7.20	ft
(WLm-WLc)/WLm * 100 =	-0.6	%
MAX MEASURED DEPTH (Dm)=	0.40	ft
MAX CALCULATED DEPTH (Dc)=	0.40	ft
(Dm-Dc)/Dm * 100	1.0	%
MEAN VELOCITY=	0.48	ft/sec
MANNING'S N=	0.183	
SLOPE=	0.02533333	ft/ft
.4 * Qm =	0.7	cfs
2.5 * Qm=	4.6	cfs

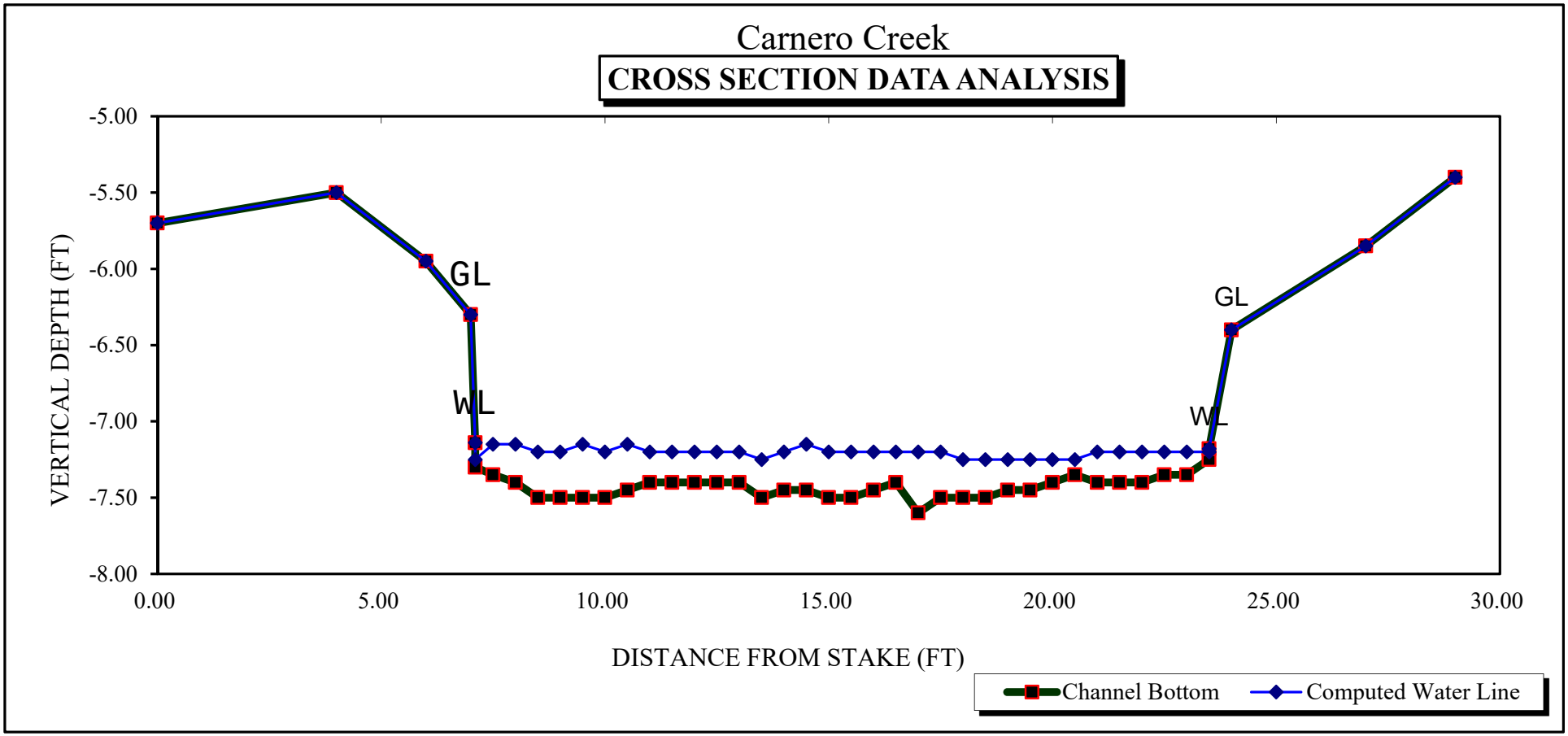
RECOMMENDED INSTREAM FLOW:
==========

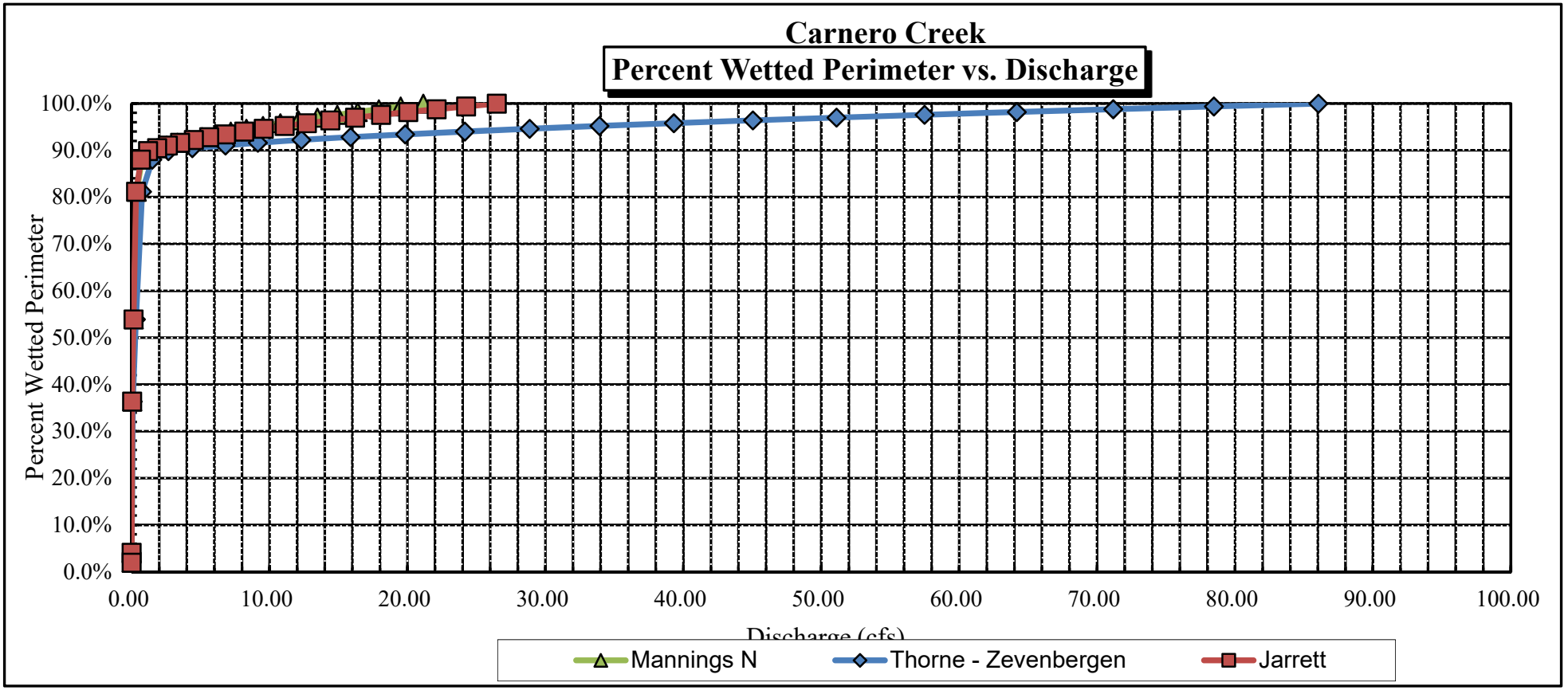
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

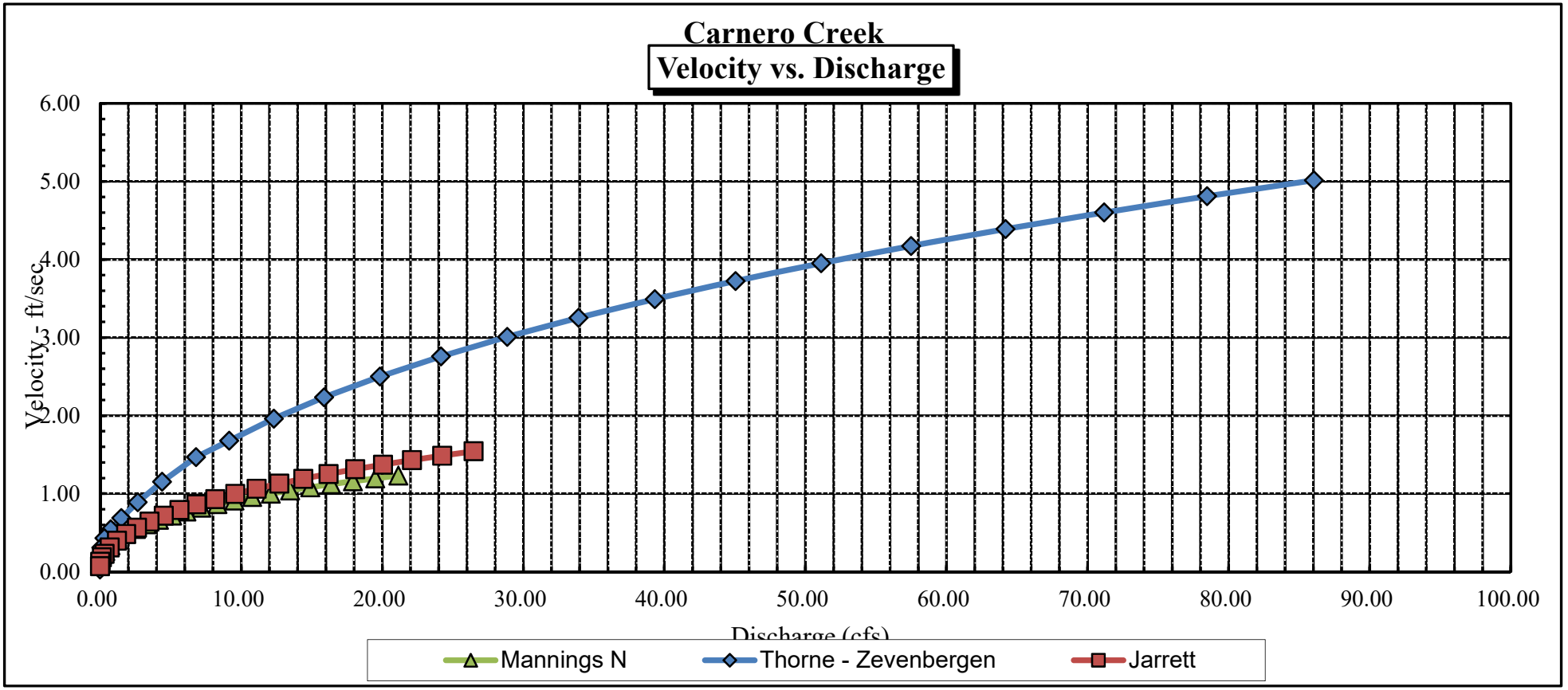
RATIONALE FOR RECOMMENDATION:
==========

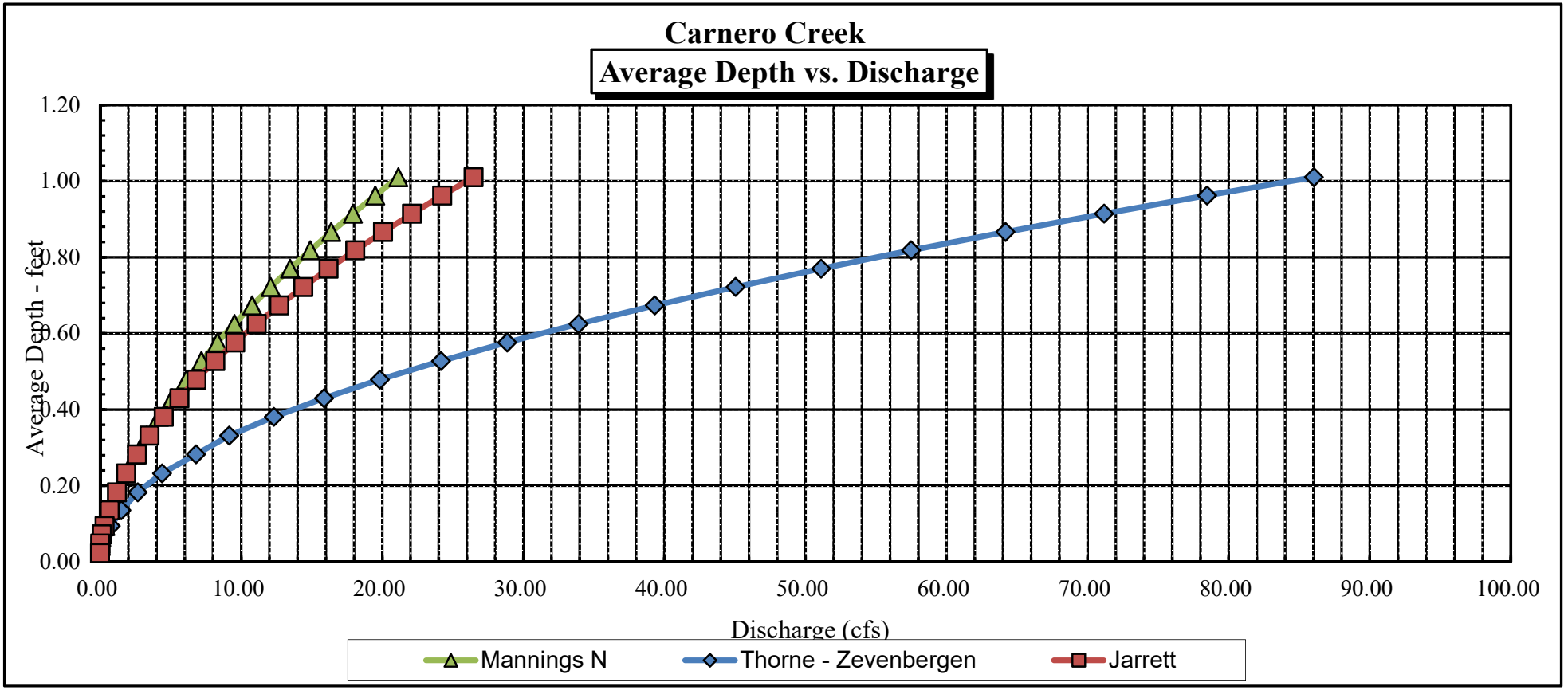
RECOMMENDATION BY: …….. AGENCY…….. DATE:……

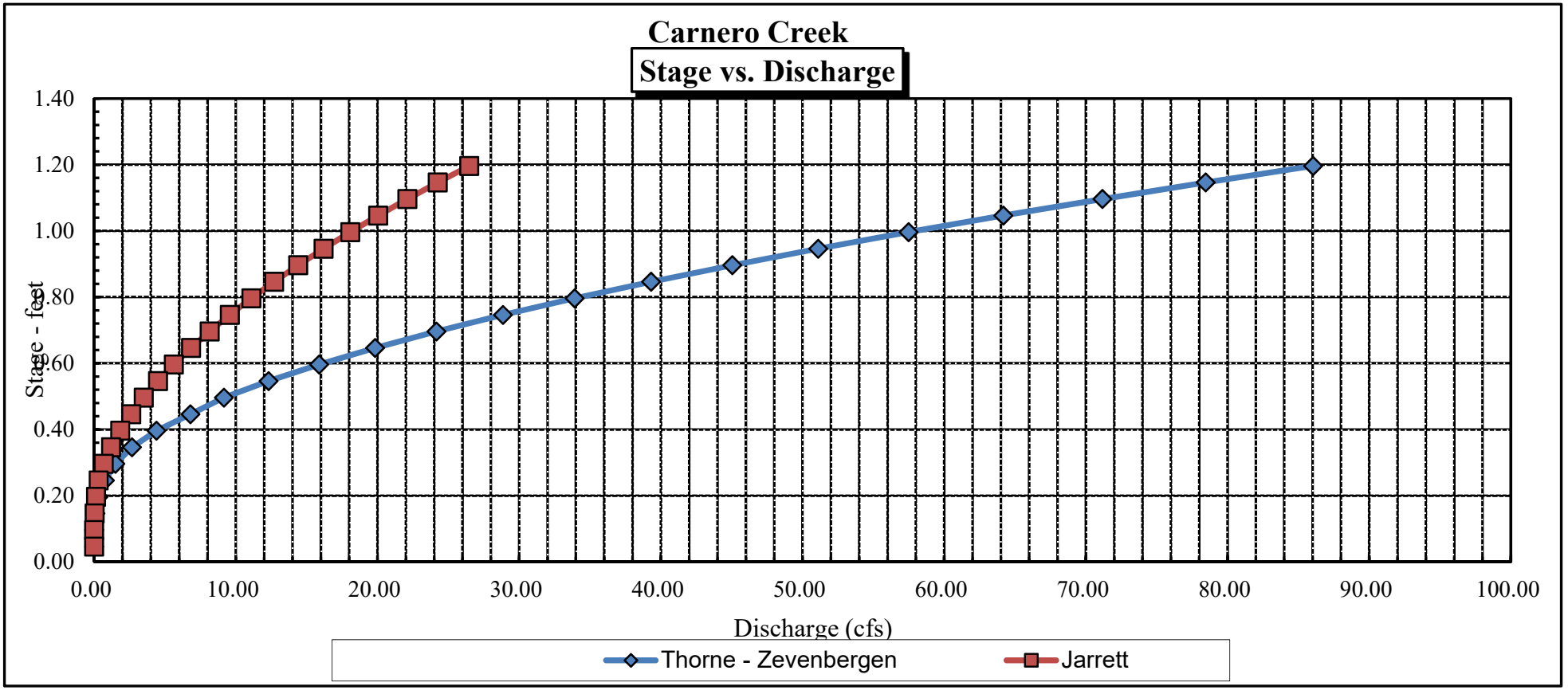
CWCB REVIEW BY: …….. DATE:……


Carnero Creek
CROSS SECTION DATA ANALYSIS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
VERTICAL DEPTH (FT)
GL
WL
GL
WL
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Carnero Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Velocity vs. Discharge
Velocity - ft/sec
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Stage vs. Discharge
Stage - feet
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Carnero Creek
XS LOCATION:	13S 380682 4192263 UTM
XS NUMBER:	1 Upper
DATE:	6/26/2018
OBSERVERS:	Skinner, Viehl, Birch, Dutton
1/4 SEC:	
SECTION:	
TWP:	
RANGE:	
PM:	
COUNTY:	Saguache
WATERSHED:	Carnero Creek
DIVISION:	3
DOW CODE:	38770
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.025333333 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 = 43					
		0.00	5.70			0.00	0.00	0.00
		4.00	5.50			0.00	0.00	0.00
		6.00	5.95			0.00	0.00	0.00
1	GL	7.00	6.30			0.00	0.00	0.00
	WL	7.10	7.14	0.00		0.00	0.00	0.00
		7.10	7.30	0.05	0.00	0.01	0.00	7.25
		7.50	7.35	0.20	0.03	0.09	0.00	7.15
		8.00	7.40	0.25	0.15	0.13	0.02	7.15
		8.50	7.50	0.30	0.85	0.15	0.13	7.20
		9.00	7.50	0.30	1.27	0.15	0.19	7.20
		9.50	7.50	0.35	1.07	0.18	0.19	7.15
		10.00	7.50	0.30	0.09	0.15	0.01	7.20
		10.50	7.45	0.30	0.93	0.15	0.14	7.15
		11.00	7.40	0.20	0.38	0.10	0.04	7.20
		11.50	7.40	0.20	0.21	0.10	0.02	7.20
		12.00	7.40	0.20	0.04	0.10	0.00	7.20
		12.50	7.40	0.20	0.07	0.10	0.01	7.20
		13.00	7.40	0.20	0.31	0.10	0.03	7.20
		13.50	7.50	0.25	0.09	0.13	0.01	7.25
		14.00	7.45	0.25	0.12	0.13	0.02	7.20
		14.50	7.45	0.30	0.91	0.15	0.14	7.15
		15.00	7.50	0.30	0.25	0.15	0.04	7.20
		15.50	7.50	0.30	0.70	0.15	0.11	7.20
		16.00	7.45	0.25	0.38	0.13	0.05	7.20
		16.50	7.40	0.20	1.14	0.10	0.11	7.20
		17.00	7.60	0.40	0.56	0.20	0.11	7.20
		17.50	7.50	0.30	0.69	0.15	0.10	7.20
		18.00	7.50	0.25	0.04	0.13	0.01	7.25
		18.50	7.50	0.25	0.40	0.13	0.05	7.25
		19.00	7.45	0.20	0.79	0.10	0.08	7.25
		19.50	7.45	0.20	0.17	0.10	0.02	7.25
		20.00	7.40	0.15	0.57	0.08	0.04	7.25
		20.50	7.35	0.10	0.86	0.05	0.04	7.25
		21.00	7.40	0.20	0.50	0.10	0.05	7.20
		21.50	7.40	0.20	0.56	0.10	0.06	7.20
		22.00	7.40	0.20	0.19	0.10	0.02	7.20
		22.50	7.35	0.15	0.02	0.08	0.00	7.20
		23.00	7.35	0.15	0.13	0.08	0.01	7.20
		23.50	7.25	0.05	0.00	0.01	0.00	7.20
	WL	23.50	7.18	0.00		0.00	0.00	0.00
1	GL	24.00	6.40			0.00	0.00	0.00
		27.00	5.85			0.00	0.00	0.00
		29.00	5.40			0.00	0.00	0.00
					Totals	3.81	1.84	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Carnero Cr #2					CROSS-SECTION NO.: Lwer 2 (2018)
CROSS-SECTION LOCATION: @ Public Lands / private lands interface					
DATE: 6/26/18	OBSERVERS: JS, RV, K.B				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:	WATER DIVISION: 3	DOW WATER CODE:		
MAP(S):	USGS:				
	USFS:				

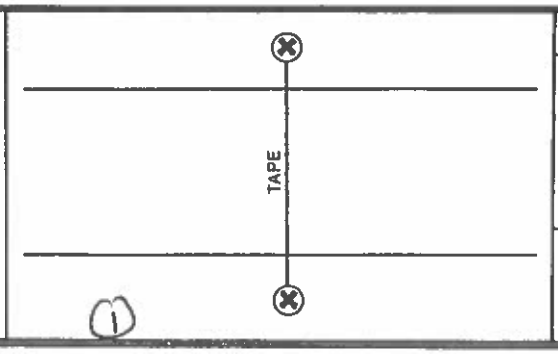
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: Marsh McB			
METER NUMBER:	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 - (Rob)		

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	7.83 / 7.84
② WS Upstream	5.8	7.79
③ WS Downstream	6.5	8.12
SLOPE		

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
Sucker ? other fish observed																	

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Carnero Ck #2	CROSS-SECTION NO: 2 Lwer (2018)	DATE: 6/26/18	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME:

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	0	6.35									
	2	6.55									
GL	3.9	6.90									
	3.9	11.5	} corrected +7								
	4.4	11.65									
	4.9	7.75									
	5.4	7.75									
	5.9	7.75									
	6.4	7.75									
	6.9	7.75									
	7.4	7.70									
	7.9	7.75									
	8.4	7.75									
WL	9.0	7.83		0							
	9.5	7.90		.05					0		
	10.0	8.0		.15					0.2		
	10.5	8.0		.15					0.32		
	11.0	7.95		.15					0.63		
	11.5	8.05		.2					1.06		
	12	7.85		.3					0.91		
	12.5	8.2		.4					1.29		
	13.0	8.35		.5					1.42		
	13.5	8.30		.5					0.16		
	14.0	8.35		.5					0.68		
	14.5	8.35		0.5					1.40		
	15.0	8.30		0.5					0.89		
	15.5	8.35		0.5					1.01		
	16	8.35		0.5					0.41		
	16.5	8.0		0.4					0.34		
	17.0	8.15		0.35					0.34		
	17.5	8.05		0.25					Ø		
	18.0	8.00		0.2					0.18		
	18.5	7.95		0.1					Ø		
WL	18.8	7.83		0							
GL	19.0	6.65	beaten down by grazing								
	20.0	6.2									
S	23.9	6.05									
TOTALS:											

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

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

LOCATION INFORMATION

STREAM NAME:	Carnero Creek
XS LOCATION:	13S 380657 4192250
XS NUMBER:	2 (Lower) 2018
DATE:	26-Jun-18
OBSERVERS:	Skinner, Viehl, Birch
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	Saguache
WATERSHED:	Carnero Creek
DIVISION:	3
DOW CODE:	38770
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:	0.02682927

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

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

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380657 4192250
XS NUMBER: 2 (Lower) 2018

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
S	0.00	6.35			0.00		0.00	0.00	0.0%
	2.00	6.55			0.00		0.00	0.00	0.0%
1 GL	3.40	6.90			0.00		0.00	0.00	0.0%
	3.90	7.50			0.00		0.00	0.00	0.0%
	4.40	7.65			0.00		0.00	0.00	0.0%
	4.90	7.75			0.00		0.00	0.00	0.0%
	5.40	7.75			0.00		0.00	0.00	0.0%
	5.90	7.75			0.00		0.00	0.00	0.0%
	6.40	7.75			0.00		0.00	0.00	0.0%
	6.90	7.75			0.00		0.00	0.00	0.0%
	7.40	7.70			0.00		0.00	0.00	0.0%
	7.90	7.75			0.00		0.00	0.00	0.0%
	8.40	7.75			0.00		0.00	0.00	0.0%
WL	9.00	7.83	0.00		0.00		0.00	0.00	0.0%
	9.50	7.90	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
	10.00	8.00	0.15	0.20	0.51	0.15	0.08	0.02	0.7%
	10.50	8.00	0.15	0.32	0.50	0.15	0.08	0.02	1.1%
	11.00	7.95	0.15	0.63	0.50	0.15	0.08	0.05	2.1%
	11.50	8.05	0.20	1.06	0.51	0.20	0.10	0.11	4.8%
	12.00	7.85	0.30	0.91	0.54	0.30	0.15	0.14	6.1%
	12.50	8.20	0.40	1.29	0.61	0.40	0.20	0.26	11.6%
	13.00	8.35	0.50	1.42	0.52	0.50	0.25	0.36	16.0%
	13.50	8.30	0.50	0.16	0.50	0.50	0.25	0.04	1.8%
	14.00	8.35	0.50	0.68	0.50	0.50	0.25	0.17	7.6%
	14.50	8.35	0.50	1.40	0.50	0.50	0.25	0.35	15.7%
	15.00	8.30	0.50	0.89	0.50	0.50	0.25	0.22	10.0%
	15.50	8.35	0.50	1.01	0.50	0.50	0.25	0.25	11.3%
	16.00	8.35	0.50	0.41	0.50	0.50	0.25	0.10	4.6%
	16.50	8.00	0.40	0.34	0.61	0.40	0.20	0.07	3.1%
	17.00	8.15	0.35	0.34	0.52	0.35	0.18	0.06	2.7%
	17.50	8.05	0.25	0.00	0.51	0.25	0.13	0.00	0.0%
	18.00	8.00	0.20	0.18	0.50	0.20	0.10	0.02	0.8%
	18.50	7.95	0.10	0.00	0.50	0.10	0.04	0.00	0.0%
WL	18.80	7.83	0.00		0.32		0.00	0.00	0.0%
1 GL	19.00	6.65			0.00		0.00	0.00	0.0%
	20.00	6.20			0.00		0.00	0.00	0.0%
	23.80	6.05			0.00		0.00	0.00	0.0%
TOTALS ----------					10.18	0.5 (Max.)	3.09	2.22	100.0%

Manning's n = 0.1527
Hydraulic Radius= 0.30358552

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380657 4192250
XS NUMBER: 2 (Lower) 2018

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.09	2.83	-8.5%
7.58	3.09	6.05	95.7%
7.60	3.09	5.75	86.2%
7.62	3.09	5.46	76.8%
7.64	3.09	5.17	67.4%
7.66	3.09	4.88	58.1%
7.68	3.09	4.60	48.8%
7.70	3.09	4.31	39.6%
7.72	3.09	4.04	30.6%
7.74	3.09	3.77	21.9%
7.76	3.09	3.53	14.3%
7.78	3.09	3.33	7.7%
7.79	3.09	3.23	4.4%
7.80	3.09	3.13	1.1%
7.81	3.09	3.03	-2.1%
7.82	3.09	2.93	-5.3%
7.83	3.09	2.83	-8.5%
7.84	3.09	2.73	-11.6%
7.85	3.09	2.63	-14.8%
7.86	3.09	2.54	-17.8%
7.87	3.09	2.44	-20.9%
7.88	3.09	2.35	-23.9%
7.90	3.09	2.17	-29.8%
7.92	3.09	1.99	-35.5%
7.94	3.09	1.82	-41.0%
7.96	3.09	1.66	-46.4%
7.98	3.09	1.50	-51.4%
8.00	3.09	1.36	-55.9%
8.02	3.09	1.24	-59.7%
8.04	3.09	1.14	-63.3%
8.06	3.09	1.04	-66.5%
8.08	3.09	0.94	-69.6%

WATERLINE AT ZERO
AREA ERROR = 7.804

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380657 4192250
XS NUMBER: 2 (Lower) 2018

Thorne-Zevenbergen D84 Correction Applied
User Supplied D84 = 0.31

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

Velocity based on test of R/D84>1

	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	6.90	15.56	1.05	1.45	16.39	17.04	100.0%	0.96	87.57	5.34
	6.90	15.55	1.05	1.45	16.33	17.04	100.0%	0.96	87.05	5.33
	6.95	15.50	1.00	1.40	15.56	16.92	99.3%	0.92	79.84	5.13
	7.00	15.45	0.96	1.35	14.78	16.81	98.6%	0.88	72.90	4.93
	7.05	15.40	0.91	1.30	14.01	16.69	97.9%	0.84	66.23	4.73
	7.10	15.35	0.86	1.25	13.24	16.57	97.2%	0.80	59.82	4.52
	7.15	15.30	0.82	1.20	12.47	16.46	96.6%	0.76	53.69	4.30
	7.20	15.25	0.77	1.15	11.71	16.34	95.9%	0.72	47.84	4.09
	7.25	15.20	0.72	1.10	10.95	16.23	95.2%	0.67	42.28	3.86
	7.30	15.15	0.67	1.05	10.19	16.11	94.5%	0.63	37.01	3.63
	7.35	15.10	0.62	1.00	9.43	15.99	93.8%	0.59	32.05	3.40
	7.40	15.05	0.58	0.95	8.68	15.88	93.2%	0.55	27.39	3.16
	7.45	15.00	0.53	0.90	7.93	15.76	92.5%	0.50	23.06	2.91
	7.50	14.94	0.48	0.85	7.18	15.64	91.8%	0.46	19.06	2.65
	7.55	14.77	0.44	0.80	6.44	15.41	90.4%	0.42	15.50	2.41
	7.60	14.59	0.39	0.75	5.70	15.19	89.1%	0.38	12.28	2.15
	7.65	14.41	0.35	0.70	4.98	14.96	87.8%	0.33	9.41	1.89
	7.70	14.08	0.30	0.65	4.26	14.58	85.6%	0.29	7.16	1.68
	7.75	10.39	0.35	0.60	3.60	10.83	63.6%	0.33	6.57	1.82
WL	7.80	10.00	0.31	0.55	3.09	10.41	61.0%	0.30	5.82	1.88
	7.85	9.56	0.27	0.50	2.60	9.93	58.3%	0.26	4.05	1.56
	7.90	8.89	0.24	0.45	2.14	9.22	54.1%	0.23	2.81	1.31
	7.95	8.24	0.21	0.40	1.71	8.53	50.0%	0.20	1.84	1.08
	8.00	6.08	0.22	0.35	1.34	6.33	37.1%	0.21	1.62	1.21
	8.05	4.94	0.22	0.30	1.07	5.13	30.1%	0.21	1.28	1.20
	8.10	4.38	0.19	0.25	0.83	4.53	26.6%	0.18	0.83	1.00
	8.15	3.85	0.16	0.20	0.63	3.96	23.2%	0.16	0.50	0.80
	8.20	3.70	0.12	0.15	0.44	3.78	22.1%	0.12	0.23	0.52
	8.25	3.46	0.08	0.10	0.26	3.51	20.6%	0.07	0.08	0.32
	8.30	3.08	0.03	0.05	0.09	3.11	18.2%	0.03	0.02	0.18

STREAM NAME: Carnero Creek
XS LOCATION: 13S 380657 4192250
XS NUMBER: 2 (Lower) 2018

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.22	cfs
CALCULATED FLOW (Qc)=	2.19	cfs
(Qm-Qc)/Qm * 100 =	1.5	%
MEASURED WATERLINE (WLm)=	7.83	ft
CALCULATED WATERLINE (WLc)=	7.80	ft
(WLm-WLc)/WLm * 100 =	0.3	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-9.3	%
MEAN VELOCITY=	0.71	ft/sec
MANNING'S N=	0.153	
SLOPE=	0.02682927	ft/ft
.4 * Qm =	0.9	cfs
2.5 * Qm=	5.6	cfs

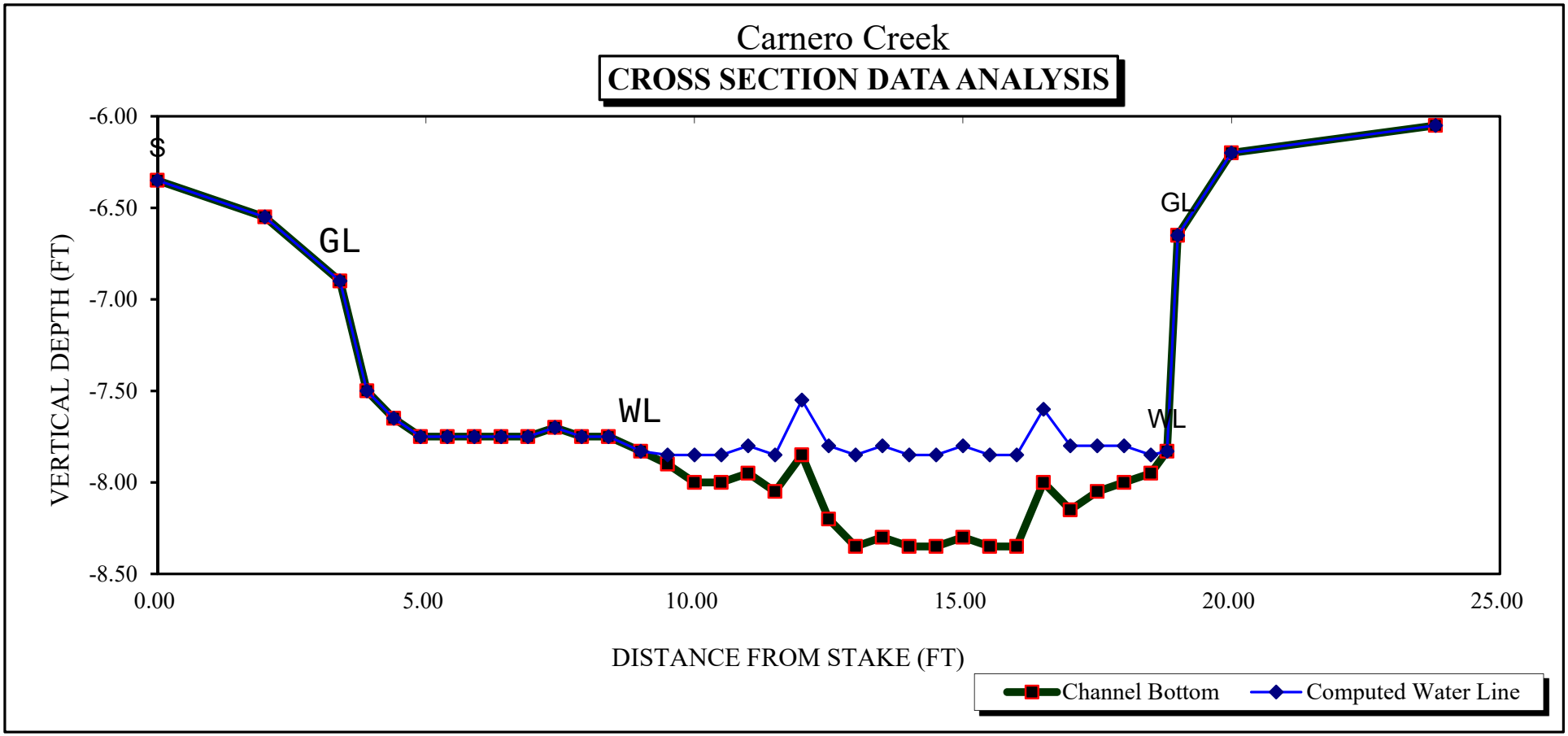
RECOMMENDED INSTREAM FLOW:
==========

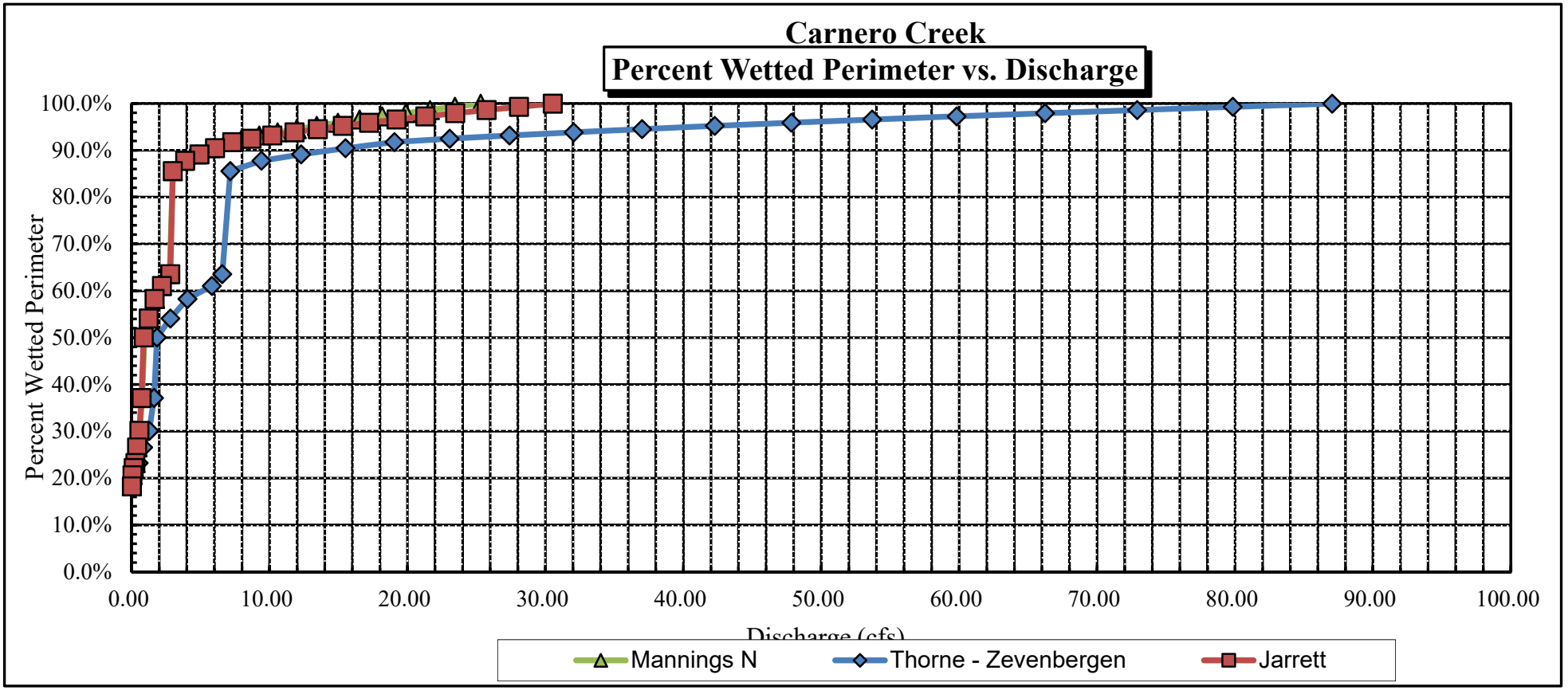
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

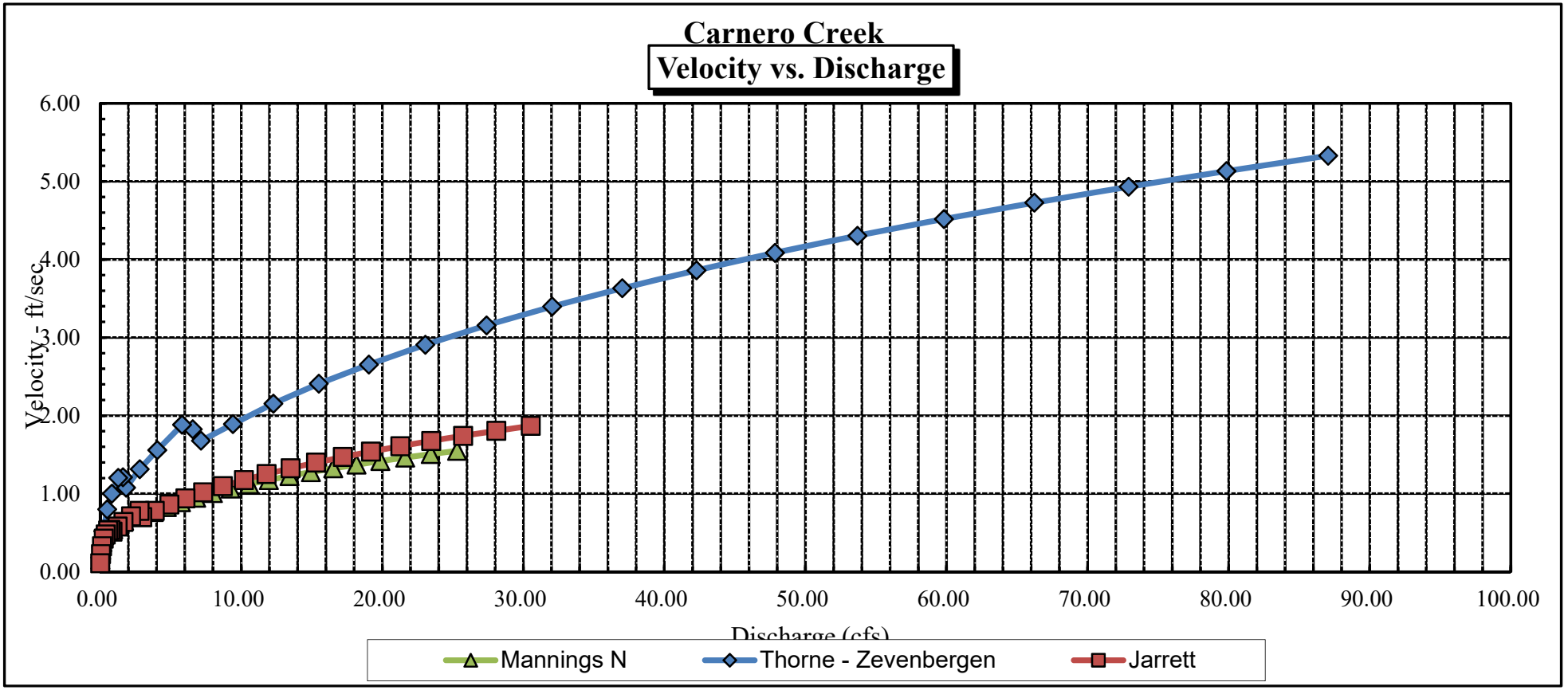
RATIONALE FOR RECOMMENDATION:
==========

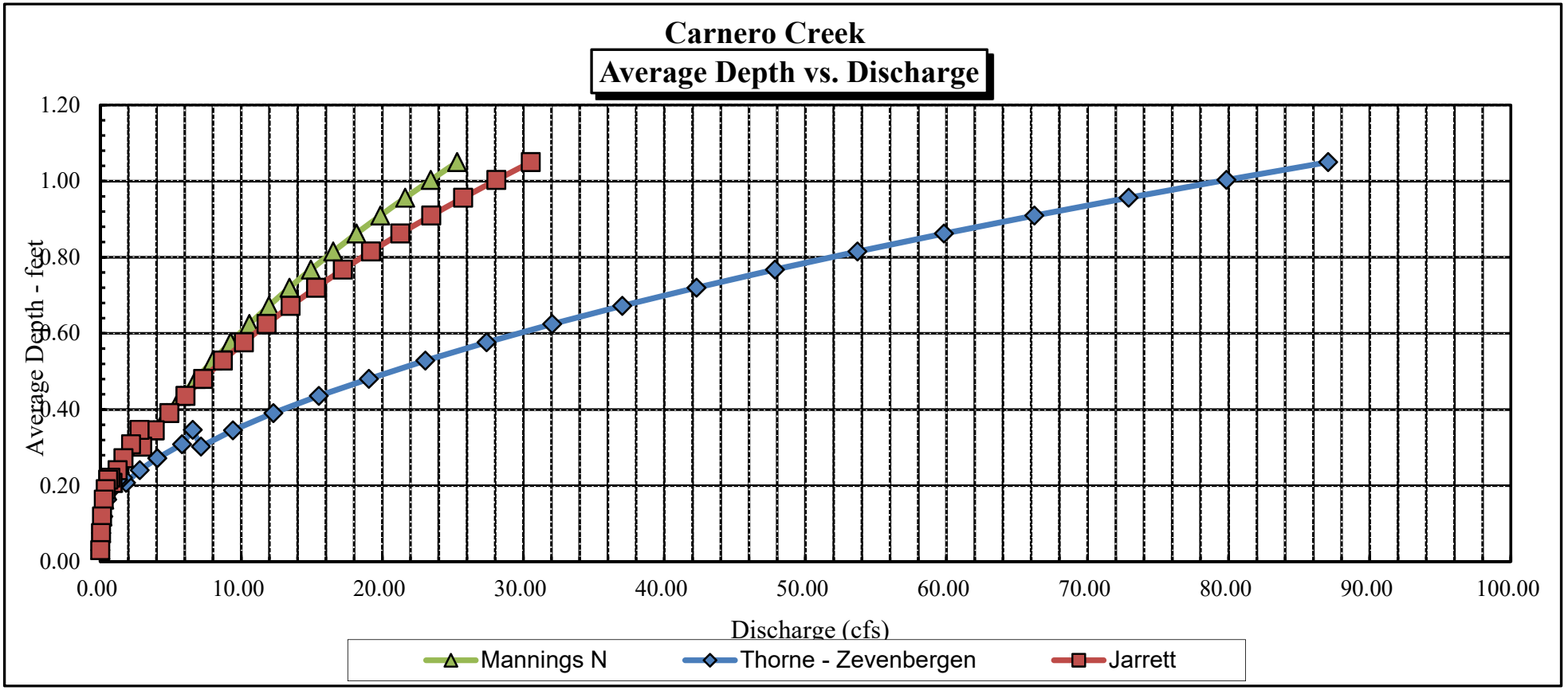
RECOMMENDATION BY: …… AGENCY…… DATE:……

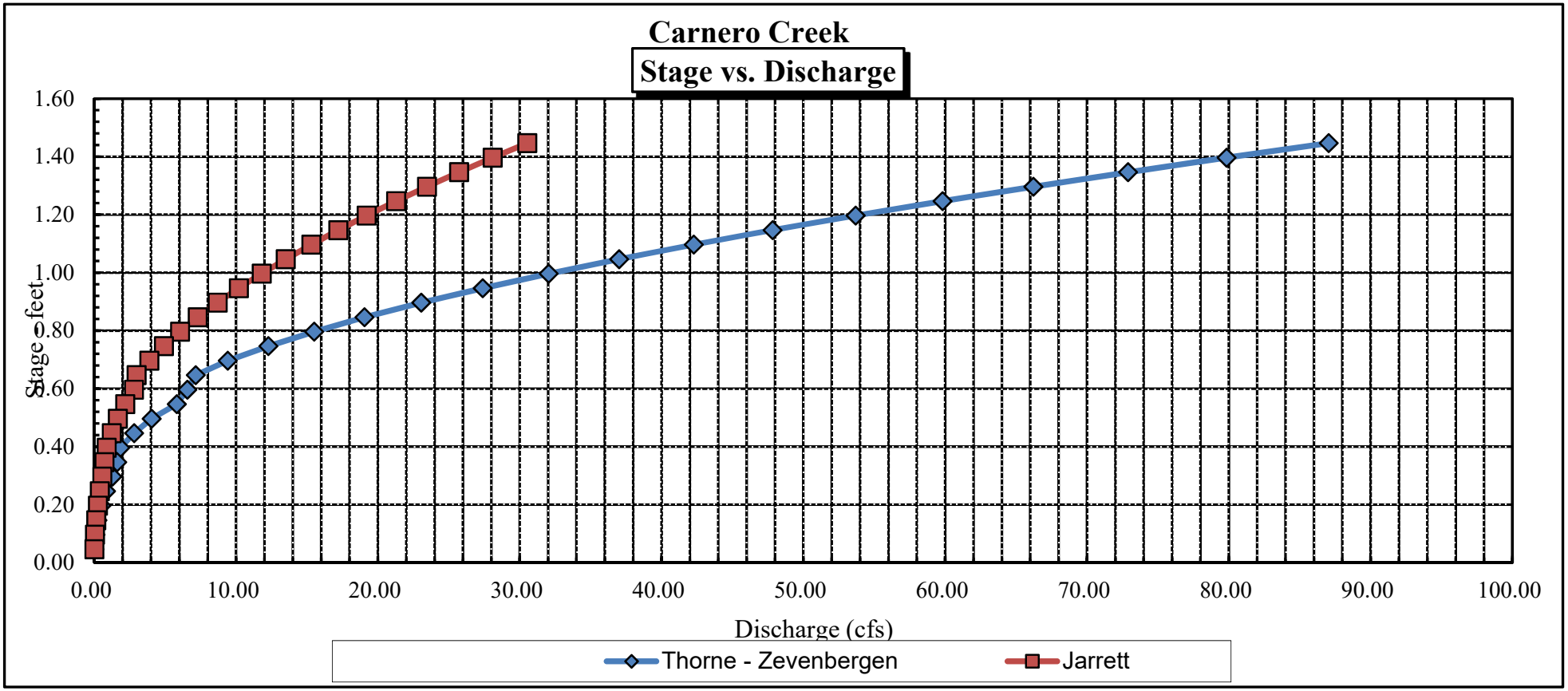
CWCB REVIEW BY: …… DATE:……


Carnero Creek
CROSS SECTION DATA ANALYSIS
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
VERTICAL DEPTH (FT)
S
GL
WL
WL
GL
0.00
5.00
10.00
15.00
20.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Carnero Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Velocity vs. Discharge
Velocity - ft/sec
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Carnero Creek
Stage vs. Discharge
Stage feet
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Carnero Creek
XS LOCATION:	13S 380657 4192250
XS NUMBER:	2 (Lower) 2018
DATE:	6/26/2018
OBSERVERS:	Skinner, Viehl, Birch
1/4 SEC:	
SECTION:	
TWP:	
RANGE:	
PM:	
COUNTY:	Saguache
WATERSHED:	Carnero Creek
DIVISION:	3
DOW CODE:	38770
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.026829268 ft / ft

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

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

Total Data Points = 37

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	S	0.00	6.35			0.00	0.00	0.00
		2.00	6.55			0.00	0.00	0.00
1	GL	3.40	6.90			0.00	0.00	0.00
		3.90	7.50			0.00	0.00	0.00
		4.40	7.65			0.00	0.00	0.00
		4.90	7.75			0.00	0.00	0.00
		5.40	7.75			0.00	0.00	0.00
		5.90	7.75			0.00	0.00	0.00
		6.40	7.75			0.00	0.00	0.00
		6.90	7.75			0.00	0.00	0.00
		7.40	7.70			0.00	0.00	0.00
		7.90	7.75			0.00	0.00	0.00
		8.40	7.75			0.00	0.00	0.00
	WL	9.00	7.83	0.00		0.00	0.00	0.00
		9.50	7.90	0.05	0.00	0.03	0.00	7.85
		10.00	8.00	0.15	0.20	0.08	0.02	7.85
		10.50	8.00	0.15	0.32	0.08	0.02	7.85
		11.00	7.95	0.15	0.63	0.08	0.05	7.80
		11.50	8.05	0.20	1.06	0.10	0.11	7.85
		12.00	7.85	0.30	0.91	0.15	0.14	7.55
		12.50	8.20	0.40	1.29	0.20	0.26	7.80
		13.00	8.35	0.50	1.42	0.25	0.36	7.85
		13.50	8.30	0.50	0.16	0.25	0.04	7.80
		14.00	8.35	0.50	0.68	0.25	0.17	7.85
		14.50	8.35	0.50	1.40	0.25	0.35	7.85
		15.00	8.30	0.50	0.89	0.25	0.22	7.80
		15.50	8.35	0.50	1.01	0.25	0.25	7.85
		16.00	8.35	0.50	0.41	0.25	0.10	7.85
		16.50	8.00	0.40	0.34	0.20	0.07	7.60
		17.00	8.15	0.35	0.34	0.18	0.06	7.80
		17.50	8.05	0.25	0.00	0.13	0.00	7.80
		18.00	8.00	0.20	0.18	0.10	0.02	7.80
		18.50	7.95	0.10	0.00	0.04	0.00	7.85
	WL	18.80	7.83	0.00		0.00	0.00	0.00
1	GL	19.00	6.65			0.00	0.00	0.00
		20.00	6.20			0.00	0.00	0.00
		23.80	6.05			0.00	0.00	0.00
					Totals	3.09	2.22	

Carnero Creek Cross Section 1, looking across from left bank.

Carnero Creek Cross Section 2, looking across from left bank.

Carnero Creek Cross Section 1, looking upstream

Carnero Creek Cross Section 1, looking downstream