

DRAFT RECOMMENDATION – SUBJECT TO CHANGE

Ms. Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right on Stout Creek, located in Water Division 2.

Location and Land Status. Stout Creek originates at Stout Creek Lakes in the Sangre de Christo Wilderness Area, approximately 7.0 miles southwest of the community of Howard. Stout Creek flows into the Arkansas River approximately 2.5 miles southwest of community of Howard. This recommendation addresses only the portion of Stout Creek that starts at the BLM – U.S. Forest Service boundary and ends at the headgate of the Woods Pasture Ditch, a distance of approximately 0.7 miles. The BLM manages 0.30 miles of this reach, and approximately 0.4 miles are in private ownership.

Existing Instream Flow Water Rights. In 1977, the Colorado Water Conservation Board appropriated an instream flow water right on Stout Creek that begins on at the outlet of Lower Stout Creek Lake and ends at the U.S. Forest Service boundary. The protected flow rate is 4.0 cfs, year round. The purpose of this recommendation is to extend instream flow protection from the BLM-Forest Service boundary across BLM lands and down to the first headgate that diverts water from Stout Creek. Protecting this additional segment of Stout Creek will provide protection for all parts of the creek that have unaltered natural hydrology.

Biological Summary. Stout Creek is a cold water, very high gradient stream. The reach that is the subject of this recommendation flows through alluvial fans on the northern slopes of the Sangre de Christo Range. This portion of Stout Creek has large substrate, with boulders up to four feet in diameter. The large substrate and steep gradient provide fish habitat consisting primarily of pools separated by large drops, with few riffles. Water quality is excellent for supporting salmonid fish species.

Fish surveys indicate that Stout Creek supports self-sustaining populations of brook trout and brown trout. (Stream to be resurveyed during summer 2018.) Spot surveys indicated abundant populations of stonefly and caddisfly.

The creek also supports a vigorous riparian community comprised of white fir, maple, and aspen. The riparian community provides ample cover and shading for the creek, and contributes to substantial to bank stability.

R2Cross Analysis. The BLM collected the following R2Cross data from Stout Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation	Summer Flow Recommendation
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			(meets 2 of 3 hydraulic criteria)	(meets 3 of 3 hydraulic criteria)
07/10/2017 #1	3.48 cfs	18.03 feet	1.54 cfs	3.43 cfs
07/10/2017 #2	3.48 cfs	12.60 feet	Out of range	3.48 cfs
Averages:			1.54 cfs	3.46 cfs

BLM's analysis of this data, coordinated with Colorado Parks and Wildlife, indicates that the following flows are needed to protect the natural environment to a reasonable degree.

3.45 cubic feet per second is recommended during the snowmelt runoff period from May 1 to June 30. This recommendation is driven by the average velocity criteria. Given the very small amount of riffle habitat in this reach, it is important to provide velocities that are suitable for spawning trout. (Check to see what species are in the creek and spawning at this time of year.)

1.5 cubic feet per second is recommended during summer, from July 1 to September 15. This recommendation is driven by the wetted perimeter criteria. This flow rate will maintain sufficient physical habitat in the creek for the fish population to complete important parts of their life cycle before cold temperatures reduce fish activity for the winter.

0.7 cubic feet per second is recommended from September 16 to April 30. This recommendation is driven by limited water availability. This flow rate should prevent complete icing of the numerous pools in this reach, allowing the fish population to overwinter.

Water Availability. The BLM recommends relying upon Streamstats for an indication of water availability, because this creek has not been historically gaged. The BLM does not recommend reliance upon stream gages located along the Arkansas River and other nearby Arkansas River tributaries as an indicator of water availability, because those gages are heavily influenced by reservoir operations and irrigation diversions.

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

Relationship to Land Management Plans. The BLM land use plan calls for managing this creek to support riparian, wildlife, and water quality values and to continue meeting land health standards. Establishing an instream flow water right would assist in meeting these objectives.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2018. We thank both Colorado Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

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

Sincerely,

Brian St. George
Deputy State Director
Resources and Fire

Cc: David Gilbert, Royal Gorge Field Office
Keith Berger, Royal Gorge Field Office
Thomas Heinlein, Rocky Mountain District Manager



FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER
CONSERVATION BOARD

LOCATION INFORMATION

COLORADO WATER CONSERVATION BOARD		LOCATION INFORMATION	
STREAM NAME: Stout Creek			CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: At BLM-USFS boundary			
13N 425087.8E 4248310.5N			
DATE: 7-10-17	OBSERVERS: R. Smith, D. Gilbert		
LEGAL DESCRIPTION	% SECTION: SW	SECTION: 27	TOWNSHIP: 48N/S
			RANGE: 10E/W
			PM: NM
COUNTY: Fremont	WATERSHED: Arkansas R.	WATER DIVISION: 2	DOW WATER CODE: 30952
MAP(S):	USGS:		
	USFS:		

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO		METER TYPE: <u>M-M</u>		<u>Surveyed</u>		<u>Surveyed</u>	
METER NUMBER: _____		DATE RATED: _____		CALIB/SPIN: _____ sec		TAPE WEIGHT: _____ lbs/foot	
CHANNEL BED MATERIAL SIZE RANGE: <u>4 in cobble - 4 ft boulders</u>		PHOTOGRAPHS TAKEN: ☒ YES ☐ NO		NUMBER OF PHOTOGRAPHS: <u>3</u>			

CHANNEL PROFILE DATA

STATION		DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗	Tape @ Stake LB	0.0	SUNNY
⊗	Tape @ Stake RB	0.0	SUNNY
①	WS @ Tape LB/RB	7.8 - 3.56 3.40	
②	WS Upstream	7.0	3.08
③	WS Downstream	22.0	6.32
SLOPE		$3.24 / 29.0 = 0.112$	

SKETCH

LEGEND:

Stake ⊗

Station ①

Photo ① →

Direction of Flow →

AQUATIC SAMPLING SUMMARY

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

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: *Stream bed armor; high density of two species of stonefly and one species of caddisfly (very shaded)*

COMMENTS

stream is sticking on right bank because of boulders
White Fir, Maple, Aspen riparian zone. Very steep channel
riffles difficult to find

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:

Shout Creek

CROSS-SECTION NO.:

1

DATE:

7-10

SHEET ____ OF ____

BEGINNING OF MEASUREMENT

EDGE OF WATER LOOKING DOWNSTREAM:
(0.0 AT STAKE)

LEFT / RIGHT

Gage Reading: ____ ft

TIME:

11:40 am

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)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
		2.0			2.57							
		2.5		2.74								
		3.5		2.94								
		6.2		3.22								
LW		7.8		3.55	0				0			
		8.7		3.65	0.1				0.76			
		9.2		3.65	0.1				0.89			
		9.6		3.85	0.3				2.05			
		10.0		3.85	0.3				1.35			
		10.4		3.85	0.3				1.09			
		10.8		3.80	0.25				1.82			
		11.2		3.95	0.4				0.58			
		11.6		3.95	0.4				0			
		12.0		3.95	0.4				0			
		12.4		3.85	0.3				0.06			
		12.8		4.0	0.45				0.25			
		13.2		4.0	0.45				0.53			
		13.6		3.65	0.1				0.47			
		14.0		3.85	0.3				0.41			
		14.4		4.05	0.5				0.80			
		14.7		4.05	0.5				0.85			
		15.0		4.00	0.45				1.07			
		15.3		3.90	0.35				0.54			
		15.6		3.90	0.35				1.26			
		15.9		4.00	0.45				2.13			
		16.2		3.80	0.4				1.52			
		16.5		3.75	0.35				2.34			
		16.8		3.75	0.35				1.58			
		17.1		3.70	0.3				1.34			
		17.4		3.75	0.35				1.47			
		17.7		3.85	0.45				1.23			
		18.0		3.80	0.4				1.52			
18.5		18.3		3.85	0.45				1.99			
RW		18.6	3.85	3.40	0	0.45			0	1.51		
		19.2		2.92								
G		20.1		2.54								
		23.0		2.46								
RS		25.0		2.46								

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: Stout Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1

DATE: 10-Jul-17
OBSERVERS: R. Smith, D. Gilbert

1/4 SEC: SW
SECTION: 27
TWP: 48N
RANGE: 10W
PM: NM

COUNTY: Fremont
WATERSHED: Arkansas R.
DIVISION: 4
DOW CODE: 30952

USGS MAP: 0
USFS MAP: 0

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: 0.112

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 1

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 LS & G	2.00	2.57		
	2.50	2.74		
	3.50	2.94		
	6.20	3.22		
LW	7.80	3.55	0.00	0.00
	8.70	3.65	0.10	0.76
	9.20	3.65	0.10	0.89
	9.60	3.85	0.30	2.05
	10.00	3.85	0.30	1.35
	10.40	3.85	0.30	1.09
	10.80	3.80	0.25	1.82
	11.20	3.95	0.40	0.58
	11.60	3.95	0.40	0.00
	12.00	3.95	0.40	0.00
	12.40	3.85	0.30	0.06
	12.80	4.00	0.45	0.25
	13.20	4.00	0.45	0.53
	13.60	3.65	0.10	0.47
	14.00	3.85	0.30	0.41
	14.40	4.05	0.50	0.80
	14.70	4.05	0.50	0.85
	15.00	4.00	0.45	1.07
	15.30	3.90	0.35	0.54
	15.60	3.90	0.35	1.26
	15.90	4.00	0.45	2.13
	16.20	3.80	0.40	1.52
	16.50	3.50	0.25	2.34
	16.80	3.75	0.35	1.58
	17.10	3.70	0.30	1.34
	17.40	3.75	0.35	1.47
	17.70	3.85	0.45	1.23
	18.00	3.80	0.40	1.52
	18.30	3.85	0.45	1.99
	18.50	3.85	0.45	1.51
RW	18.60	3.40	0.00	0.00
	19.20	2.92		
1 G	20.10	2.54		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.91	0.10	0.07	0.05	1.5%
0.50	0.10	0.05	0.04	1.1%
0.45	0.30	0.12	0.25	7.1%
0.40	0.30	0.12	0.16	4.6%
0.40	0.30	0.12	0.13	3.8%
0.40	0.25	0.10	0.18	5.2%
0.43	0.40	0.16	0.09	2.7%
0.40	0.40	0.16	0.00	0.0%
0.40	0.40	0.16	0.00	0.0%
0.41	0.30	0.12	0.01	0.2%
0.43	0.45	0.18	0.04	1.3%
0.40	0.45	0.18	0.10	2.7%
0.53	0.10	0.04	0.02	0.5%
0.45	0.30	0.12	0.05	1.4%
0.45	0.50	0.18	0.14	4.0%
0.30	0.50	0.15	0.13	3.7%
0.30	0.45	0.14	0.14	4.1%
0.32	0.35	0.11	0.06	1.6%
0.30	0.35	0.11	0.13	3.8%
0.32	0.45	0.14	0.29	8.3%
0.36	0.40	0.12	0.18	5.2%
0.42	0.25	0.08	0.18	5.0%
0.39	0.35	0.11	0.17	4.8%
0.30	0.30	0.09	0.12	3.5%
0.30	0.35	0.11	0.15	4.4%
0.32	0.45	0.14	0.17	4.8%
0.30	0.40	0.12	0.18	5.2%
0.30	0.45	0.11	0.22	6.4%
0.20	0.45	0.07	0.10	2.9%
0.46		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

11.85 0.5 3.43 3.48 100.0%
 (Max.)

Manning's n = 0.2142
 Hydraulic Radius= 0.28934909

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.43	3.83	11.6%
3.23	3.43	6.79	97.9%
3.25	3.43	6.54	90.6%
3.27	3.43	6.29	83.3%
3.29	3.43	6.04	76.2%
3.31	3.43	5.80	69.1%
3.33	3.43	5.56	62.1%
3.35	3.43	5.32	55.1%
3.37	3.43	5.08	48.2%
3.39	3.43	4.85	41.4%
3.41	3.43	4.62	34.7%
3.43	3.43	4.39	28.0%
3.44	3.43	4.28	24.7%
3.45	3.43	4.16	21.4%
3.46	3.43	4.05	18.1%
3.47	3.43	3.94	14.8%
3.48	3.43	3.83	11.6%
3.49	3.43	3.72	8.3%
3.50	3.43	3.60	5.1%
3.51	3.43	3.49	1.9%
3.52	3.43	3.39	-1.3%
3.53	3.43	3.28	-4.5%
3.55	3.43	3.06	-10.8%
3.57	3.43	2.85	-16.9%
3.59	3.43	2.64	-23.0%
3.61	3.43	2.44	-28.9%
3.63	3.43	2.24	-34.7%
3.65	3.43	2.05	-40.3%
3.67	3.43	1.86	-45.6%
3.69	3.43	1.69	-50.8%
3.71	3.43	1.52	-55.8%
3.73	3.43	1.35	-60.7%

WATERLINE AT ZERO
 AREA ERROR = 3.511

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 1

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	2.57	18.03	0.95	1.48	17.08	19.42	100.0%	0.88	36.40	2.13
	2.61	17.81	0.92	1.44	16.35	19.19	98.8%	0.85	34.11	2.09
	2.66	17.55	0.88	1.39	15.46	18.90	97.3%	0.82	31.40	2.03
	2.71	17.28	0.84	1.34	14.59	18.62	95.9%	0.78	28.80	1.97
	2.76	16.97	0.81	1.29	13.73	18.29	94.2%	0.75	26.34	1.92
	2.81	16.60	0.78	1.24	12.90	17.91	92.2%	0.72	24.05	1.87
	2.86	16.24	0.74	1.19	12.07	17.53	90.3%	0.69	21.87	1.81
	2.91	15.87	0.71	1.14	11.27	17.14	88.3%	0.66	19.79	1.76
	2.96	15.45	0.68	1.09	10.49	16.70	86.0%	0.63	17.86	1.70
	3.01	14.90	0.65	1.04	9.73	16.14	83.1%	0.60	16.12	1.66
	3.06	14.36	0.63	0.99	9.00	15.57	80.2%	0.58	14.49	1.61
	3.11	13.81	0.60	0.94	8.29	15.01	77.3%	0.55	12.97	1.56
	3.16	13.27	0.57	0.89	7.62	14.44	74.4%	0.53	11.54	1.52
	3.21	12.72	0.55	0.84	6.97	13.88	71.5%	0.50	10.22	1.47
	3.26	12.38	0.51	0.79	6.34	13.51	69.6%	0.47	8.89	1.40
	3.31	12.07	0.47	0.74	5.73	13.18	67.9%	0.43	7.63	1.33
	3.36	11.77	0.44	0.69	5.13	12.85	66.2%	0.40	6.46	1.26
	3.41	11.47	0.40	0.64	4.55	12.53	64.5%	0.36	5.38	1.18
	3.46	11.22	0.36	0.59	3.98	12.23	63.0%	0.33	4.38	1.10
WL	3.51	10.94	0.31	0.54	3.43	11.90	61.3%	0.29	3.47	1.01
	3.56	10.53	0.27	0.49	2.89	11.41	58.8%	0.25	2.69	0.93
	3.61	9.96	0.24	0.44	2.38	10.76	55.4%	0.22	2.02	0.85
	3.66	8.93	0.21	0.39	1.90	9.64	49.6%	0.20	1.50	0.79
	3.71	8.42	0.17	0.34	1.46	9.00	46.4%	0.16	1.01	0.69
	3.76	7.56	0.14	0.29	1.07	8.01	41.3%	0.13	0.65	0.61
	3.81	6.83	0.10	0.24	0.70	7.18	37.0%	0.10	0.35	0.49
	3.86	4.41	0.09	0.19	0.41	4.64	23.9%	0.09	0.19	0.46
	3.91	3.35	0.06	0.14	0.21	3.50	18.0%	0.06	0.08	0.36
	3.96	1.62	0.05	0.09	0.08	1.69	8.7%	0.05	0.02	0.30
	4.01	0.61	0.03	0.04	0.02	0.63	3.2%	0.03	0.00	0.22

STREAM NAME: Stout Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	3.48 cfs
CALCULATED FLOW (Qc)=	3.47 cfs
(Qm-Qc)/Qm * 100 =	0.3 %

MEASURED WATERLINE (W _{Lm})=	3.48 ft
CALCULATED WATERLINE (W _{Lc})=	3.51 ft
(W _{Lm} -W _{Lc})/W _{Lm} * 100 =	-1.0 %

MAX MEASURED DEPTH (Dm)=	0.50 ft
MAX CALCULATED DEPTH (Dc)=	0.54 ft
(Dm-Dc)/Dm * 100	-7.8 %

MEAN VELOCITY=	1.01 ft/sec
MANNING'S N=	0.214
SLOPE=	0.112 ft/ft

.4 * Qm =	1.4 cfs
2.5 * Qm=	8.7 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION.
=====

[illegible]

RECOMMENDATION BY: AGENCY DATE:

CWCB REVIEW BY: DATE:

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 1

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

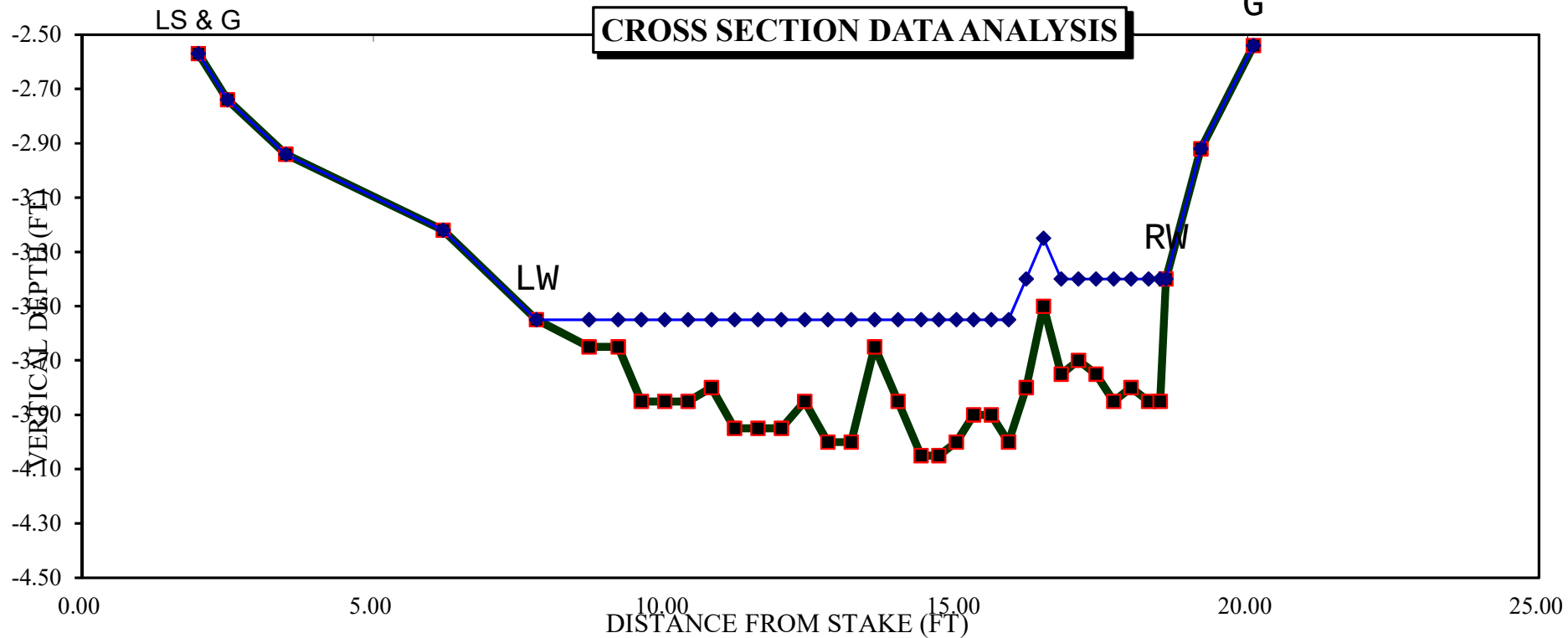
STAGING TABLE

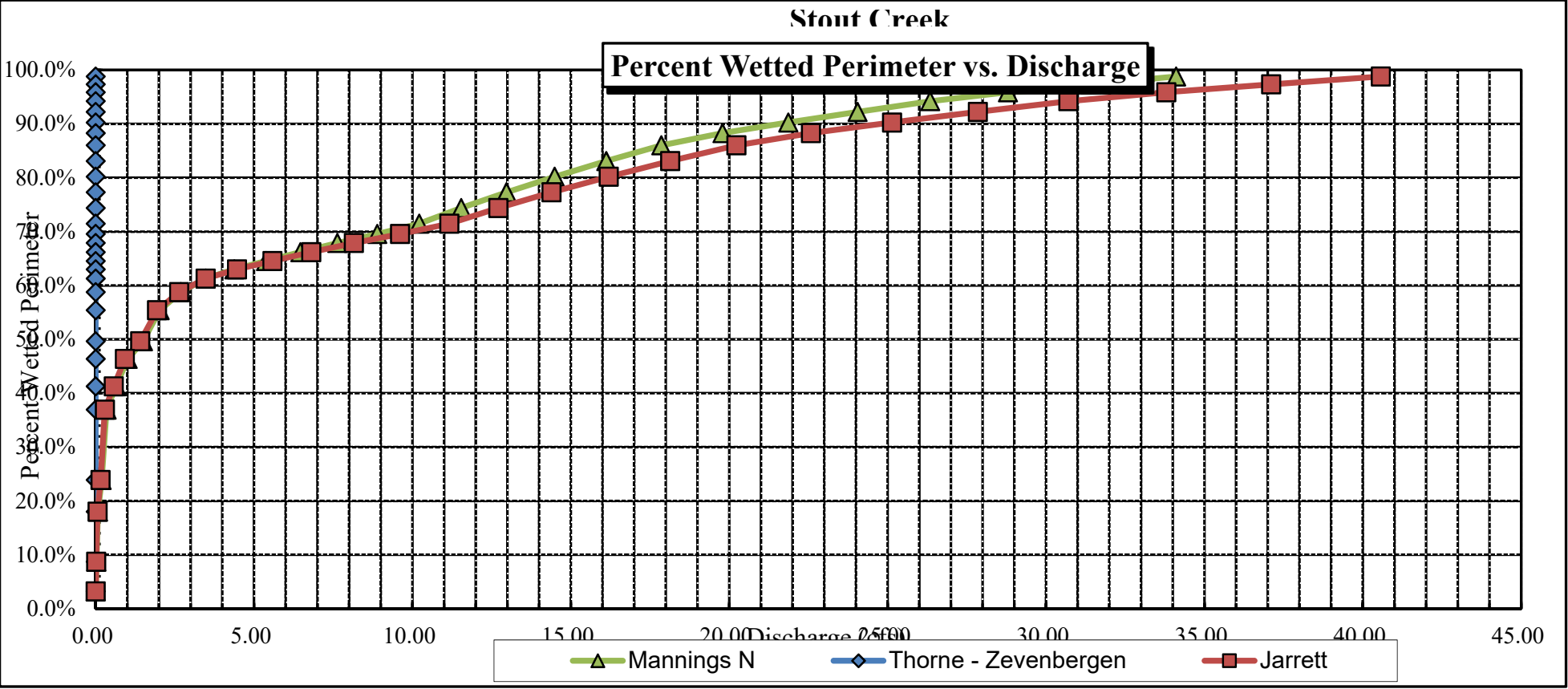
WL = Waterline corrected for variations in field measured water surface elevations and sag

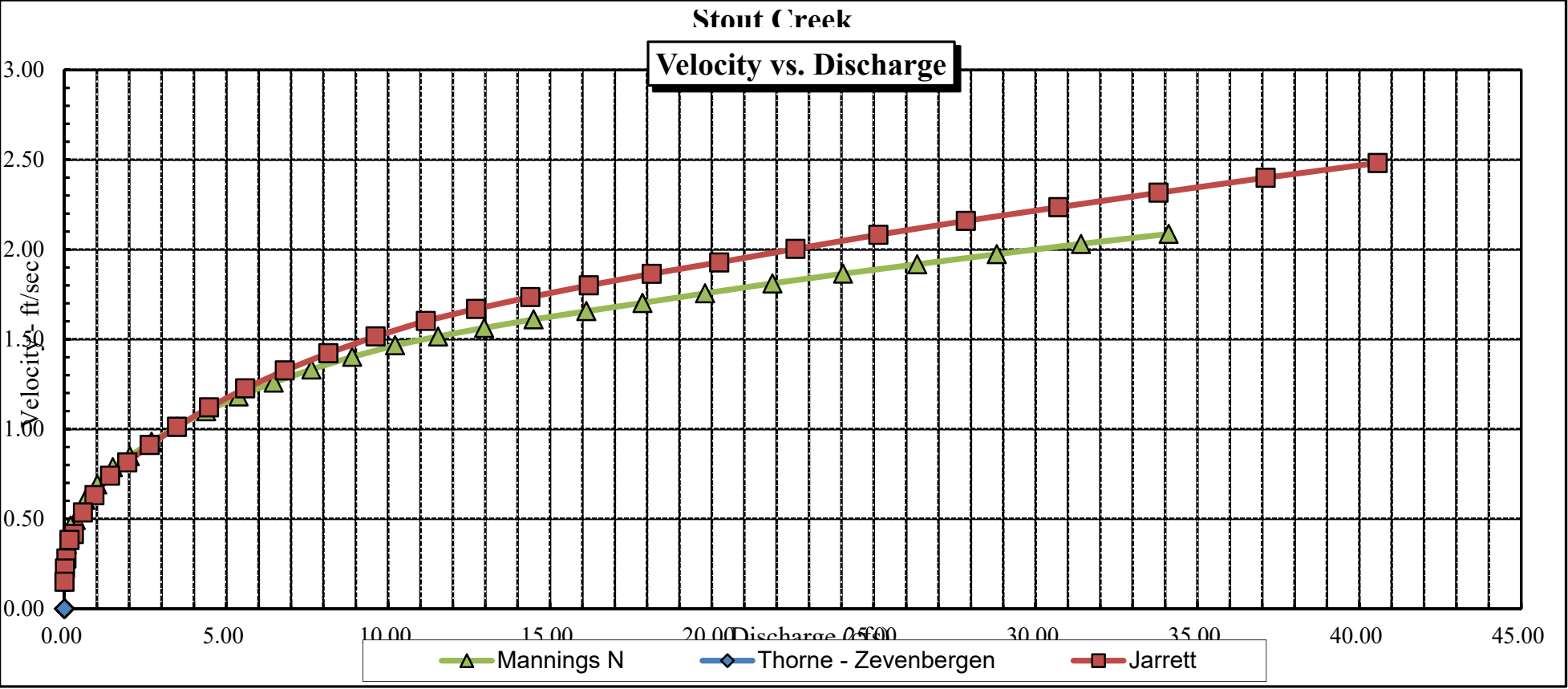
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	2.57	18.03	0.95	1.48	17.08	19.42	100.0%	0.88	43.52	2.55
	2.61	17.81	0.92	1.44	16.35	19.19	98.8%	0.85	40.57	2.48
	2.66	17.55	0.88	1.39	15.46	18.90	97.3%	0.82	37.11	2.40
	2.71	17.28	0.84	1.34	14.59	18.62	95.9%	0.78	33.80	2.32
	2.76	16.97	0.81	1.29	13.73	18.29	94.2%	0.75	30.70	2.24
	2.81	16.60	0.78	1.24	12.90	17.91	92.2%	0.72	27.85	2.16
	2.86	16.24	0.74	1.19	12.07	17.53	90.3%	0.69	25.14	2.08
	2.91	15.87	0.71	1.14	11.27	17.14	88.3%	0.66	22.58	2.00
	2.96	15.45	0.68	1.09	10.49	16.70	86.0%	0.63	20.22	1.93
	3.01	14.90	0.65	1.04	9.73	16.14	83.1%	0.60	18.14	1.86
	3.06	14.36	0.63	0.99	9.00	15.57	80.2%	0.58	16.20	1.80
	3.11	13.81	0.60	0.94	8.29	15.01	77.3%	0.55	14.39	1.74
	3.16	13.27	0.57	0.89	7.62	14.44	74.4%	0.53	12.71	1.67
	3.21	12.72	0.55	0.84	6.97	13.88	71.5%	0.50	11.16	1.60
	3.26	12.38	0.51	0.79	6.34	13.51	69.6%	0.47	9.61	1.52
	3.31	12.07	0.47	0.74	5.73	13.18	67.9%	0.43	8.15	1.42
	3.36	11.77	0.44	0.69	5.13	12.85	66.2%	0.40	6.81	1.33
	3.41	11.47	0.40	0.64	4.55	12.53	64.5%	0.36	5.58	1.23
	3.46	11.22	0.36	0.59	3.98	12.23	63.0%	0.33	4.47	1.12
WL	3.51	10.94	0.31	0.54	3.43	11.90	61.3%	0.29	3.47	1.01
	3.56	10.53	0.27	0.49	2.89	11.41	58.8%	0.25	2.64	0.91
	3.61	9.96	0.24	0.44	2.38	10.76	55.4%	0.22	1.94	0.81
	3.66	8.93	0.21	0.39	1.90	9.64	49.6%	0.20	1.41	0.74
	3.71	8.42	0.17	0.34	1.46	9.00	46.4%	0.16	0.92	0.63
	3.76	7.56	0.14	0.29	1.07	8.01	41.3%	0.13	0.57	0.54
	3.81	6.83	0.10	0.24	0.70	7.18	37.0%	0.10	0.29	0.42
	3.86	4.41	0.09	0.19	0.41	4.64	23.9%	0.09	0.16	0.38
	3.91	3.35	0.06	0.14	0.21	3.50	18.0%	0.06	0.06	0.28
	3.96	1.62	0.05	0.09	0.08	1.69	8.7%	0.05	0.02	0.22
	4.01	0.61	0.03	0.04	0.02	0.63	3.2%	0.03	0.00	0.15

Stout Creek

CROSS SECTION DATA ANALYSIS

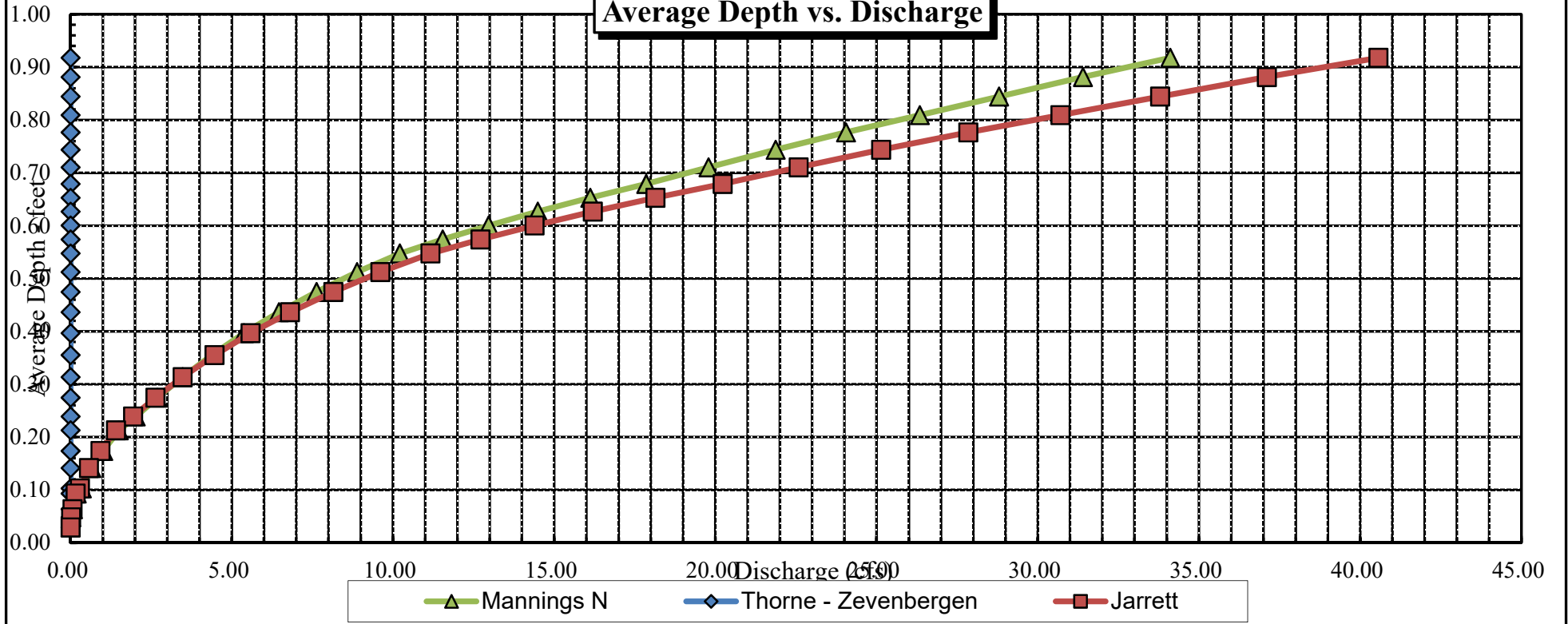


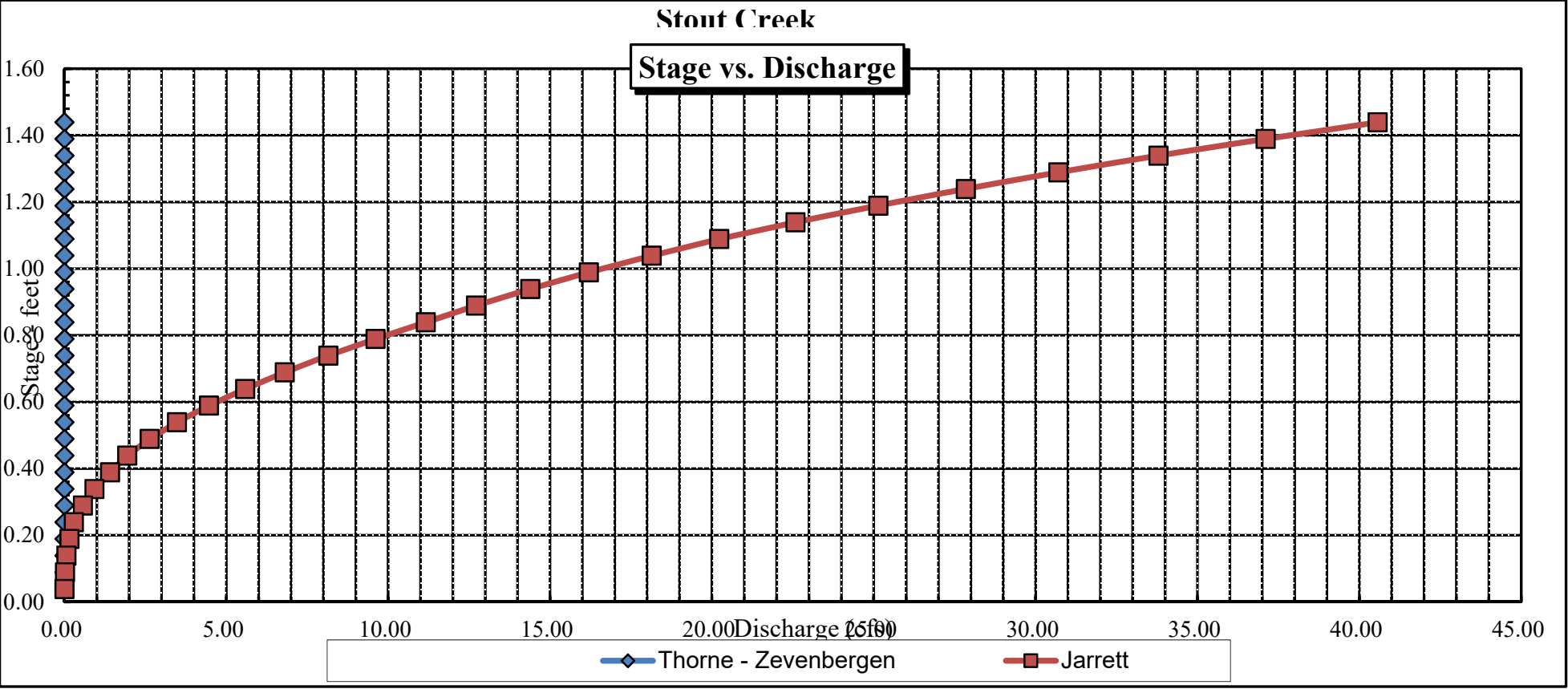




Stout Creek

Average Depth vs. Discharge





Data Input & Proofing

STREAM NAME:	Stout Creek
XS LOCATION:	At BLM-USFS boundary
XS NUMBER:	1
DATE:	7/10/2017
OBSERVERS:	R. Smith, D. Gilbert
1/4 SEC:	SW
SECTION:	27
TWP:	48N
RANGE:	10W
PM:	NM
COUNTY:	Fremont
WATERSHED:	Arkansas R.
DIVISION:	4
DOW CODE:	30952
USGS MAP:	
USFS MAP:	
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.112 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 = 37								
1	LS & G	2.00	2.57			0.00	0.00	0.00
		2.50	2.74			0.00	0.00	0.00
		3.50	2.94			0.00	0.00	0.00
		6.20	3.22			0.00	0.00	0.00
		7.80	3.55	0.00	0.00	0.00	0.00	0.00
		8.70	3.65	0.10	0.76	0.07	0.05	3.55
		9.20	3.65	0.10	0.89	0.05	0.04	3.55
		9.60	3.85	0.30	2.05	0.12	0.25	3.55
		10.00	3.85	0.30	1.35	0.12	0.16	3.55
		10.40	3.85	0.30	1.09	0.12	0.13	3.55
		10.80	3.80	0.25	1.82	0.10	0.18	3.55
		11.20	3.95	0.40	0.58	0.16	0.09	3.55
		11.60	3.95	0.40	0.00	0.16	0.00	3.55
		12.00	3.95	0.40	0.00	0.16	0.00	3.55
		12.40	3.85	0.30	0.06	0.12	0.01	3.55
		12.80	4.00	0.45	0.25	0.18	0.04	3.55
		13.20	4.00	0.45	0.53	0.18	0.10	3.55
		13.60	3.65	0.10	0.47	0.04	0.02	3.55
		14.00	3.85	0.30	0.41	0.12	0.05	3.55
		14.40	4.05	0.50	0.80	0.18	0.14	3.55
		14.70	4.05	0.50	0.85	0.15	0.13	3.55
		15.00	4.00	0.45	1.07	0.14	0.14	3.55
		15.30	3.90	0.35	0.54	0.11	0.06	3.55
		15.60	3.90	0.35	1.26	0.11	0.13	3.55
		15.90	4.00	0.45	2.13	0.14	0.29	3.55
		16.20	3.80	0.40	1.52	0.12	0.18	3.40
		16.50	3.50	0.25	2.34	0.08	0.18	3.25
		16.80	3.75	0.35	1.58	0.11	0.17	3.40
		17.10	3.70	0.30	1.34	0.09	0.12	3.40
		17.40	3.75	0.35	1.47	0.11	0.15	3.40
		17.70	3.85	0.45	1.23	0.14	0.17	3.40
		18.00	3.80	0.40	1.52	0.12	0.18	3.40
		18.30	3.85	0.45	1.99	0.11	0.22	3.40
		18.50	3.85	0.45	1.51	0.07	0.10	3.40
		18.60	3.40	0.00	0.00	0.00	0.00	0.00
		19.20	2.92			0.00	0.00	0.00
		20.10	2.54			0.00	0.00	0.00

Totals	3.43	3.48
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FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER
CONSERVATION BOARD

LOCATION INFORMATION

CONSERVATION BOARD										
STREAM NAME: <u>Stout Creek</u>								CROSS-SECTION NO.: <u>2</u>		
CROSS-SECTION LOCATION: <u>At BLM-USFS Boundary</u>										
<u>13N 425097.8E 4248312.8N</u>										
DATE: <u>7-10-17</u>		OBSERVERS: <u>R. Smith, B. Gilbert</u>								
LEGAL DESCRIPTION		1/4 SECTION: <u>SW</u>		SECTION: <u>27</u>		TOWNSHIP: <u>48N/S</u>		RANGE: <u>10E/W</u>		PM: <u>NM</u>
COUNTY: <u>Fremont</u>		WATERSHED: <u>Arkansas R.</u>			WATER DIVISION: <u>2</u>			DOW WATER CODE: <u>30952</u>		
MAP(S):		USGS:								
		USFS:								

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveied
⊗ Tape @ Stake RB	0.0	surveied
① WS @ Tape LB/RB	0.0	6.54/6.52
② WS Upstream	18.0	5.04
③ WS Downstream	6.5	6.68
SLOPE	$1.64 / 24.5 = .067$	

S K E T C H

LEGEND:

Stake ⊗

Station ①

Photo ◇ ① →

Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

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

stonefly, caddisfly

COMMENTS

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: Stout Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2

DATE: 10-Jul-17
OBSERVERS: R. Smith, D. Gilbert

1/4 SEC: SW
SECTION: 27
TWP: 48N
RANGE: 10E
PM: NM

COUNTY: Fremont
WATERSHED: Arkansas
DIVISION: 2
DOW CODE: 0

USGS MAP: 0
USFS MAP: 0

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: 0.067

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 2

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 LS & G	11.30	5.83		
	13.00	6.02		
	14.40	6.13		
LW	14.60	6.55	0.00	0.00
	15.00	6.75	0.20	0.44
	15.40	6.75	0.20	0.52
	15.80	6.80	0.25	0.66
	16.20	6.90	0.35	1.48
	16.60	6.90	0.35	1.78
	17.00	6.95	0.40	1.71
	17.40	6.95	0.40	1.44
	17.80	6.90	0.35	1.49
	18.20	7.00	0.45	1.56
	18.60	7.10	0.55	1.67
	19.00	6.95	0.40	0.78
	19.40	6.95	0.45	0.07
	19.80	6.90	0.40	0.00
	20.20	6.80	0.30	0.11
	20.60	6.90	0.40	0.00
	21.00	7.00	0.50	0.66
	21.40	7.05	0.55	2.46
	21.80	6.95	0.45	1.58
	22.20	7.00	0.50	1.36
	22.60	7.05	0.55	0.03
	23.00	6.95	0.45	0.69
	23.40	6.75	0.25	0.07
RW	23.70	6.50	0.00	0.00
	23.90	6.31		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.45	0.20	0.08	0.04	1.0%
0.40	0.20	0.08	0.04	1.2%
0.40	0.25	0.10	0.07	1.9%
0.41	0.35	0.14	0.21	6.0%
0.40	0.35	0.14	0.25	7.2%
0.40	0.40	0.16	0.27	7.9%
0.40	0.40	0.16	0.23	6.6%
0.40	0.35	0.14	0.21	6.0%
0.41	0.45	0.18	0.28	8.1%
0.41	0.55	0.22	0.37	10.6%
0.43	0.40	0.16	0.12	3.6%
0.40	0.45	0.18	0.01	0.4%
0.40	0.40	0.16	0.00	0.0%
0.41	0.30	0.12	0.01	0.4%
0.41	0.40	0.16	0.00	0.0%
0.41	0.50	0.20	0.13	3.8%
0.40	0.55	0.22	0.54	15.6%
0.41	0.45	0.18	0.28	8.2%
0.40	0.50	0.20	0.27	7.8%
0.40	0.55	0.22	0.01	0.2%
0.41	0.45	0.18	0.12	3.6%
0.45	0.25	0.09	0.01	0.2%
0.39		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

9.43 0.55 3.47 3.48 100.0%
 (Max.)

Manning's n = 0.1968
 Hydraulic Radius= 0.36761531

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.47	3.47	0.1%
6.28	3.47	5.79	67.0%
6.30	3.47	5.60	61.5%
6.32	3.47	5.41	56.1%
6.34	3.47	5.22	50.7%
6.36	3.47	5.04	45.3%
6.38	3.47	4.85	39.9%
6.40	3.47	4.66	34.5%
6.42	3.47	4.48	29.2%
6.44	3.47	4.29	23.8%
6.46	3.47	4.11	18.5%
6.48	3.47	3.93	13.2%
6.49	3.47	3.84	10.6%
6.50	3.47	3.74	8.0%
6.51	3.47	3.65	5.3%
6.52	3.47	3.56	2.7%
6.53	3.47	3.47	0.1%
6.54	3.47	3.38	-2.5%
6.55	3.47	3.29	-5.1%
6.56	3.47	3.20	-7.7%
6.57	3.47	3.11	-10.3%
6.58	3.47	3.02	-12.9%
6.60	3.47	2.84	-18.1%
6.62	3.47	2.66	-23.2%
6.64	3.47	2.49	-28.3%
6.66	3.47	2.31	-33.3%
6.68	3.47	2.14	-38.3%
6.70	3.47	1.97	-43.3%
6.72	3.47	1.80	-48.2%
6.74	3.47	1.63	-53.1%
6.76	3.47	1.46	-57.9%
6.78	3.47	1.30	-62.4%

WATERLINE AT ZERO

AREA ERROR = 6.525

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 2

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	5.83	12.60	0.83	1.27	10.52	13.29	100.0%	0.79	17.58	1.67
	5.88	12.19	0.82	1.22	9.95	12.88	96.9%	0.77	16.38	1.65
	5.93	11.75	0.80	1.17	9.36	12.43	93.5%	0.75	15.13	1.62
	5.98	11.30	0.78	1.12	8.78	11.98	90.2%	0.73	13.94	1.59
	6.03	10.83	0.76	1.07	8.23	11.51	86.6%	0.71	12.85	1.56
	6.08	10.20	0.76	1.02	7.70	10.87	81.8%	0.71	11.96	1.55
	6.13	9.56	0.75	0.97	7.21	10.23	77.0%	0.70	11.15	1.55
	6.18	9.48	0.71	0.92	6.73	10.12	76.2%	0.66	10.02	1.49
	6.23	9.45	0.66	0.87	6.26	10.07	75.8%	0.62	8.91	1.42
	6.28	9.43	0.61	0.82	5.79	10.01	75.3%	0.58	7.84	1.36
	6.33	9.39	0.57	0.77	5.32	9.93	74.8%	0.53	6.84	1.29
	6.38	9.31	0.52	0.72	4.85	9.81	73.8%	0.49	5.92	1.22
	6.43	9.24	0.47	0.67	4.38	9.68	72.8%	0.45	5.05	1.15
	6.48	9.16	0.43	0.62	3.92	9.55	71.9%	0.41	4.24	1.08
WL	6.53	9.08	0.38	0.57	3.47	9.42	70.9%	0.37	3.48	1.00
	6.58	8.96	0.34	0.52	3.02	9.26	69.7%	0.33	2.79	0.93
	6.63	8.80	0.29	0.47	2.57	9.07	68.2%	0.28	2.17	0.84
	6.68	8.64	0.25	0.42	2.14	8.88	66.8%	0.24	1.61	0.76
	6.73	8.48	0.20	0.37	1.71	8.69	65.4%	0.20	1.13	0.66
	6.78	7.75	0.17	0.32	1.30	7.93	59.7%	0.16	0.76	0.59
	6.83	7.15	0.13	0.27	0.93	7.31	55.0%	0.13	0.46	0.49
	6.88	6.45	0.09	0.22	0.59	6.58	49.5%	0.09	0.23	0.39
	6.93	4.84	0.06	0.17	0.30	4.94	37.2%	0.06	0.09	0.30
	6.98	2.52	0.05	0.12	0.12	2.59	19.5%	0.05	0.03	0.25
	7.03	1.09	0.02	0.07	0.03	1.12	8.4%	0.02	0.00	0.16
	7.08	0.16	0.01	0.02	0.00	0.17	1.3%	0.01	0.00	0.10

STREAM NAME: Stout Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)= 3.48 cfs
CALCULATED FLOW (Qc)= 3.48 cfs
(Qm-Qc)/Qm * 100 = -0.1 %

MEASURED WATERLINE (WLm)= 6.53 ft
CALCULATED WATERLINE (WLc)= 6.53 ft
(WLm-WLc)/WLm * 100 = 0.0 %

MAX MEASURED DEPTH (Dm)= 0.55 ft
MAX CALCULATED DEPTH (Dc)= 0.57 ft
(Dm-Dc)/Dm * 100 = -4.5 %

MEAN VELOCITY= 1.00 ft/sec
MANNING'S N= 0.197
SLOPE= 0.067 ft/ft

.4 * Qm = 1.4 cfs
2.5 * Qm= 8.7 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

RECOMMENDATION BY: AGENCY..... DATE:.....
CWCB REVIEW BY: DATE:.....

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 2

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

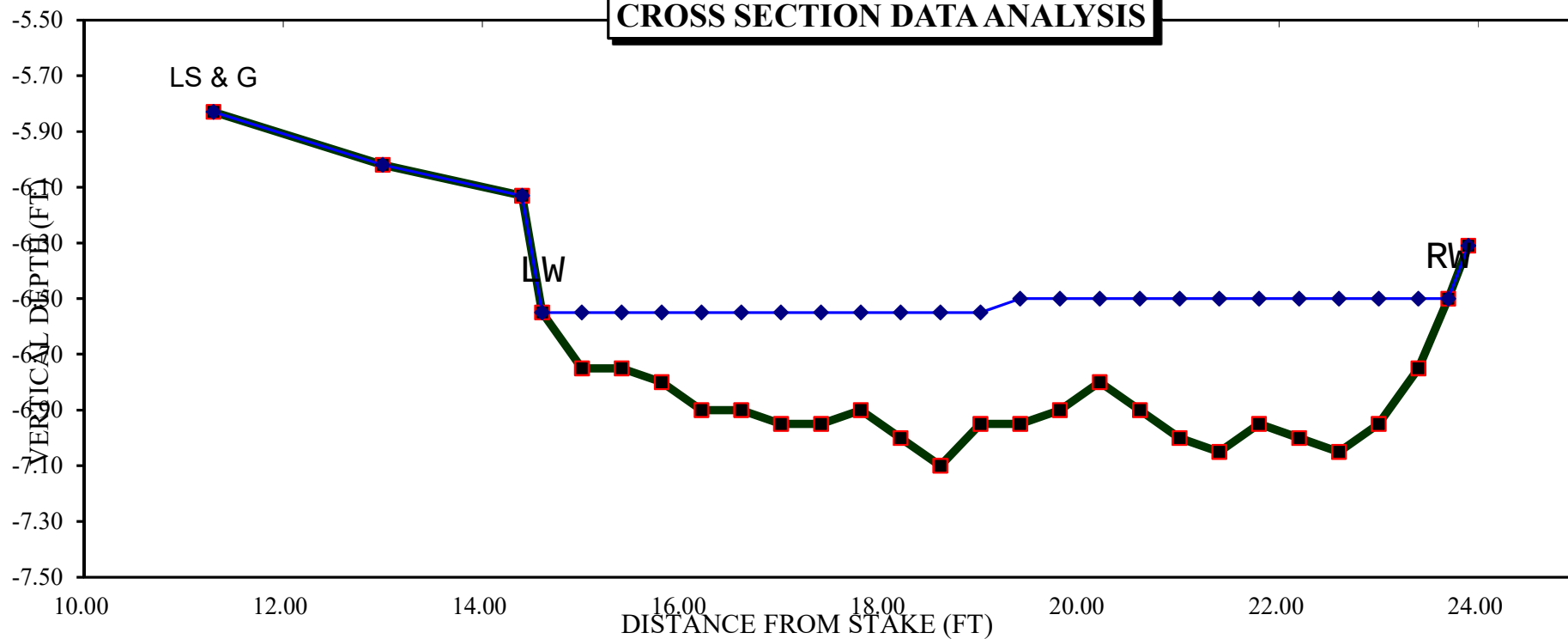
STAGING TABLE

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	5.83	12.60	0.83	1.27	10.52	13.29	100.0%	0.79	19.87	1.89
	5.88	12.19	0.82	1.22	9.95	12.88	96.9%	0.77	18.44	1.85
	5.93	11.75	0.80	1.17	9.36	12.43	93.5%	0.75	16.96	1.81
	5.98	11.30	0.78	1.12	8.78	11.98	90.2%	0.73	15.57	1.77
	6.03	10.83	0.76	1.07	8.23	11.51	86.6%	0.71	14.29	1.74
	6.08	10.20	0.76	1.02	7.70	10.87	81.8%	0.71	13.28	1.72
	6.13	9.56	0.75	0.97	7.21	10.23	77.0%	0.70	12.36	1.72
	6.18	9.48	0.71	0.92	6.73	10.12	76.2%	0.66	11.02	1.64
	6.23	9.45	0.66	0.87	6.26	10.07	75.8%	0.62	9.69	1.55
	6.28	9.43	0.61	0.82	5.79	10.01	75.3%	0.58	8.43	1.46
	6.33	9.39	0.57	0.77	5.32	9.93	74.8%	0.53	7.27	1.37
	6.38	9.31	0.52	0.72	4.85	9.81	73.8%	0.49	6.21	1.28
	6.43	9.24	0.47	0.67	4.38	9.68	72.8%	0.45	5.22	1.19
	6.48	9.16	0.43	0.62	3.92	9.55	71.9%	0.41	4.31	1.10
WL	6.53	9.08	0.38	0.57	3.47	9.42	70.9%	0.37	3.48	1.00
	6.58	8.96	0.34	0.52	3.02	9.26	69.7%	0.33	2.74	0.91
	6.63	8.80	0.29	0.47	2.57	9.07	68.2%	0.28	2.08	0.81
	6.68	8.64	0.25	0.42	2.14	8.88	66.8%	0.24	1.51	0.71
	6.73	8.48	0.20	0.37	1.71	8.69	65.4%	0.20	1.02	0.60
	6.78	7.75	0.17	0.32	1.30	7.93	59.7%	0.16	0.67	0.51
	6.83	7.15	0.13	0.27	0.93	7.31	55.0%	0.13	0.39	0.42
	6.88	6.45	0.09	0.22	0.59	6.58	49.5%	0.09	0.18	0.31
	6.93	4.84	0.06	0.17	0.30	4.94	37.2%	0.06	0.07	0.23
	6.98	2.52	0.05	0.12	0.12	2.59	19.5%	0.05	0.02	0.18
	7.03	1.09	0.02	0.07	0.03	1.12	8.4%	0.02	0.00	0.10
	7.08	0.16	0.01	0.02	0.00	0.17	1.3%	0.01	0.00	0.06

Stout Creek

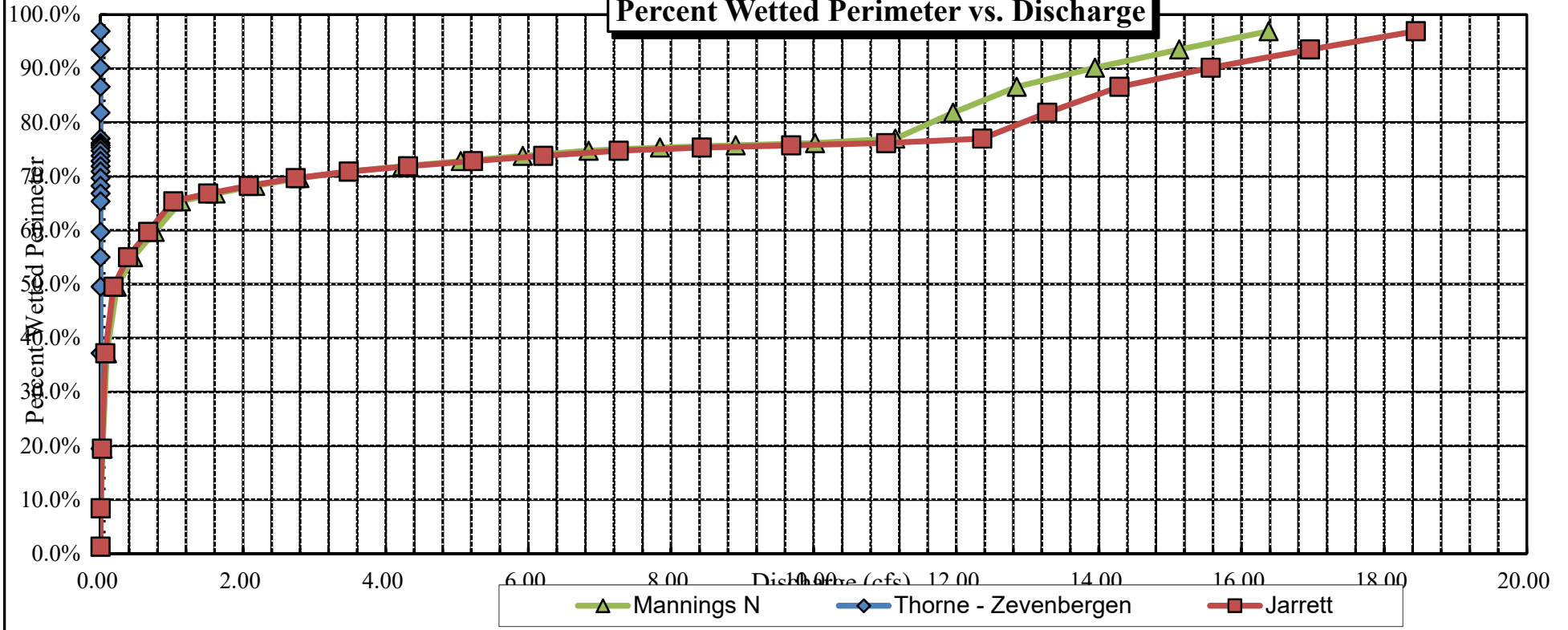
CROSS SECTION DATA ANALYSIS



Channel Bottom Computed Water Line

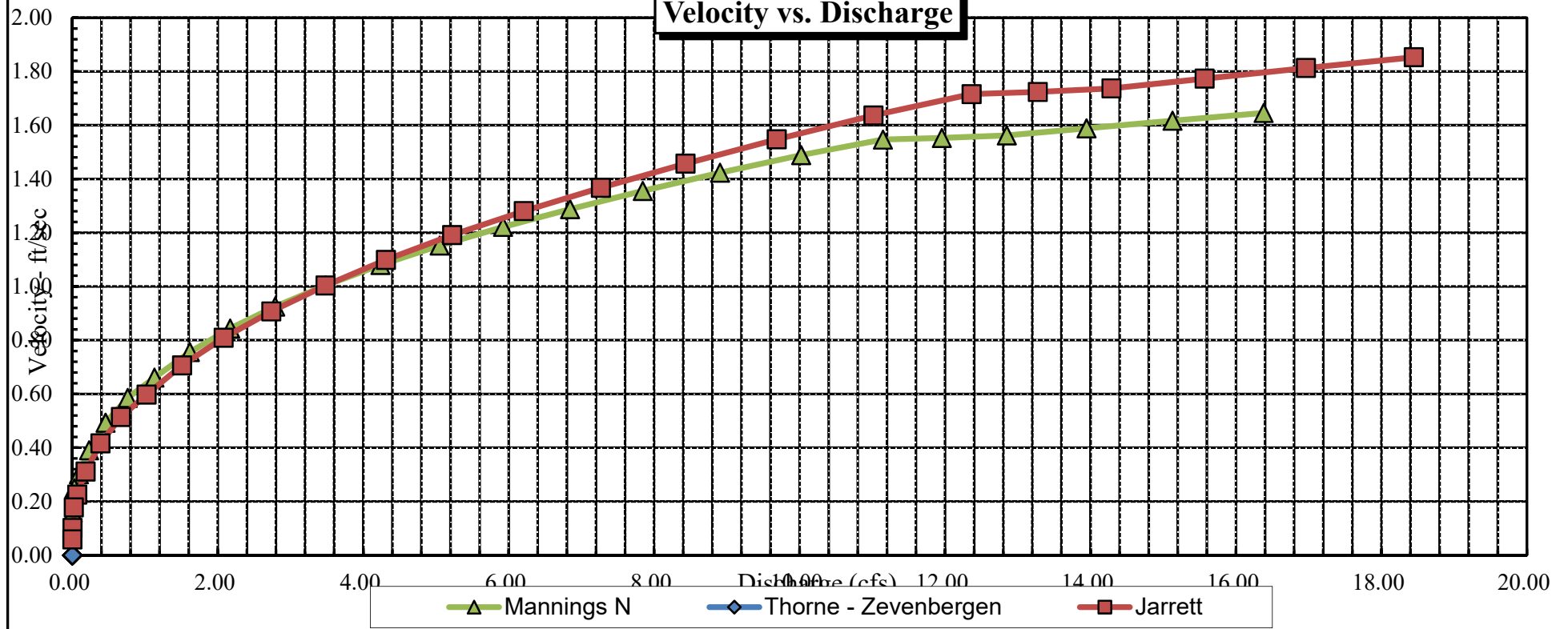
Stout Creek

Percent Wetted Perimeter vs. Discharge



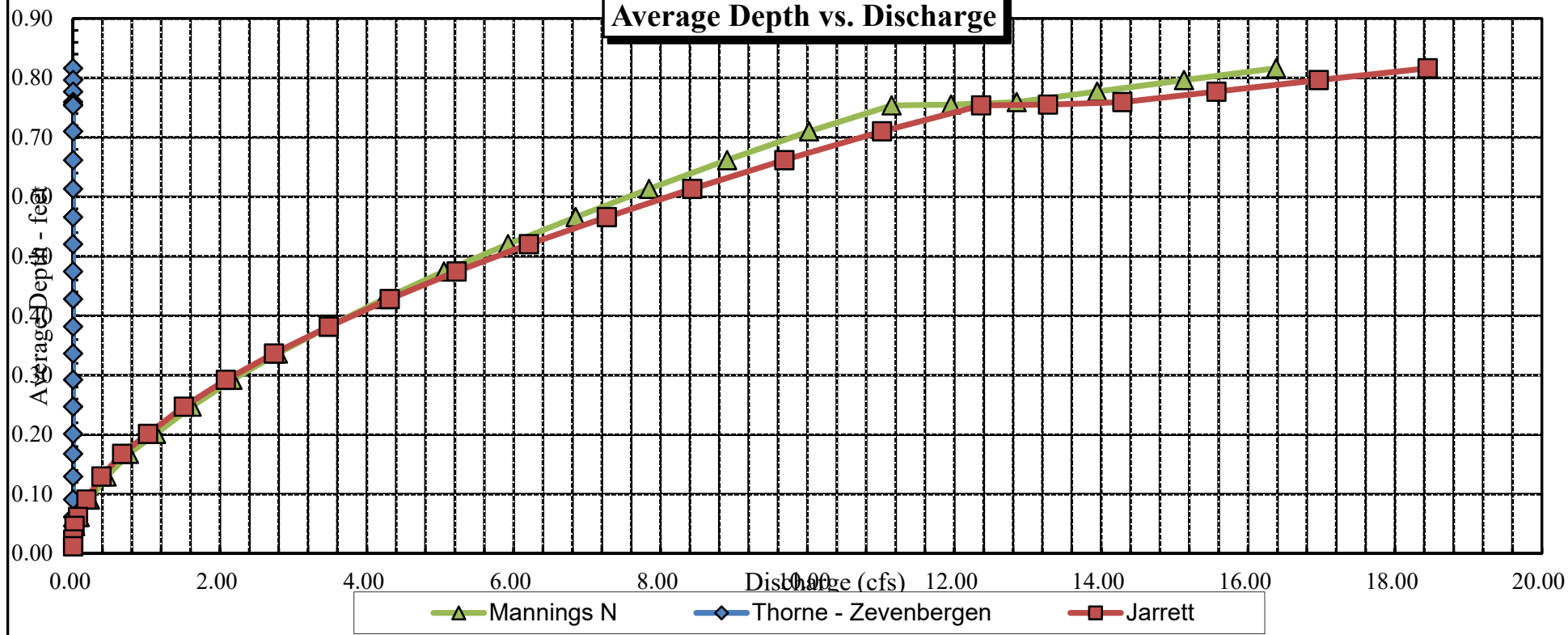
Stout Creek

Velocity vs. Discharge



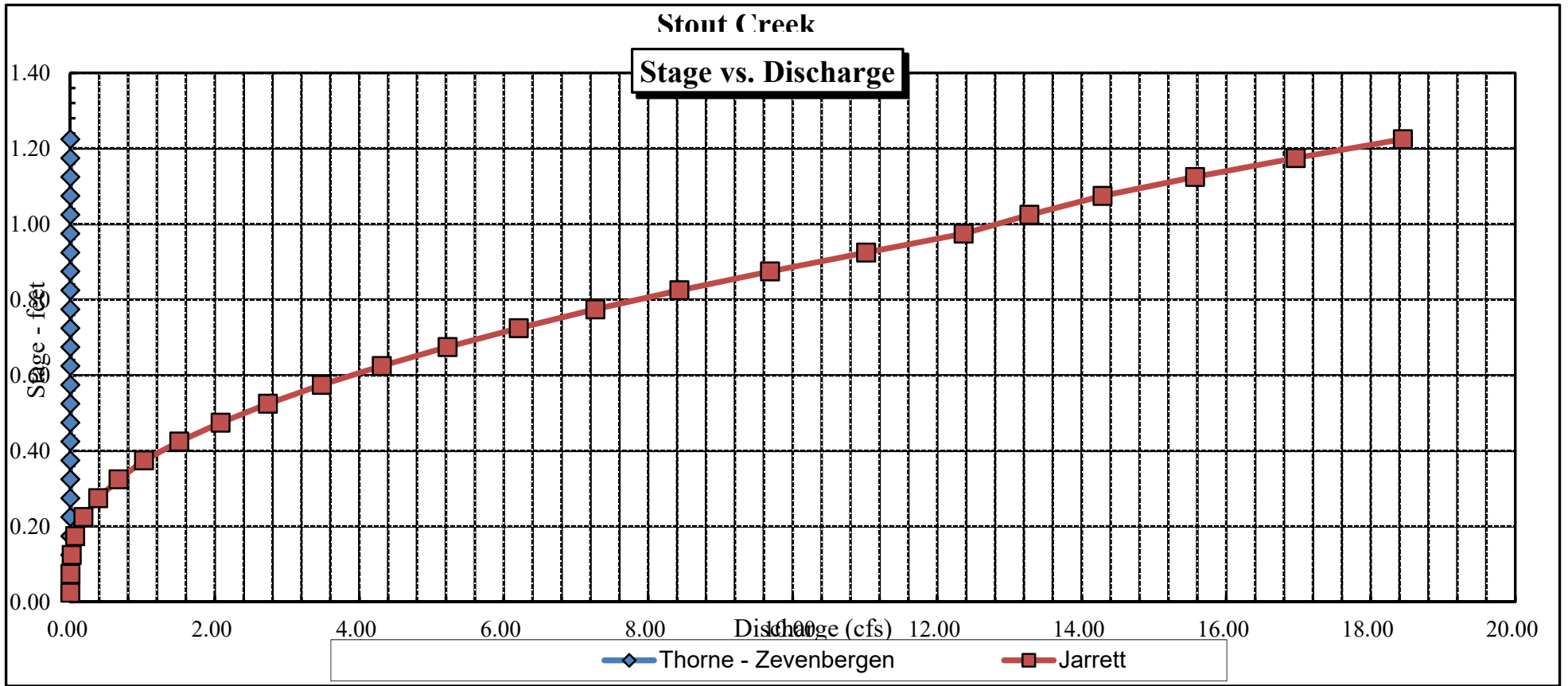
Stout Creek

Average Depth vs. Discharge



Stout Creek

Stage vs. Discharge



Data Input & Proofing

STREAM NAME: Stout Creek
 XS LOCATION: At BLM-USFS boundary
 XS NUMBER: 2
 DATE: 7/10/2017
 OBSERVERS: R. Smith, D. Gilbert

1/4 SEC: SW
 SECTION: 27
 TWP: 48N
 RANGE: 10E
 PM: NM

COUNTY: Fremont
 WATERSHED: Arkansas
 DIVISION: 2
 DOW CODE:
 USGS MAP:
 USFS MAP:

TAPE WT: 0.0106 lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.067 ft / ft

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

ASSIGNED TO:DATE.....

GL=1 FEATURE

VERT	WATER								Tape to
DEPTH	DEPTH	VEL	A	Q	Water				
Total Data Points = 28									
11.30	5.83		0.00	0.00	0.00				
13.00	6.02		0.00	0.00	0.00				
14.40	6.13		0.00	0.00	0.00				
14.60	6.55	0.00	0.00	0.00	0.00				
15.00	6.75	0.20	0.44	0.08	0.04	6.55			
15.40	6.75	0.20	0.52	0.08	0.04	6.55			
15.80	6.80	0.25	0.66	0.10	0.07	6.55			
16.20	6.90	0.35	1.48	0.14	0.21	6.55			
16.60	6.90	0.35	1.78	0.14	0.25	6.55			
17.00	6.95	0.40	1.71	0.16	0.27	6.55			
17.40	6.95	0.40	1.44	0.16	0.23	6.55			
17.80	6.90	0.35	1.49	0.14	0.21	6.55			
18.20	7.00	0.45	1.56	0.18	0.28	6.55			
18.60	7.10	0.55	1.67	0.22	0.37	6.55			
19.00	6.95	0.40	0.78	0.16	0.12	6.55			
19.40	6.95	0.45	0.07	0.18	0.01	6.50			
19.80	6.90	0.40	0.00	0.16	0.00	6.50			
20.20	6.80	0.30	0.11	0.12	0.01	6.50			
20.60	6.90	0.40	0.00	0.16	0.00	6.50			
21.00	7.00	0.50	0.66	0.20	0.13	6.50			
21.40	7.05	0.55	2.46	0.22	0.54	6.50			
21.80	6.95	0.45	1.58	0.18	0.28	6.50			
22.20	7.00	0.50	1.36	0.20	0.27	6.50			
22.60	7.05	0.55	0.03	0.22	0.01	6.50			
23.00	6.95	0.45	0.69	0.18	0.12	6.50			
23.40	6.75	0.25	0.07	0.09	0.01	6.50			
23.70	6.50	0.00	0.00	0.00	0.00	0.00			
23.90	6.31		0.00	0.00	0.00	0.00			
25.50	6.13								

Totals	3.47	3.48
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