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 Cold Spring Creek, located in Water Division 4.

Location and Land Status. Cold Spring Creek originates approximately 4.0 miles south of McDonough Reservoir, and flows into Cochetopa Creek approximately 4.0 miles southwest of Dome Lake State Wildlife Area. This recommendation addresses only the portion of Cold Spring Creek that is perennial. The perennial reach begins at Amala Spring, located in the NW ¼ SW ¼, Section 20, T45N R2E, New Mexico P.M., and extends downstream to the confluence with Cochetopa Creek, a distance of approximately 1.22 stream miles. The BLM manages 0.47 miles of this reach, and approximately 0.75 miles are in private ownership.

Biological Summary. Cold Spring Creek is a moderate gradient stream that flows through a shallow valley approximately averaging one-eighth mile in width. The upper part of the reach has large substrate, including many boulders. The lower part of reach has small substrate consisting of sands and gravels.

Cold Spring Creek supports a natural environment that is highly reliant on consistent discharge from Amala Spring. The creek is not known to support a fishery. However, the creek supports an abundant and diverse macroinvertebrate community, abundant aquatic vegetation such as watercress, and a very healthy riparian community that includes willow species, blue spruce, and gooseberry.

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

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
06/30/2016 #1	0.49 cfs	6.57 feet	0.43 cfs	Out of range
06/30/2016 #2	0.39 cfs	7.00 feet	0.40 cfs	Out of range
		Averages:	0.42 cfs	Out of range

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.

> 0.4 cubic feet per second is recommended during the snowmelt runoff period from May 1 to June 30. This recommendation is driven by the wetted perimeter criteria. The higher flows that occur during snowmelt recharge the alluvial

aquifer that supports the healthy riparian community.

0.25 cubic feet per second is recommended from July 1 to April 30. This recommendation is driven by limited water availability. Data from an installed pressure transducer demonstrates that spring discharge from Amala Spring is fairly consistent at approximately 0.25 cfs. The base flow provided by the spring maintains aquatic vegetation that requires consistent flow rates and high water quality. In addition, the consistent discharge of high quality water from the spring provides ideal macroinvertebrate habitat.

Water Availability. The hydrology of Cold Spring Creek is supported by a brief period of low elevation snowmelt runoff combined with extremely consistent discharge from Amala Spring, which supports base flows in the creek for the remainder of the year. The BLM recommends relying upon Streamstats for an indication of the magnitude and timing of snowmelt runoff. Data from a pressure transducer installed by the BLM and CWCB downstream from Amala Spring can provide an indication of base flows provided by Amala Spring. The BLM does not recommend reliance upon stream gages located along Cochetopa Creek as an indicator of water availability, because the hydrology of Cold Spring Creek is distinctive, with a combination of snowmelt and spring discharge.

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, and wildlife values and to continue meeting land health standards. (Andrew – do you have anything to add here?) 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: Elijah Waters, Gunnison Field Office
Andrew Breibart, Gunnison Field Office
Southwest District Manager

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Cold Spring Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 800 ft. downstream from Amala Spring (source of creek)						
DATE: 6-30-16	OBSERVERS: R. Smith, A. Breibart					
LEGAL DESCRIPTION	¼ SECTION: NW SE	SECTION: 20	TOWNSHIP: 45 (N)/S	RANGE: 2 (E)/W	PM: N.M.	
COUNTY: Saguache	WATERSHED: Cochetopa Ck.	WATER DIVISION: 4	DOW WATER CODE: none			
MAP(S): USGS:	Zone 13S 343641					
USFS:	Elev. 9675 4223334					

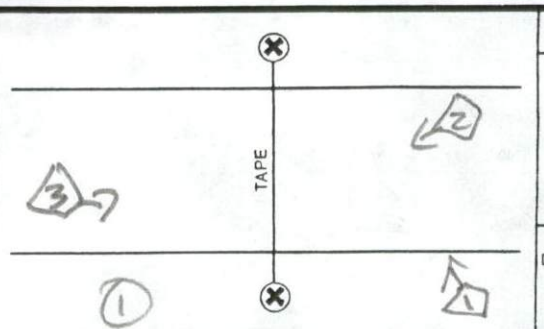
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 1-foot boulders	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	6.08 / 6.08
(2) WS Upstream	3.7'	6.06
(3) WS Downstream	13.2'	6.30
SLOPE	0.24 / 16.9' = 0.014	

SKETCH



LEGEND:
Stake (X)
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:
mayfly, caddisfly, stonefly

COMMENTS

Super abundant caddisfly + stonefly. Temp: 5.1° C
Riparian = Willow, Spruce, Gooseberry pH: 6.59
Abundant aquatic vegetation Cond: 100
Salinity = 0 ppt

FORM #USF-FD-1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cold Spring Creek	CROSS-SECTION NO.: 1	DATE: 6-30-16	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 11:15 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) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
RS/G	0.0		5.64						0.48 cfs		
	0.5		5.68								
	1.0		5.85								
	1.5		5.90								
	2.0		5.98								
	2.5		6.04								
W	3.1		6.15	ϕ				ϕ			
	3.4		6.30	.15				0.04			
	3.7		6.39	.24				0.22			
	4.0		6.42	.27				0.34			
	4.3		6.48	.33				0.62			
	4.6		6.51	.36				0.61			
	4.9		6.51	.36				0.64			
	5.2		6.48	.33				0.73			
	5.5		6.46	.31				0.89			
	5.8		6.47	.32				0.73			
	6.1		6.47	.32				0.24			
	6.4		6.44	.29				0.06			
W	6.6		6.15	ϕ				ϕ			
G	6.7		5.63								
	7.0		5.48								
	7.5		5.38								
	8.0		5.35								
	8.5		5.26								
	9.0		5.25								
LS	10.0		5.24								
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:	Cold Spring Creek
XS LOCATION:	800 ft. dwnstr from Amala Spring
XS NUMBER:	1
DATE:	30-Jun-16
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW SE
SECTION:	20
TWP:	45N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Cochetopa Creek
DIVISION:	4
DOW CODE:	none
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:	0.014

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

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

STREAM NAME: Cold Spring Creek
XS LOCATION: 800 ft. dwnstr from Amala Spring
XS NUMBER: 1

DATA POINTS= 25

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 RS & G	0.00	5.64			0.00		0.00	0.00	0.0%
	0.50	5.68			0.00		0.00	0.00	0.0%
	1.00	5.85			0.00		0.00	0.00	0.0%
	1.50	5.90			0.00		0.00	0.00	0.0%
	2.00	5.98			0.00		0.00	0.00	0.0%
	2.50	6.04			0.00		0.00	0.00	0.0%
W	3.10	6.15	0.00	0.00	0.00		0.00	0.00	0.0%
	3.40	6.30	0.15	0.04	0.34	0.15	0.05	0.00	0.4%
	3.70	6.39	0.24	0.22	0.31	0.24	0.07	0.02	3.2%
	4.00	6.42	0.27	0.34	0.30	0.27	0.08	0.03	5.6%
	4.30	6.48	0.33	0.62	0.31	0.33	0.10	0.06	12.4%
	4.60	6.51	0.36	0.61	0.30	0.36	0.11	0.07	13.3%
	4.90	6.51	0.36	0.64	0.30	0.36	0.11	0.07	14.0%
	5.20	6.48	0.33	0.73	0.30	0.33	0.10	0.07	14.6%
	5.50	6.46	0.31	0.89	0.30	0.31	0.09	0.08	16.8%
	5.80	6.47	0.32	0.73	0.30	0.32	0.10	0.07	14.2%
W	6.10	6.47	0.32	0.24	0.30	0.32	0.10	0.02	4.7%
	6.40	6.44	0.29	0.06	0.30	0.29	0.07	0.00	0.9%
	6.60	6.15	0.00	0.00	0.35		0.00	0.00	0.0%
1 G	6.70	5.65			0.00		0.00	0.00	0.0%
	7.00	5.48			0.00		0.00	0.00	0.0%
	7.50	5.38			0.00		0.00	0.00	0.0%
	8.00	5.35			0.00		0.00	0.00	0.0%
	8.50	5.26			0.00		0.00	0.00	0.0%
	9.00	5.25			0.00		0.00	0.00	0.0%
TOTALS ----------					3.71	0.36 (Max.)	0.97	0.49	100.0%

Manning's n = 0.1409
Hydraulic Radius= 0.26106346

STREAM NAME: Cold Spring Creek
XS LOCATION: 800 ft. dwnstr from Amala Spring
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.97	0.97	0.0%
5.90	0.97	2.04	110.7%
5.92	0.97	1.94	100.2%
5.94	0.97	1.84	90.0%
5.96	0.97	1.75	80.0%
5.98	0.97	1.65	70.3%
6.00	0.97	1.56	61.0%
6.02	0.97	1.47	51.9%
6.04	0.97	1.39	43.2%
6.06	0.97	1.31	34.9%
6.08	0.97	1.23	26.7%
6.10	0.97	1.15	18.8%
6.11	0.97	1.11	14.9%
6.12	0.97	1.08	11.1%
6.13	0.97	1.04	7.3%
6.14	0.97	1.00	3.6%
6.15	0.97	0.97	0.0%
6.16	0.97	0.93	-3.6%
6.17	0.97	0.90	-7.2%
6.18	0.97	0.87	-10.7%
6.19	0.97	0.83	-14.2%
6.20	0.97	0.80	-17.7%
6.22	0.97	0.73	-24.6%
6.24	0.97	0.67	-31.4%
6.26	0.97	0.60	-38.0%
6.28	0.97	0.54	-44.6%
6.30	0.97	0.47	-51.0%
6.32	0.97	0.41	-57.3%
6.34	0.97	0.35	-63.5%
6.36	0.97	0.30	-69.4%
6.38	0.97	0.24	-75.3%
6.40	0.97	0.19	-80.9%

WATERLINE AT ZERO
AREA ERROR = 6.150

STREAM NAME: Cold Spring Creek
XS LOCATION: 800 ft. dwnstr from Amala Spring
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	5.65	6.57	0.53	0.86	3.51	7.25	100.0%	0.48	2.70	0.77
	5.65	6.57	0.53	0.86	3.51	7.25	100.0%	0.48	2.70	0.77
	5.70	6.13	0.52	0.81	3.20	6.76	93.3%	0.47	2.42	0.76
	5.75	5.97	0.48	0.76	2.89	6.55	90.4%	0.44	2.09	0.72
	5.80	5.82	0.45	0.71	2.60	6.35	87.6%	0.41	1.79	0.69
	5.85	5.66	0.41	0.66	2.31	6.14	84.7%	0.38	1.50	0.65
	5.90	5.15	0.40	0.61	2.04	5.59	77.1%	0.37	1.30	0.64
	5.95	4.83	0.37	0.56	1.79	5.22	72.0%	0.34	1.10	0.61
	6.00	4.46	0.35	0.51	1.56	4.81	66.4%	0.32	0.92	0.59
	6.05	4.07	0.33	0.46	1.35	4.37	60.3%	0.31	0.77	0.57
	6.10	3.78	0.30	0.41	1.15	4.04	55.7%	0.28	0.62	0.54
WL	6.15	3.50	0.28	0.36	0.97	3.71	51.2%	0.26	0.49	0.51
	6.20	3.37	0.24	0.31	0.80	3.54	48.8%	0.23	0.37	0.46
	6.25	3.23	0.20	0.26	0.63	3.37	46.5%	0.19	0.26	0.41
	6.30	3.10	0.15	0.21	0.47	3.20	44.1%	0.15	0.17	0.35
	6.35	2.90	0.11	0.16	0.32	2.96	40.8%	0.11	0.09	0.29
	6.40	2.63	0.07	0.11	0.19	2.66	36.7%	0.07	0.04	0.21
	6.45	2.15	0.03	0.06	0.07	2.16	29.8%	0.03	0.01	0.12
	6.50	0.50	0.01	0.01	0.00	0.50	6.9%	0.01	0.00	0.05

STREAM NAME: Cold Spring Creek
XS LOCATION: 800 ft. dwnstr from Amala Spring
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.49	cfs
CALCULATED FLOW (Qc)=	0.49	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	6.15	ft
CALCULATED WATERLINE (WLc)=	6.15	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.36	ft
MAX CALCULATED DEPTH (Dc)=	0.36	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.51	ft/sec
MANNING'S N=	0.141	
SLOPE=	0.014	ft/ft
.4 * Qm =	0.2	cfs
2.5 * Qm=	1.2	cfs

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

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

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

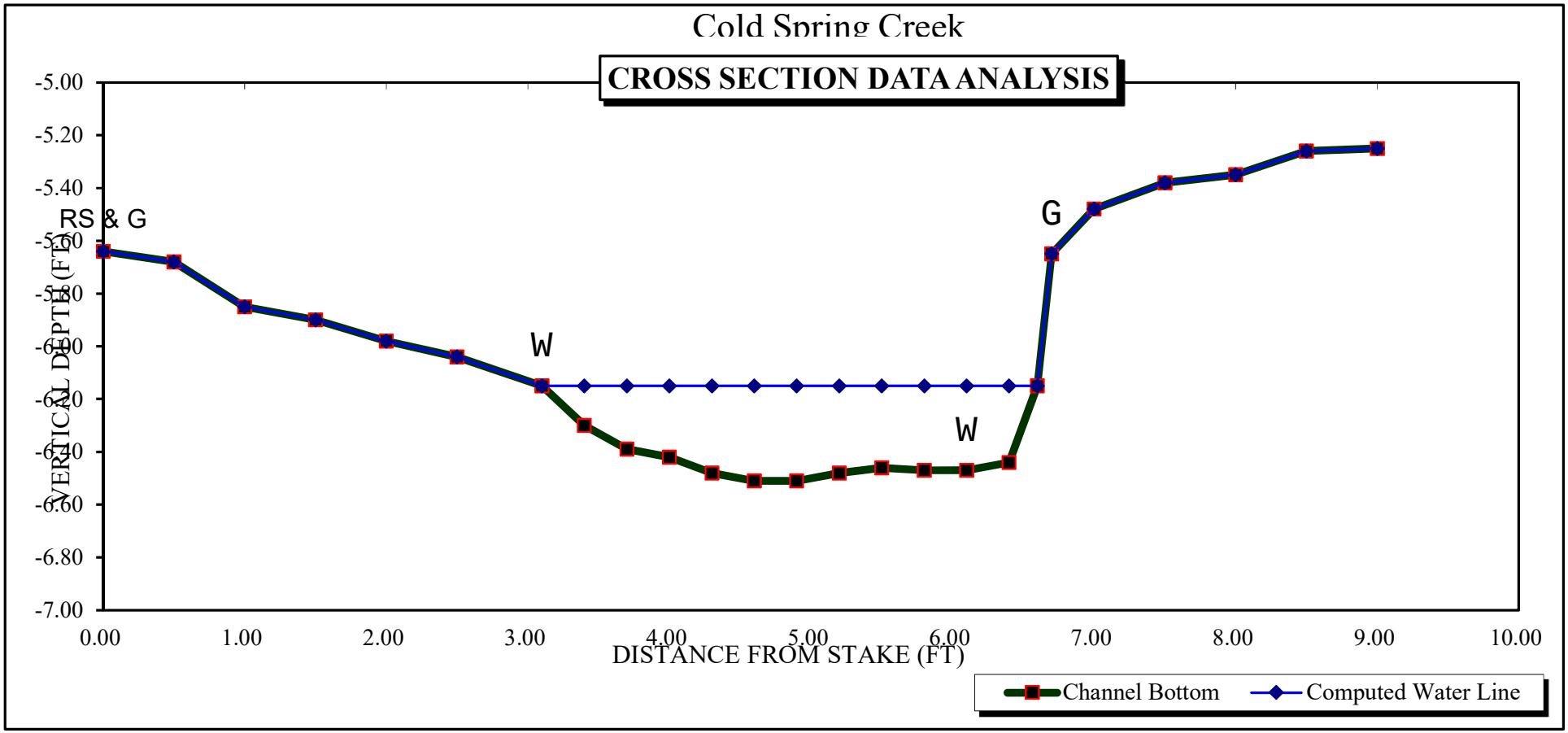
RECOMMENDATION BY: …….. AGENCY…….. DATE:……

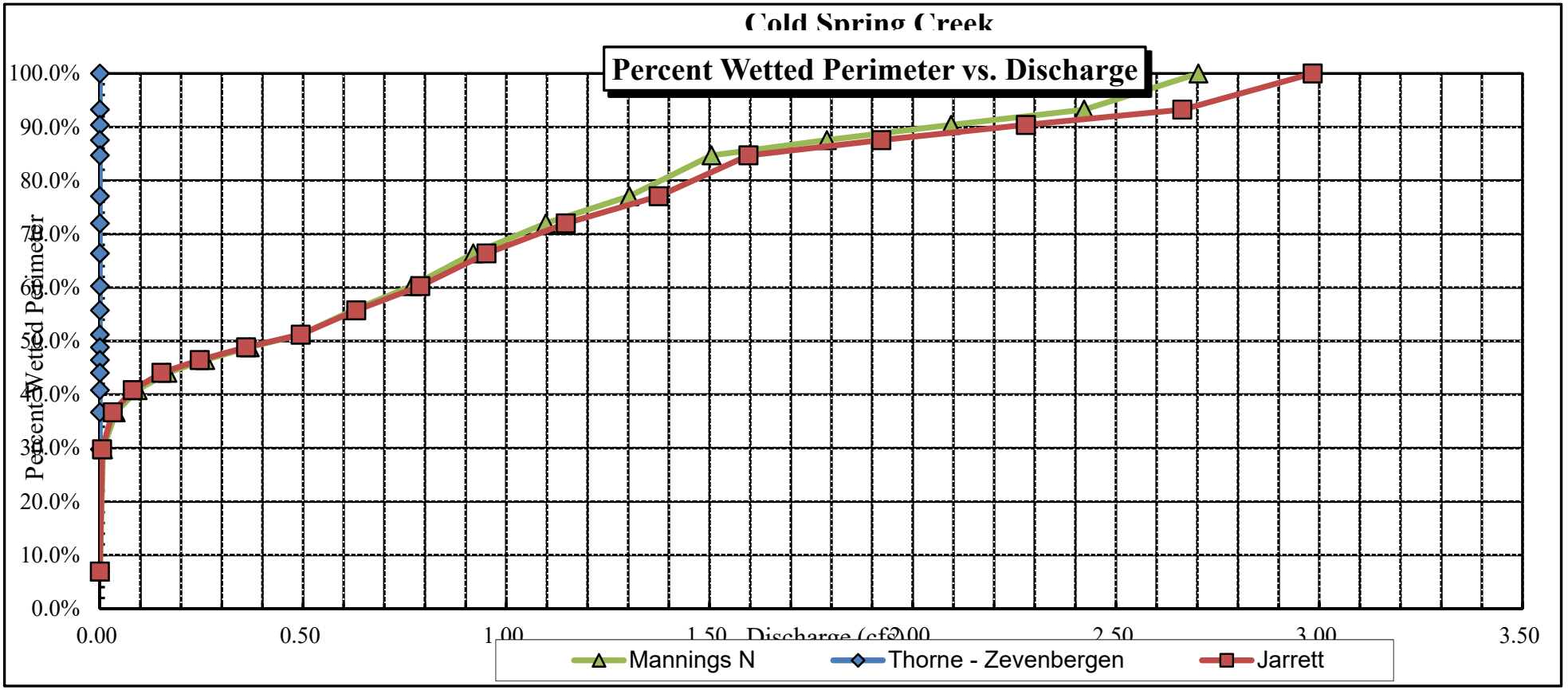
CWCB REVIEW BY: …….. DATE:……

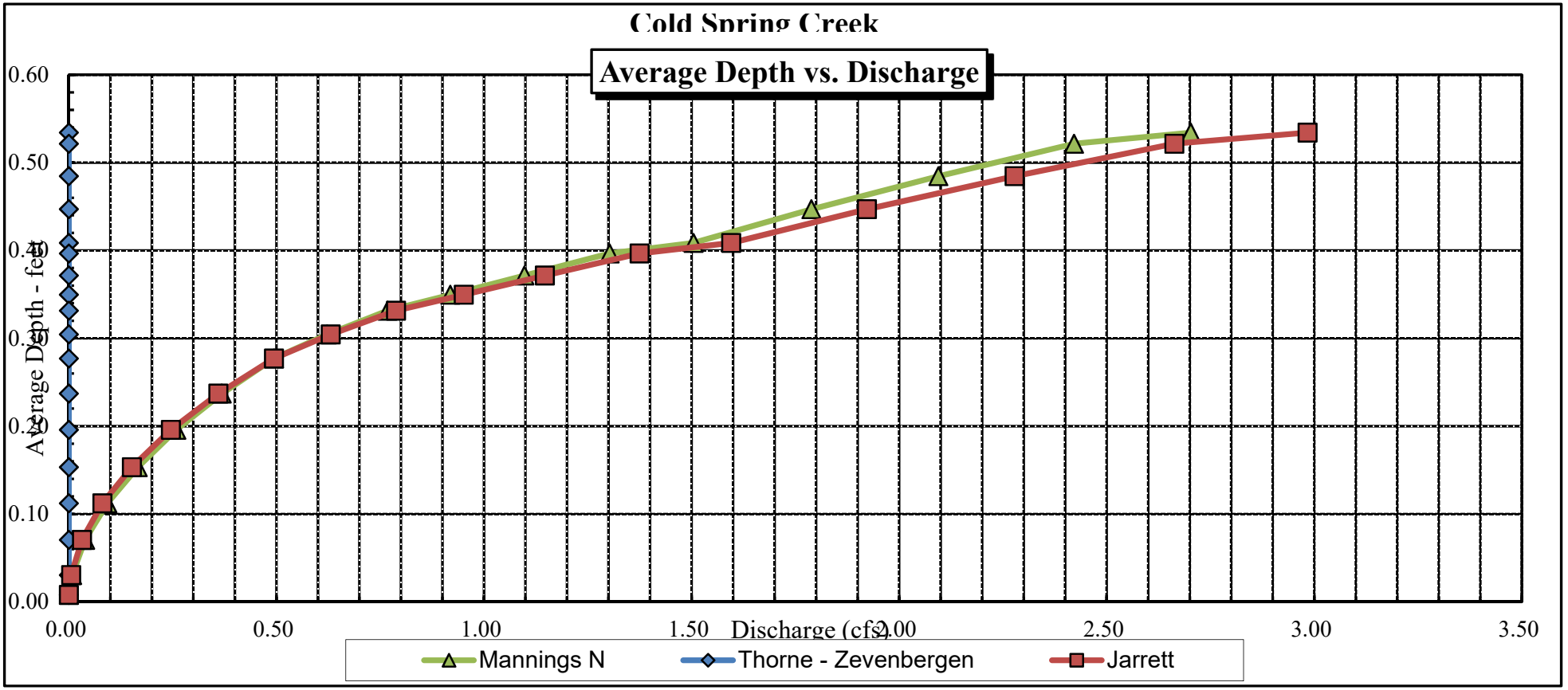
STREAM NAME: Cold Spring Creek
XS LOCATION: 800 ft. dwnstr from Amala Spring
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

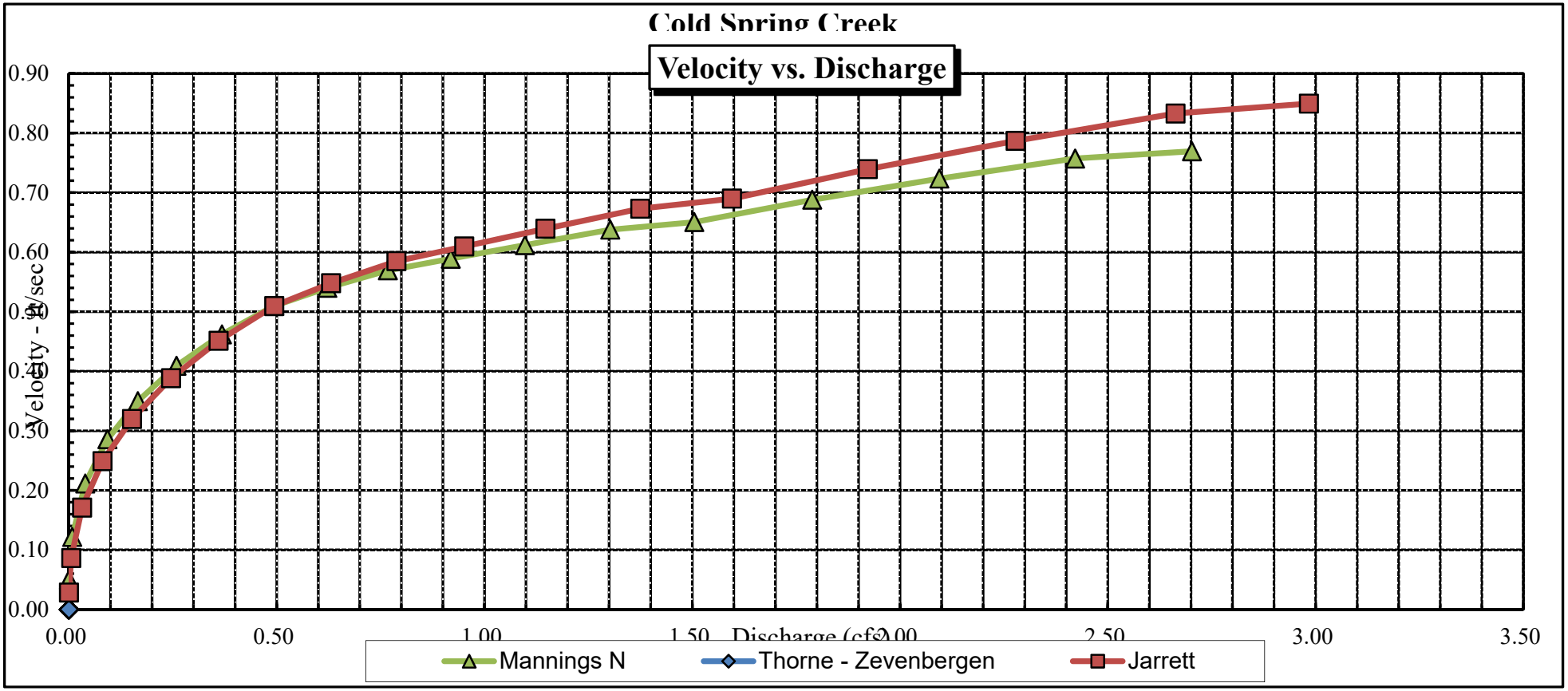
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

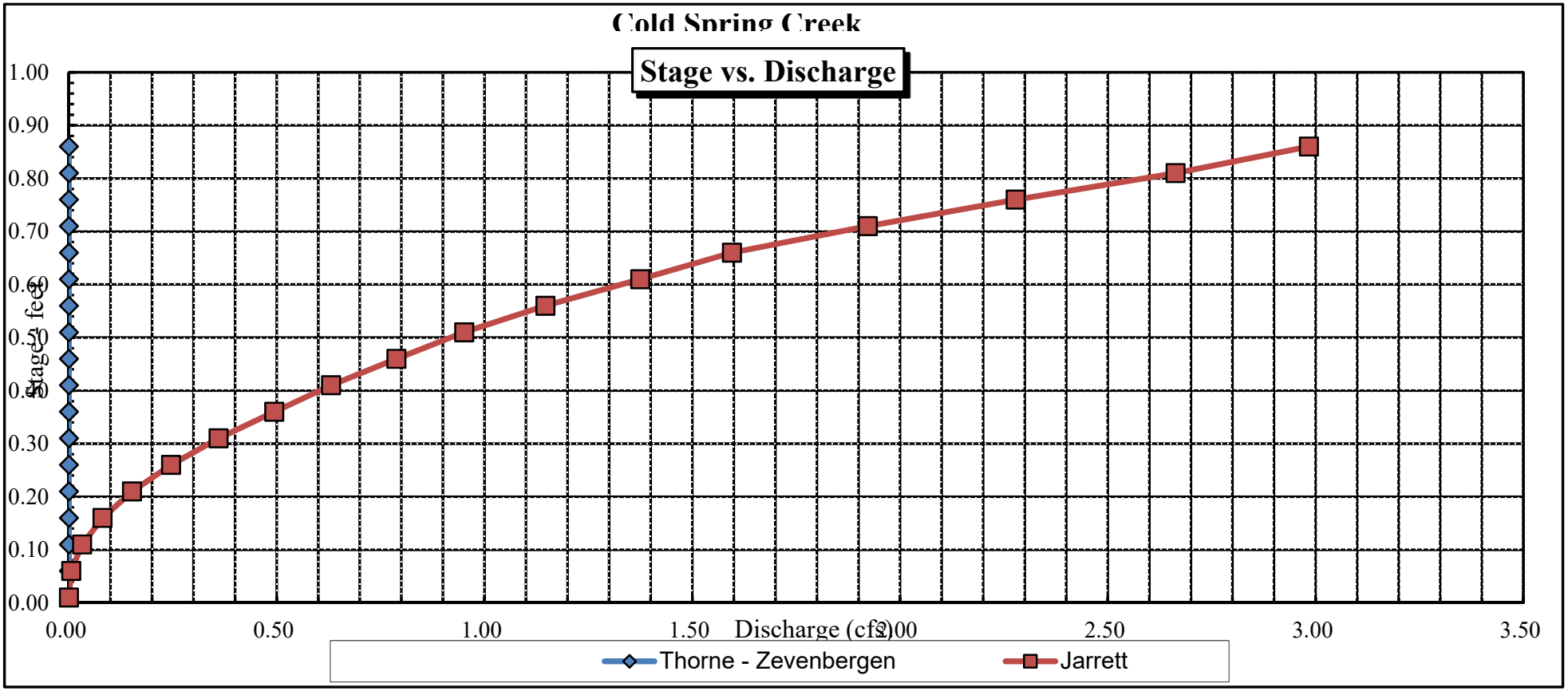
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.65	6.57	0.53	0.86	3.51	7.25	100.0%	0.48	2.98	0.85
	5.65	6.57	0.53	0.86	3.51	7.25	100.0%	0.48	2.98	0.85
	5.70	6.13	0.52	0.81	3.20	6.76	93.3%	0.47	2.66	0.83
	5.75	5.97	0.48	0.76	2.89	6.55	90.4%	0.44	2.28	0.79
	5.80	5.82	0.45	0.71	2.60	6.35	87.6%	0.41	1.92	0.74
	5.85	5.66	0.41	0.66	2.31	6.14	84.7%	0.38	1.60	0.69
	5.90	5.15	0.40	0.61	2.04	5.59	77.1%	0.37	1.37	0.67
	5.95	4.83	0.37	0.56	1.79	5.22	72.0%	0.34	1.15	0.64
	6.00	4.46	0.35	0.51	1.56	4.81	66.4%	0.32	0.95	0.61
	6.05	4.07	0.33	0.46	1.35	4.37	60.3%	0.31	0.79	0.58
	6.10	3.78	0.30	0.41	1.15	4.04	55.7%	0.28	0.63	0.55
WL	6.15	3.50	0.28	0.36	0.97	3.71	51.2%	0.26	0.49	0.51
	6.20	3.37	0.24	0.31	0.80	3.54	48.8%	0.23	0.36	0.45
	6.25	3.23	0.20	0.26	0.63	3.37	46.5%	0.19	0.25	0.39
	6.30	3.10	0.15	0.21	0.47	3.20	44.1%	0.15	0.15	0.32
	6.35	2.90	0.11	0.16	0.32	2.96	40.8%	0.11	0.08	0.25
	6.40	2.63	0.07	0.11	0.19	2.66	36.7%	0.07	0.03	0.17
	6.45	2.15	0.03	0.06	0.07	2.16	29.8%	0.03	0.01	0.09
	6.50	0.50	0.01	0.01	0.00	0.50	6.9%	0.01	0.00	0.03


Cold Spring Creek
CROSS SECTION DATA ANALYSIS
-5.00
-5.20
-5.40
-5.60
-5.80
-6.00
-6.20
-6.40
-6.60
-6.80
-7.00
VERTICAL DEPTH (FT)
RS & G
W
W
G
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


Cold Spring Creek
Percent Wetted Perimeter vs. Discharge
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Percent Wetted Perimeter
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Average Depth vs. Discharge
Average Depth - feet
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Velocity vs. Discharge
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Stage vs. Discharge
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Stage, feet
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Cold Spring Creek
XS LOCATION:	800 ft. dwnstr from Amala Spring
XS NUMBER:	1
DATE:	6/30/2016
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW SE
SECTION:	20
TWP:	45N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Cochetopa Creek
DIVISION:	4
DOW CODE:	none
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.014 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 = 25					
1	RS & G	0.00	5.64			0.00	0.00	0.00
		0.50	5.68			0.00	0.00	0.00
		1.00	5.85			0.00	0.00	0.00
		1.50	5.90			0.00	0.00	0.00
		2.00	5.98			0.00	0.00	0.00
		2.50	6.04			0.00	0.00	0.00
	W	3.10	6.15	0.00	0.00	0.00	0.00	0.00
		3.40	6.30	0.15	0.04	0.05	0.00	6.15
		3.70	6.39	0.24	0.22	0.07	0.02	6.15
		4.00	6.42	0.27	0.34	0.08	0.03	6.15
		4.30	6.48	0.33	0.62	0.10	0.06	6.15
		4.60	6.51	0.36	0.61	0.11	0.07	6.15
		4.90	6.51	0.36	0.64	0.11	0.07	6.15
		5.20	6.48	0.33	0.73	0.10	0.07	6.15
		5.50	6.46	0.31	0.89	0.09	0.08	6.15
		5.80	6.47	0.32	0.73	0.10	0.07	6.15
	W	6.10	6.47	0.32	0.24	0.10	0.02	6.15
		6.40	6.44	0.29	0.06	0.07	0.00	6.15
		6.60	6.15	0.00	0.00	0.00	0.00	0.00
1	G	6.70	5.65			0.00	0.00	0.00
		7.00	5.48			0.00	0.00	0.00
		7.50	5.38			0.00	0.00	0.00
		8.00	5.35			0.00	0.00	0.00
		8.50	5.26			0.00	0.00	0.00
		9.00	5.25			0.00	0.00	0.00
	LS	10.00	5.24					
					Totals	0.97	0.49	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Cold Spring Creek						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: At BLM-private boundary						
DATE: 6-30-16	OBSERVERS: R. Smith, A. Breibart					
LEGAL DESCRIPTION	¼ SECTION: NE SE	SECTION: 20	TOWNSHIP: 45 (N)/S	RANGE: 2 (E)/W	PM: N.M.	
COUNTY: Saguache	WATERSHED: Cochetopa Ck.	WATER DIVISION: 4	DOW WATER CODE: none			
MAP(S): USGS:	Zone 13 S 344879					
USFS:	9,250 ft. 4223266					

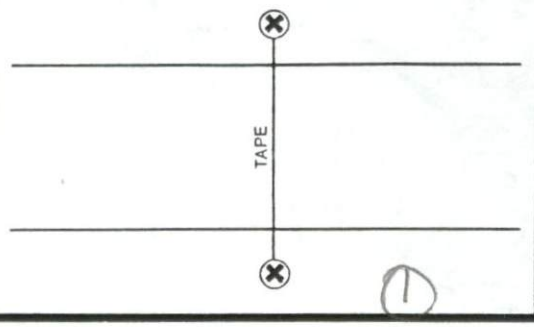
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravels & sand	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	7.00/7.00
(2) WS Upstream	33.0	6.30
(3) WS Downstream	4.5	7.03
SLOPE	0.73/37.5 = 0.019	

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

Extremely dense riparian - very few riffles.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cold Spring Creek	CROSS-SECTION NO.: 2	DATE: 6-30-19	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 12:50 p.m.

Features (Stake (S), Grassline (G), Waterline (W), Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
RS/G	0.0		6.20								
	0.9		6.47								
W	1.3		7.00	ϕ				ϕ			
	1.4		7.45	.45				.16			
	1.7		7.49	.49				.14			
	2.0		7.53	.53				.32			
	2.3		7.60	.60				.6			
	2.6		7.65	.65				.29			
	2.9		7.67	.67				.38			
	3.2		7.55	.55				.19			
	3.5		7.60	.60				.19			
	3.8		7.36	.36				ϕ			
W	4.4		7.00					ϕ			
	5.0		6.86								
	5.5		6.88								
	6.0		7.02								
	7.0		6.53								
LS/G	8.0		6.16								
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:	Cold Spring Creek
XS LOCATION:	At BLM-Private Boundary
XS NUMBER:	2
DATE:	30-Jun-16
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NE SE
SECTION:	20
TWP:	45N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Cochetopa Creek
DIVISION:	4
DOW CODE:	none
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:	0.019

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

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

STREAM NAME: Cold Spring Creek
XS LOCATION: At BLM-Private Boundary
XS NUMBER: 2

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	RS & G	0.00	6.20			0.00		0.00	0.00	0.0%
		0.90	6.47			0.00		0.00	0.00	0.0%
	W	1.30	7.00	0.00	0.00	0.00		0.00	0.00	0.0%
		1.40	7.45	0.45	0.16	0.46	0.45	0.09	0.01	3.7%
		1.70	7.49	0.49	0.14	0.30	0.49	0.15	0.02	5.3%
		2.00	7.53	0.53	0.32	0.30	0.53	0.16	0.05	13.0%
		2.30	7.60	0.60	0.60	0.31	0.60	0.18	0.11	27.7%
		2.60	7.65	0.65	0.29	0.30	0.65	0.20	0.06	14.5%
		2.90	7.67	0.67	0.38	0.30	0.67	0.20	0.08	19.6%
		3.20	7.55	0.55	0.19	0.32	0.55	0.17	0.03	8.0%
		3.50	7.60	0.60	0.18	0.30	0.60	0.18	0.03	8.3%
		3.80	7.36	0.36	0.00	0.38	0.36	0.16	0.00	0.0%
	W	4.40	7.00	0.00	0.00	0.70		0.00	0.00	0.0%
		5.00	6.86			0.00		0.00	0.00	0.0%
		5.50	6.88			0.00		0.00	0.00	0.0%
		6.00	7.02			0.00		0.00	0.00	0.0%
		7.00	6.53			0.00		0.00	0.00	0.0%
	TOTALS ----------					3.69	0.67 (Max.)	1.48	0.39	100.0%

Manning's n = 0.4217
Hydraulic Radius= 0.40078051

STREAM NAME: Cold Spring Creek
XS LOCATION: At BLM-Private Boundary
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.48	1.48	0.1%
6.75	1.48	2.62	77.1%
6.77	1.48	2.51	69.8%
6.79	1.48	2.40	62.6%
6.81	1.48	2.30	55.4%
6.83	1.48	2.19	48.3%
6.85	1.48	2.09	41.3%
6.87	1.48	1.99	34.5%
6.89	1.48	1.90	28.3%
6.91	1.48	1.81	22.5%
6.93	1.48	1.73	17.0%
6.95	1.48	1.65	11.8%
6.96	1.48	1.62	9.3%
6.97	1.48	1.58	6.9%
6.98	1.48	1.55	4.6%
6.99	1.48	1.51	2.3%
7.00	1.48	1.48	0.1%
7.01	1.48	1.45	-2.1%
7.02	1.48	1.42	-4.2%
7.03	1.48	1.39	-6.2%
7.04	1.48	1.36	-8.3%
7.05	1.48	1.33	-10.3%
7.07	1.48	1.27	-14.4%
7.09	1.48	1.21	-18.3%
7.11	1.48	1.15	-22.3%
7.13	1.48	1.09	-26.2%
7.15	1.48	1.04	-30.0%
7.17	1.48	0.98	-33.8%
7.19	1.48	0.92	-37.5%
7.21	1.48	0.87	-41.2%
7.23	1.48	0.82	-44.8%
7.25	1.48	0.76	-48.4%

WATERLINE AT ZERO
AREA ERROR = 7.000

STREAM NAME: Cold Spring Creek
XS LOCATION: At BLM-Private 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	6.20	7.00	0.86	1.47	6.02	8.04	100.0%	0.75	2.41	0.40
	6.20	7.00	0.86	1.47	6.02	8.04	100.0%	0.75	2.41	0.40
	6.25	6.83	0.83	1.42	5.67	7.87	97.8%	0.72	2.21	0.39
	6.30	6.67	0.80	1.37	5.33	7.69	95.7%	0.69	2.03	0.38
	6.35	6.50	0.77	1.32	5.00	7.52	93.5%	0.67	1.85	0.37
	6.40	6.33	0.74	1.27	4.68	7.35	91.3%	0.64	1.68	0.36
	6.45	6.17	0.71	1.22	4.37	7.17	89.2%	0.61	1.53	0.35
	6.50	6.08	0.67	1.17	4.06	7.07	87.8%	0.58	1.37	0.34
	6.55	6.00	0.63	1.12	3.76	6.96	86.5%	0.54	1.21	0.32
	6.60	5.86	0.59	1.07	3.47	6.78	84.3%	0.51	1.08	0.31
	6.65	5.72	0.56	1.02	3.18	6.60	82.1%	0.48	0.95	0.30
	6.70	5.58	0.52	0.97	2.89	6.43	79.9%	0.45	0.83	0.29
	6.75	5.44	0.48	0.92	2.62	6.25	77.7%	0.42	0.71	0.27
	6.80	5.30	0.44	0.87	2.35	6.08	75.5%	0.39	0.61	0.26
	6.85	5.16	0.40	0.82	2.09	5.90	73.3%	0.35	0.51	0.24
	6.90	4.27	0.43	0.77	1.85	4.97	61.8%	0.37	0.47	0.25
	6.95	3.74	0.44	0.72	1.65	4.39	54.5%	0.38	0.42	0.25
WL	7.00	3.21	0.46	0.67	1.48	3.81	47.3%	0.39	0.38	0.26
	7.05	3.00	0.44	0.62	1.33	3.54	44.0%	0.37	0.33	0.25
	7.10	2.91	0.40	0.57	1.18	3.39	42.2%	0.35	0.28	0.24
	7.15	2.82	0.37	0.52	1.03	3.24	40.3%	0.32	0.23	0.23
	7.20	2.72	0.33	0.47	0.90	3.10	38.5%	0.29	0.19	0.21
	7.25	2.63	0.29	0.42	0.76	2.95	36.6%	0.26	0.15	0.20
	7.30	2.53	0.25	0.37	0.63	2.80	34.8%	0.23	0.11	0.18
	7.35	2.44	0.21	0.32	0.51	2.65	33.0%	0.19	0.08	0.16
	7.40	2.36	0.16	0.27	0.39	2.52	31.3%	0.15	0.05	0.14
	7.45	2.28	0.12	0.22	0.27	2.38	29.6%	0.11	0.03	0.11
	7.50	1.85	0.09	0.17	0.17	1.92	23.9%	0.09	0.02	0.10
	7.55	1.47	0.06	0.12	0.09	1.53	19.0%	0.06	0.01	0.07
	7.60	0.77	0.04	0.07	0.03	0.79	9.8%	0.04	0.00	0.06
	7.65	0.34	0.01	0.02	0.00	0.35	4.3%	0.01	0.00	0.02

STREAM NAME: Cold Spring Creek
XS LOCATION: At BLM-Private Boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.39	cfs
CALCULATED FLOW (Qc)=	0.38	cfs
(Qm-Qc)/Qm * 100 =	2.1	%
MEASURED WATERLINE (WLm)=	7.00	ft
CALCULATED WATERLINE (WLc)=	7.00	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.67	ft
MAX CALCULATED DEPTH (Dc)=	0.67	ft
(Dm-Dc)/Dm * 100	0.1	%
MEAN VELOCITY=	0.26	ft/sec
MANNING'S N=	0.422	
SLOPE=	0.019	ft/ft
.4 * Qm =	0.2	cfs
2.5 * Qm=	1.0	cfs

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

FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

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

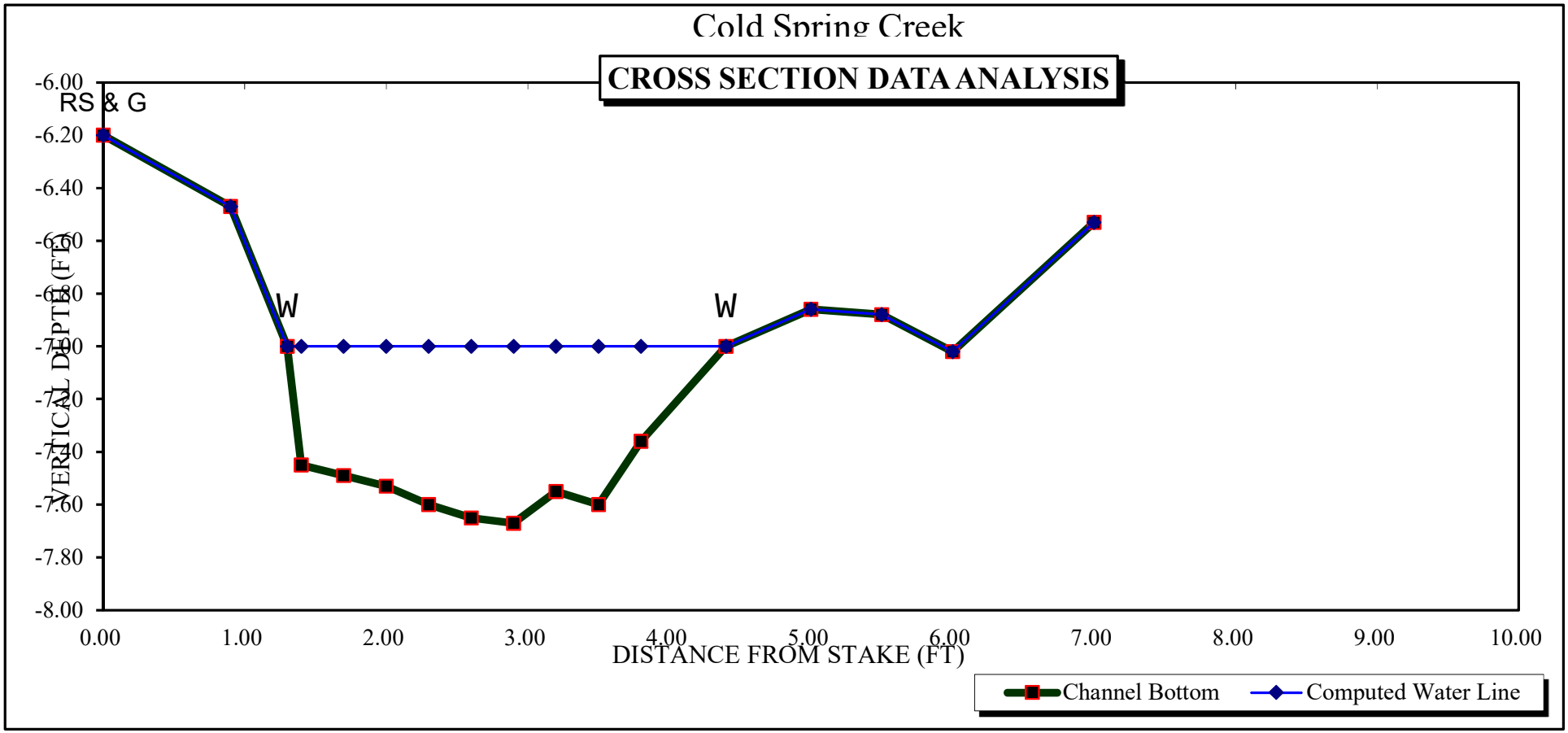
RECOMMENDATION BY: ……………………………………………… AGENCY……………………………………………… DATE:………………………

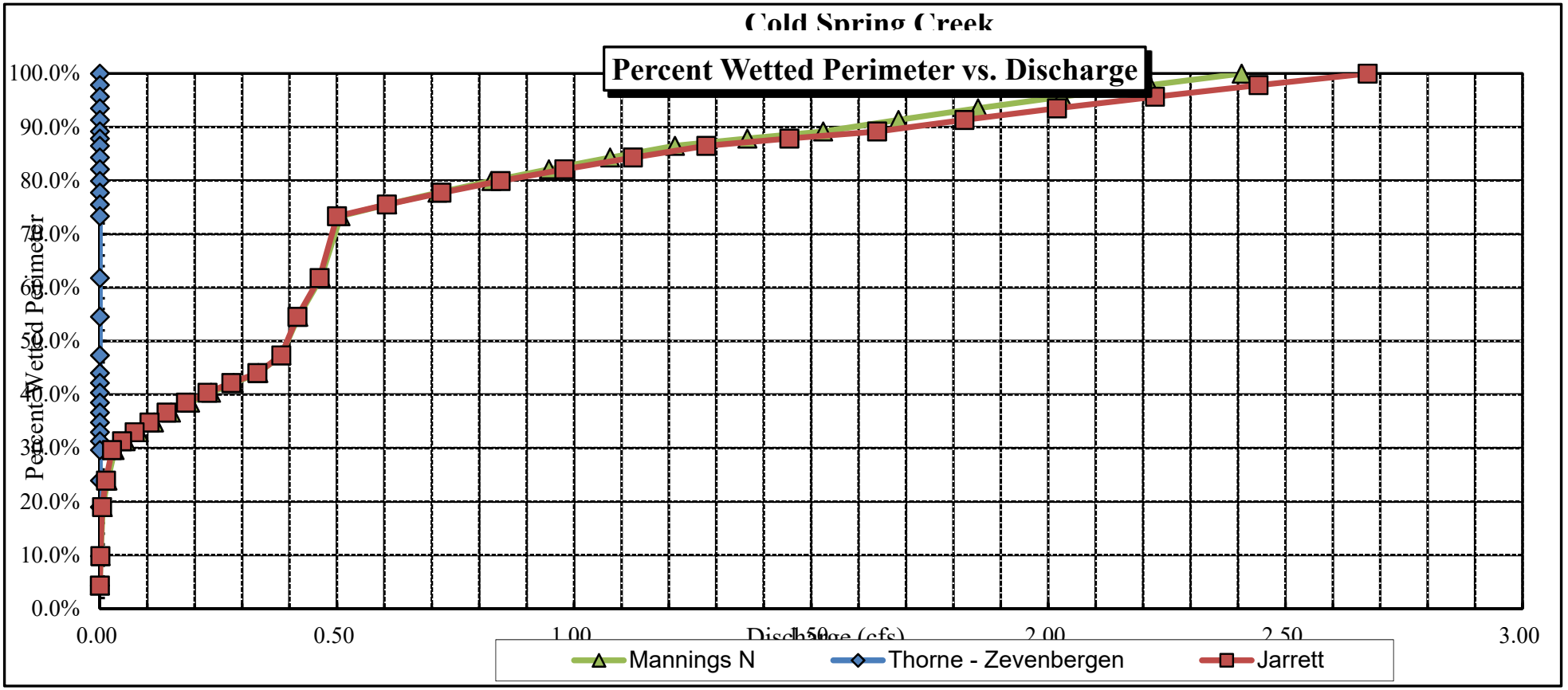
CWCB REVIEW BY: …… DATE:………………………

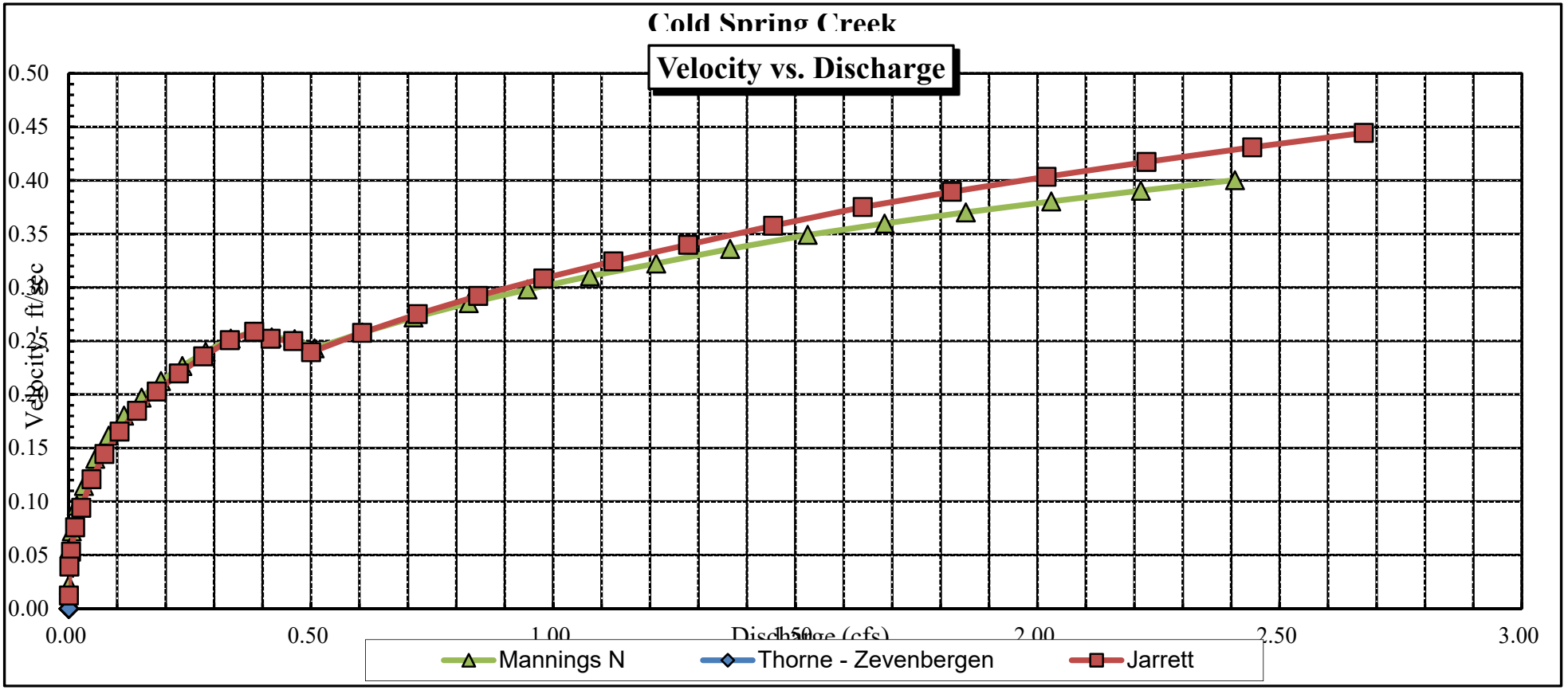
STREAM NAME: Cold Spring Creek
XS LOCATION: At BLM-Private Boundary
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

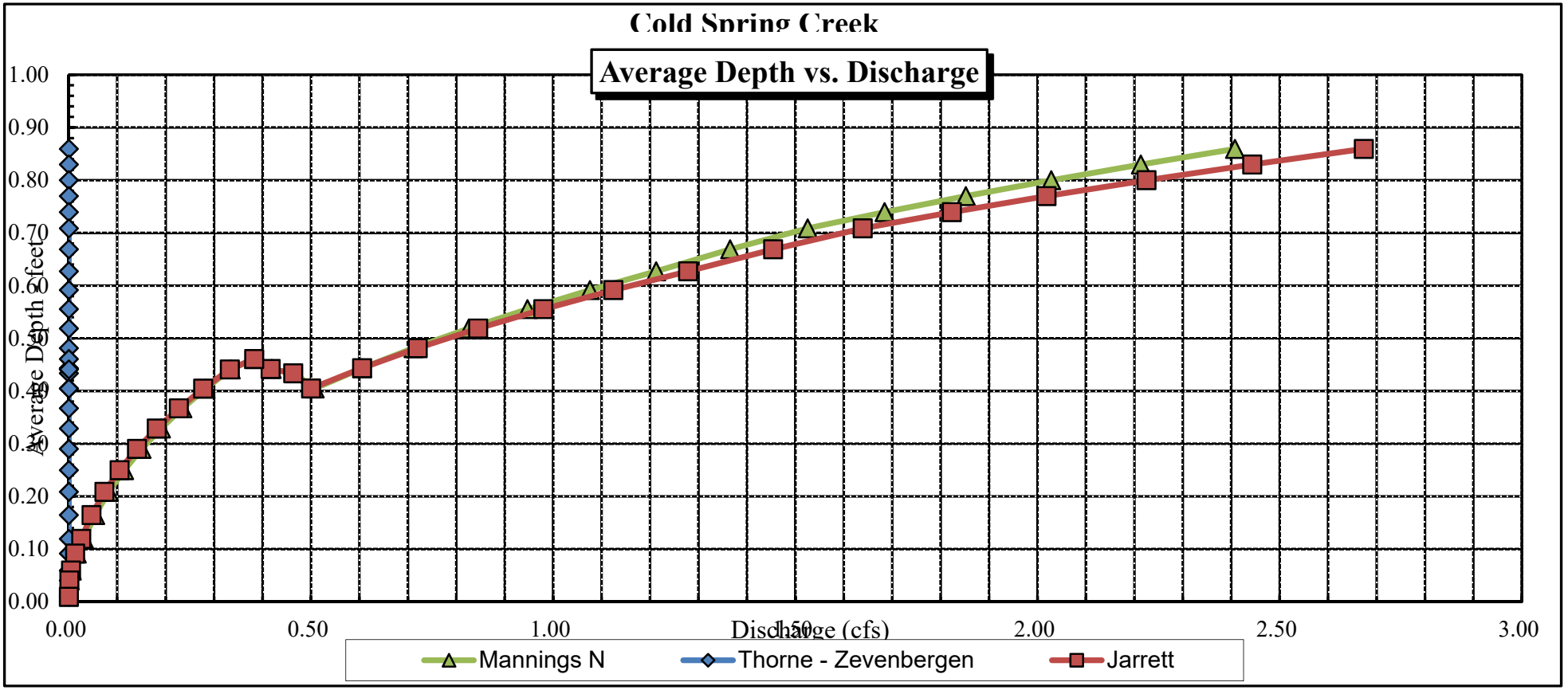
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

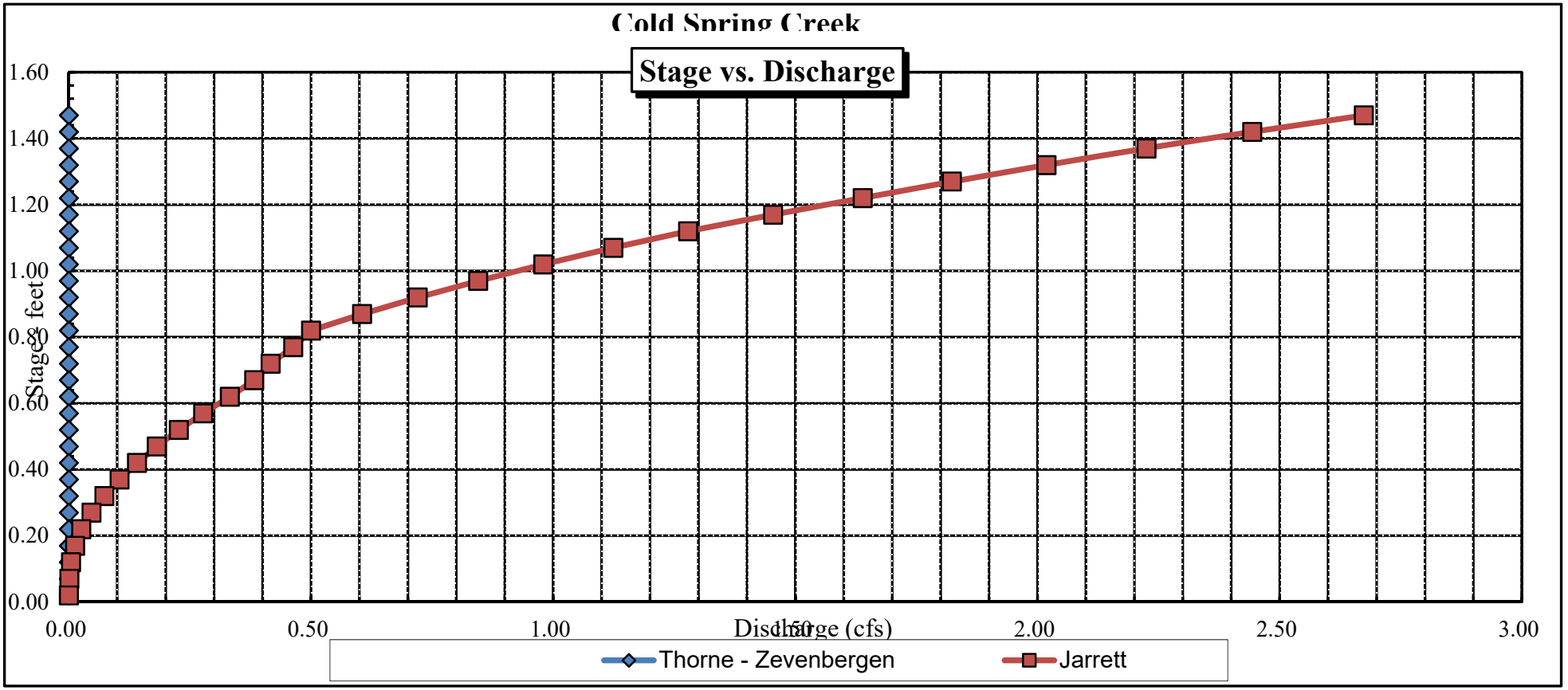
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.20	7.00	0.86	1.47	6.02	8.04	100.0%	0.75	2.68	0.44
	6.20	7.00	0.86	1.47	6.02	8.04	100.0%	0.75	2.67	0.44
	6.25	6.83	0.83	1.42	5.67	7.87	97.8%	0.72	2.44	0.43
	6.30	6.67	0.80	1.37	5.33	7.69	95.7%	0.69	2.23	0.42
	6.35	6.50	0.77	1.32	5.00	7.52	93.5%	0.67	2.02	0.40
	6.40	6.33	0.74	1.27	4.68	7.35	91.3%	0.64	1.82	0.39
	6.45	6.17	0.71	1.22	4.37	7.17	89.2%	0.61	1.64	0.38
	6.50	6.08	0.67	1.17	4.06	7.07	87.8%	0.58	1.45	0.36
	6.55	6.00	0.63	1.12	3.76	6.96	86.5%	0.54	1.28	0.34
	6.60	5.86	0.59	1.07	3.47	6.78	84.3%	0.51	1.12	0.32
	6.65	5.72	0.56	1.02	3.18	6.60	82.1%	0.48	0.98	0.31
	6.70	5.58	0.52	0.97	2.89	6.43	79.9%	0.45	0.85	0.29
	6.75	5.44	0.48	0.92	2.62	6.25	77.7%	0.42	0.72	0.28
	6.80	5.30	0.44	0.87	2.35	6.08	75.5%	0.39	0.61	0.26
	6.85	5.16	0.40	0.82	2.09	5.90	73.3%	0.35	0.50	0.24
	6.90	4.27	0.43	0.77	1.85	4.97	61.8%	0.37	0.46	0.25
	6.95	3.74	0.44	0.72	1.65	4.39	54.5%	0.38	0.42	0.25
WL	7.00	3.21	0.46	0.67	1.48	3.81	47.3%	0.39	0.38	0.26
	7.05	3.00	0.44	0.62	1.33	3.54	44.0%	0.37	0.33	0.25
	7.10	2.91	0.40	0.57	1.18	3.39	42.2%	0.35	0.28	0.24
	7.15	2.82	0.37	0.52	1.03	3.24	40.3%	0.32	0.23	0.22
	7.20	2.72	0.33	0.47	0.90	3.10	38.5%	0.29	0.18	0.20
	7.25	2.63	0.29	0.42	0.76	2.95	36.6%	0.26	0.14	0.18
	7.30	2.53	0.25	0.37	0.63	2.80	34.8%	0.23	0.10	0.17
	7.35	2.44	0.21	0.32	0.51	2.65	33.0%	0.19	0.07	0.14
	7.40	2.36	0.16	0.27	0.39	2.52	31.3%	0.15	0.05	0.12
	7.45	2.28	0.12	0.22	0.27	2.38	29.6%	0.11	0.03	0.09
	7.50	1.85	0.09	0.17	0.17	1.92	23.9%	0.09	0.01	0.08
	7.55	1.47	0.06	0.12	0.09	1.53	19.0%	0.06	0.00	0.05
	7.60	0.77	0.04	0.07	0.03	0.79	9.8%	0.04	0.00	0.04
	7.65	0.34	0.01	0.02	0.00	0.35	4.3%	0.01	0.00	0.01


Cold Spring Creek
CROSS SECTION DATA ANALYSIS
RS & G
W
W
-6.00
-6.20
-6.40
-6.60
-6.80
-7.00
-7.20
-7.40
-7.60
-7.80
-8.00
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


Cold Spring Creek
Percent Wetted Perimeter vs. Discharge
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Percent Wetted Perimeter
0.00
0.50
1.00
2.00
2.50
3.00
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Velocity vs. Discharge
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Velocity - ft/sec
0.00
0.50
1.00
1.50
2.00
2.50
3.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Average Depth vs. Discharge
Average Depth (feet)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cold Spring Creek
Stage vs. Discharge
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
0.50
1.00
1.50
2.00
2.50
3.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Cold Spring Creek
XS LOCATION:	At BLM-Private Boundary
XS NUMBER:	2
DATE:	6/30/2016
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NE SE
SECTION:	20
TWP:	45N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Cochetopa Creek
DIVISION:	4
DOW CODE:	none
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.019 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 = 17					
1	RS & G	0.00	6.20			0.00	0.00	0.00
		0.90	6.47			0.00	0.00	0.00
	W	1.30	7.00	0.00	0.00	0.00	0.00	0.00
		1.40	7.45	0.45	0.16	0.09	0.01	7.00
		1.70	7.49	0.49	0.14	0.15	0.02	7.00
		2.00	7.53	0.53	0.32	0.16	0.05	7.00
		2.30	7.60	0.60	0.60	0.18	0.11	7.00
		2.60	7.65	0.65	0.29	0.20	0.06	7.00
		2.90	7.67	0.67	0.38	0.20	0.08	7.00
		3.20	7.55	0.55	0.19	0.17	0.03	7.00
		3.50	7.60	0.60	0.18	0.18	0.03	7.00
		3.80	7.36	0.36	0.00	0.16	0.00	7.00
	W	4.40	7.00	0.00	0.00	0.00	0.00	0.00
		5.00	6.86			0.00	0.00	0.00
		5.50	6.88			0.00	0.00	0.00
		6.00	7.02			0.00	0.00	0.00
		7.00	6.53			0.00	0.00	0.00
1	LS & G	8.00	6.16					

Totals	1.48	0.39