United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210
www.co.blm.gov

In Reply Refer To:
7250 (CO-932)

DEC 19 2016

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 Fourmile Creek, located in Water Division 6.

Location and Land Status. Fourmile Creek originates on the western flank of Mount Oliphant in the Elkhead Mountains, approximately 24 miles northeast of Craig. This instream flow recommendation focuses on a reach beginning at the headwaters and extending to the headgate of the Norma Ryan Ditch, a distance of approximately 3.25 miles. The BLM manages approximately 0.3 miles of this reach, the U.S. Forest Service manages approximately 1.4 miles, and 1.5 miles are in private ownership.

Biological Summary. Fourmile Creek is a cold-water, high gradient stream in a densely forested environment. The stream is confined by bedrock in most locations and generally has medium to large-sized substrate, consisting of cobbles and small boulders. The stream consists mostly of series of pools broken by short drops and waterfalls. As such, the creek has abundant pool habitat for overwintering fish, but runs and riffle habitat is very limited, which limits reproduction. Abundant beaver ponds also assist in maintaining pool habitat for the fish population.

Fishery surveys have revealed a self-sustaining population of native cutthroat trout. Genetic testing revealed that the population is a genetically pure population of Yampa River lineage. Colorado Parks and Wildlife has designated the fish in this creek as a core conservation population. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly and stonefly.

The riparian community is generally comprised of spruce and alder at higher elevation and willow and aspen at lower elevation. The riparian community is in excellent condition and provides abundant shading and cover for fish habitat.

R2Cross Analysis. The BLM collected the following R2Cross data from Fourmile 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)
06/16/2015 #1	4.78 cfs	20.6 feet	2.42 cfs	3.76 cfs
07/08/2015 #1	1.19 cfs	20.2 feet	2.21 cfs	Out of range
		Averages:	2.32 cfs	3.76 cfs

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

> 3.75 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. This portion of the creek is at high altitude and the fish growth and recruitment season is short. It is important to protect a flow rate that makes most of this habitat available to the fish population while they are completing critical life history functions during the warm weather months.
>
> 0.97 cubic feet per second is recommended from July 1 to July 31. This recommendation is driven by water availability. While this flow rate does not meet at least two instream flow criteria, it provides substantially more habitat than is available during base flow periods.
>
> 0.40 cubic feet per second is recommended from August 1 to March 31. This recommendation is driven by very limited water availability. A rate of 0.4 cubic feet per second should keep pools well oxygenated and at an acceptable temperature during late summer, and should prevent pools from freezing, allowing the fish population to successfully overwinter. Even though the base flow in this creek is small, it is extremely consistent, allowing the fishery to persist.
>
> 1.25 cubic feet per second is recommended during the initial part of snowmelt period, from April 1 to April 30. This recommendation is driven by limited water availability. Depending upon variations in stream temperatures, the fish population may start spawning in April, and protecting sufficient spawning habitat is important.

Water Availability. The nearest stream flow gage with a long-term record is U.S. Geological Survey Gage 09255000 for Slater Creek near Slater, CO. This gage measures a large watershed immediately to the east of Fourmile Creek. The BLM does not recommend use of this gage because it is for a much larger watershed and is heavily influenced by irrigation diversions. As an alternative, BLM recommends consulting USGS Gage 09258000 for Willow Creek near Dixon, Wyoming. This gage is less influenced by diversions and can be prorated to reflect the watershed size of Willow Creek.

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

Relationship to Land Management Plans. The BLM's management plan calls for improvement and recovery of current and historic fisheries as a means of increasing native fish populations. In addition, the BLM plan calls for making instream flow recommendations to the Colorado Water Conservation Board to meet minimum instream flow requirements to maintain native fisheries. Finally, the plan calls for maintaining and improving the function of riparian areas to achieve advanced ecological stage for the riparian community, and it also calls for protecting riparian and wetland systems from further sources of degradation. 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 2016. 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: Eric Scherff, Little Snake Field Office
Bruce Sillitoe, Little Snake Field Office

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Fourmile Creek						CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: At BLM - USFS boundary							
DATE: 6-16-15	OBSERVERS: R. Smith, E. Scherff						
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 13	TOWNSHIP: 10 (N)/S	RANGE: 90 E/(W)	PM: 6th		
COUNTY: Moffat	WATERSHED: Little Snake	WATER DIVISION: 6	DOW WATER CODE: 21173				
MAP(S): USGS:				295038			
USFS:				4521742			

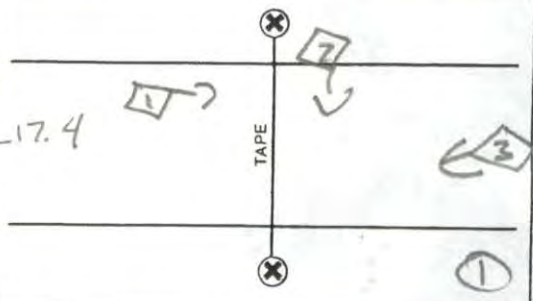
SUPPLEMENTAL DATA

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: 2" cobble 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 3.0	4.90 / 4.90
(2) WS Upstream	9.0	4.75
(3) WS Downstream	13.5	5.36
SLOPE	0.61 / 22.5 =	

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, needles - all abundant

COMMENTS

Ph = 6.42
Cond = 30.3
Temp = 5.8°C
Salinity = 0.0 ppt

Riparian = Spruce - alder

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Fourmile Creek - Upper	CROSS-SECTION NO: 1	DATE: 6-16-15	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 10:45

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)
LS	0.0		2.96								
G	0.9		4.30								
	2.4		4.85								
W	3.0		4.90								
	3.5		5.25	.35				.01			
	4		5.15	.25				.0			
	4.5		5.15	.25				.14			
	5		5.15	.25				.14			
	5.5		5.25	.35				1.39			
	6		5.20	.30				1.45			
	6.5		5.20	.30				1.47			
	7		5.25	.35				1.65			
	7.5		5.30	.40				2.01			
	8		5.3	.40				1.94			
	8.5		5.3	.40				2.26			
	9		5.3	.40				0.48			
	9.5		5.2	.30				0.08			
	10		5.2	.30				0.40			
	10.5		5.2	.30				0.74			
	11		5.1	.20				0.34			
	11.5		5.2	.30				0.07			
	12		5.1	.20				1.23			
	12.5		5.1	.20				1.60			
	13		5.2	.30				1.10			
	13.5		5.3	.40				1.60			
	14		5.3	.40				1.12			
	14.5		5.2	.30				0.69			
	15		5.2	.30				1.80			
	15.5		5.05	.15				1.32			
	16		5.25	.35				1.76			
	16.5		5.30	.40				1.25			
	17		5.20	.30				1.34			
W	17.4		4.90								
	17.8		4.80								
	18.7		4.60								
	20.4		4.55								
G	21.8		4.30								
RS	25.3		3.50								
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:	Fourmile Creek
XS LOCATION:	At BLM-USFS boundary
XS NUMBER:	1
DATE:	16-Jun-15
OBSERVERS:	R. Smith, E. Scherff
1/4 SEC:	NE
SECTION:	13
TWP:	10N
RANGE:	90W
PM:	Sixth
COUNTY:	Moffat
WATERSHED:	Little Snake
DIVISION:	6
DOW CODE:	21173
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:	0.027

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

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

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

DATA POINTS= 38

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	2.96			0.00		0.00	0.00	0.0%
1	G	0.90	4.30			0.00		0.00	0.00	0.0%
		2.40	4.85			0.00		0.00	0.00	0.0%
	W	3.00	4.90	0.00	0.00	0.00		0.00	0.00	0.0%
		3.50	5.25	0.35	0.01	0.61	0.35	0.18	0.00	0.0%
		4.00	5.15	0.25	0.00	0.51	0.25	0.13	0.00	0.0%
		4.50	5.15	0.25	0.14	0.50	0.25	0.13	0.02	0.4%
		5.00	5.15	0.25	0.14	0.50	0.25	0.13	0.02	0.4%
		5.50	5.25	0.35	1.39	0.51	0.35	0.18	0.24	5.1%
		6.00	5.20	0.30	1.45	0.50	0.30	0.15	0.22	4.6%
		6.50	5.20	0.30	1.47	0.50	0.30	0.15	0.22	4.6%
		7.00	5.25	0.35	1.65	0.50	0.35	0.18	0.29	6.0%
		7.50	5.30	0.40	2.01	0.50	0.40	0.20	0.40	8.4%
		8.00	5.30	0.40	1.94	0.50	0.40	0.20	0.39	8.1%
		8.50	5.30	0.40	2.26	0.50	0.40	0.20	0.45	9.5%
		9.00	5.30	0.40	0.48	0.50	0.40	0.20	0.10	2.0%
		9.50	5.20	0.30	0.08	0.51	0.30	0.15	0.01	0.3%
		10.00	5.20	0.30	0.40	0.50	0.30	0.15	0.06	1.3%
		10.50	5.20	0.30	0.74	0.50	0.30	0.15	0.11	2.3%
		11.00	5.10	0.20	0.34	0.51	0.20	0.10	0.03	0.7%
		11.50	5.20	0.30	0.07	0.51	0.30	0.15	0.01	0.2%
		12.00	5.10	0.20	1.23	0.51	0.20	0.10	0.12	2.6%
		12.50	5.10	0.20	1.60	0.50	0.20	0.10	0.16	3.4%
		13.00	5.20	0.30	1.10	0.51	0.30	0.15	0.17	3.5%
		13.50	5.30	0.40	1.60	0.51	0.40	0.20	0.32	6.7%
		14.00	5.30	0.40	1.12	0.50	0.40	0.20	0.22	4.7%
		14.50	5.20	0.30	0.69	0.51	0.30	0.15	0.10	2.2%
		15.00	5.20	0.30	1.80	0.50	0.30	0.15	0.27	5.7%
		15.50	5.05	0.15	1.32	0.52	0.15	0.08	0.10	2.1%
		16.00	5.25	0.35	1.76	0.54	0.35	0.18	0.31	6.4%
		16.50	5.30	0.40	1.25	0.50	0.40	0.20	0.25	5.2%
		17.00	5.20	0.30	1.34	0.51	0.30	0.14	0.18	3.8%
	W	17.40	4.90	0.00	0.00	0.50		0.00	0.00	0.0%
		17.80	4.80			0.00		0.00	0.00	0.0%
		18.70	4.60			0.00		0.00	0.00	0.0%
		20.40	4.55			0.00		0.00	0.00	0.0%
1	G	21.50	4.30			0.00		0.00	0.00	0.0%
	RS	25.30	3.50			0.00		0.00	0.00	0.0%
	TOTALS ----------					14.78	0.4 (Max.)	4.34	4.78	100.0%

Manning's n = 0.0978
Hydraulic Radius= 0.29330465

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

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.34	4.34	0.0%
4.65	4.34	8.26	90.4%
4.67	4.34	7.92	82.8%
4.69	4.34	7.60	75.2%
4.71	4.34	7.27	67.7%
4.73	4.34	6.95	60.3%
4.75	4.34	6.63	52.9%
4.77	4.34	6.31	45.6%
4.79	4.34	6.00	38.4%
4.81	4.34	5.69	31.2%
4.83	4.34	5.38	24.1%
4.85	4.34	5.08	17.1%
4.86	4.34	4.92	13.6%
4.87	4.34	4.77	10.1%
4.88	4.34	4.63	6.7%
4.89	4.34	4.48	3.3%
4.90	4.34	4.34	0.0%
4.91	4.34	4.19	-3.3%
4.92	4.34	4.05	-6.6%
4.93	4.34	3.90	-9.9%
4.94	4.34	3.76	-13.2%
4.95	4.34	3.62	-16.5%
4.97	4.34	3.33	-23.1%
4.99	4.34	3.05	-29.6%
5.01	4.34	2.77	-36.2%
5.03	4.34	2.49	-42.6%
5.05	4.34	2.21	-49.1%
5.07	4.34	1.93	-55.5%
5.09	4.34	1.65	-61.9%
5.11	4.34	1.39	-68.0%
5.13	4.34	1.14	-73.7%
5.15	4.34	0.90	-79.2%

WATERLINE AT ZERO
AREA ERROR = 4.900

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

Constant Manning's n

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.30	20.60	0.72	1.00	14.92	21.14	100.0%	0.71	29.51	1.98
	4.30	20.60	0.72	1.00	14.92	21.14	100.0%	0.71	29.51	1.98
	4.35	20.24	0.69	0.95	13.90	20.77	98.2%	0.67	26.53	1.91
	4.40	19.89	0.65	0.90	12.89	20.40	96.5%	0.63	23.70	1.84
	4.45	19.53	0.61	0.85	11.91	20.03	94.7%	0.59	21.01	1.76
	4.50	19.17	0.57	0.80	10.94	19.66	93.0%	0.56	18.47	1.69
	4.55	18.82	0.53	0.75	9.99	19.29	91.2%	0.52	16.08	1.61
	4.60	16.98	0.54	0.70	9.10	17.44	82.5%	0.52	14.70	1.62
	4.65	16.62	0.50	0.65	8.26	17.07	80.7%	0.48	12.69	1.54
	4.70	16.26	0.46	0.60	7.43	16.69	78.9%	0.45	10.82	1.46
	4.75	15.90	0.42	0.55	6.63	16.32	77.2%	0.41	9.08	1.37
	4.80	15.54	0.38	0.50	5.84	15.94	75.4%	0.37	7.47	1.28
	4.85	15.20	0.33	0.45	5.07	15.59	73.7%	0.33	5.99	1.18
WL	4.90	14.40	0.30	0.40	4.33	14.78	69.9%	0.29	4.78	1.10
	4.95	14.26	0.25	0.35	3.62	14.61	69.1%	0.25	3.56	0.98
	5.00	14.12	0.21	0.30	2.91	14.44	68.3%	0.20	2.49	0.86
	5.05	13.99	0.16	0.25	2.21	14.27	67.5%	0.15	1.59	0.72
	5.10	13.06	0.12	0.20	1.52	13.29	62.9%	0.11	0.89	0.59
	5.15	10.63	0.08	0.15	0.90	10.79	51.0%	0.08	0.43	0.48
	5.20	6.70	0.06	0.10	0.42	6.78	32.1%	0.06	0.16	0.39
	5.25	4.00	0.04	0.05	0.15	4.02	19.0%	0.04	0.04	0.28
	5.30	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

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

SUMMARY SHEET

MEASURED FLOW (Qm)=	4.78	cfs
CALCULATED FLOW (Qc)=	4.78	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	4.90	ft
CALCULATED WATERLINE (WLc)=	4.90	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.40	ft
MAX CALCULATED DEPTH (Dc)=	0.40	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	1.10	ft/sec
MANNING'S N=	0.098	
SLOPE=	0.027	ft/ft
.4 * Qm =	1.9	cfs
2.5 * Qm=	11.9	cfs

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

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

RATIONALE FOR RECOMMENDATION:
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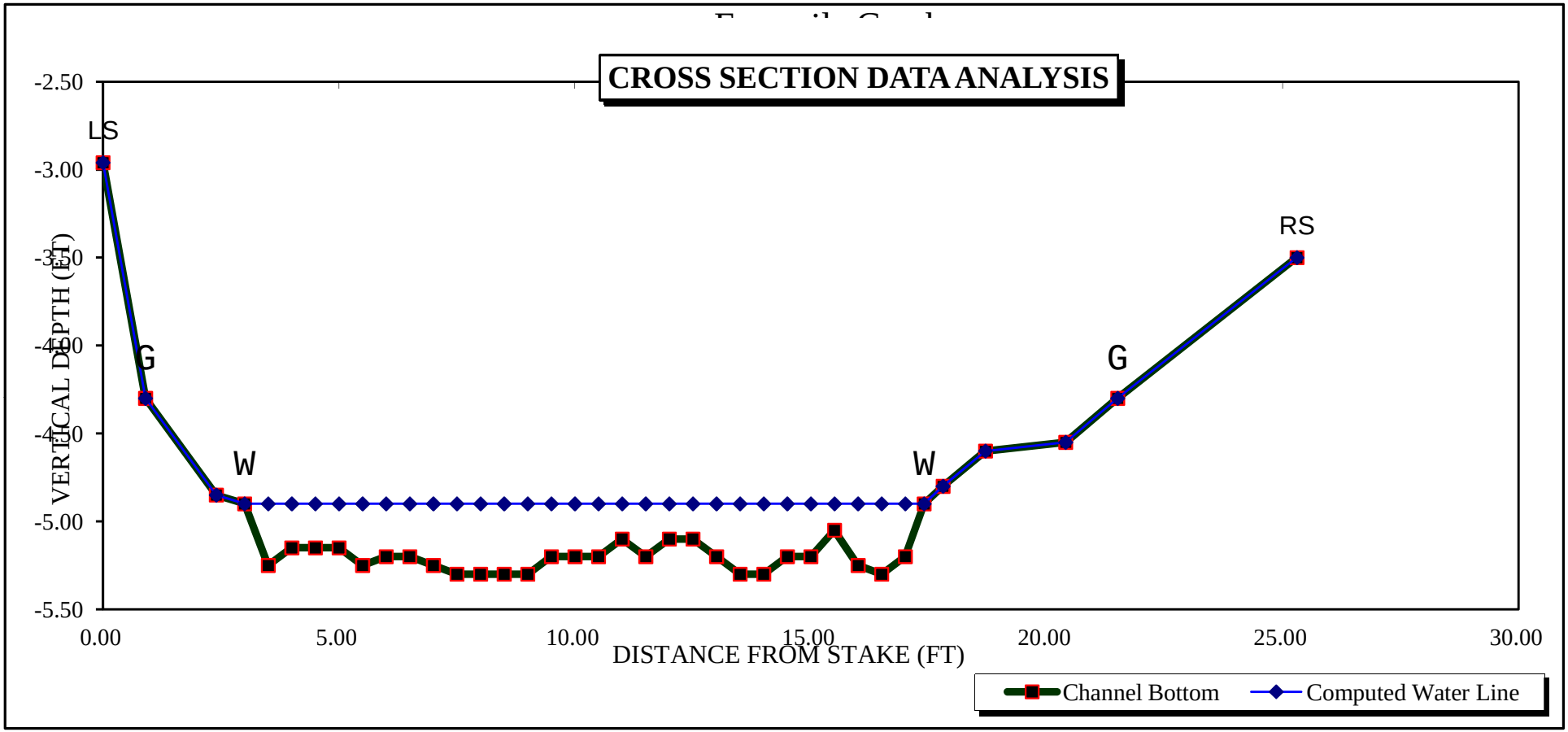
RECOMMENDATION BY: ………………...………..……............................ AGENCY..……………………......…....…...……...... DATE:.......…...….......……………

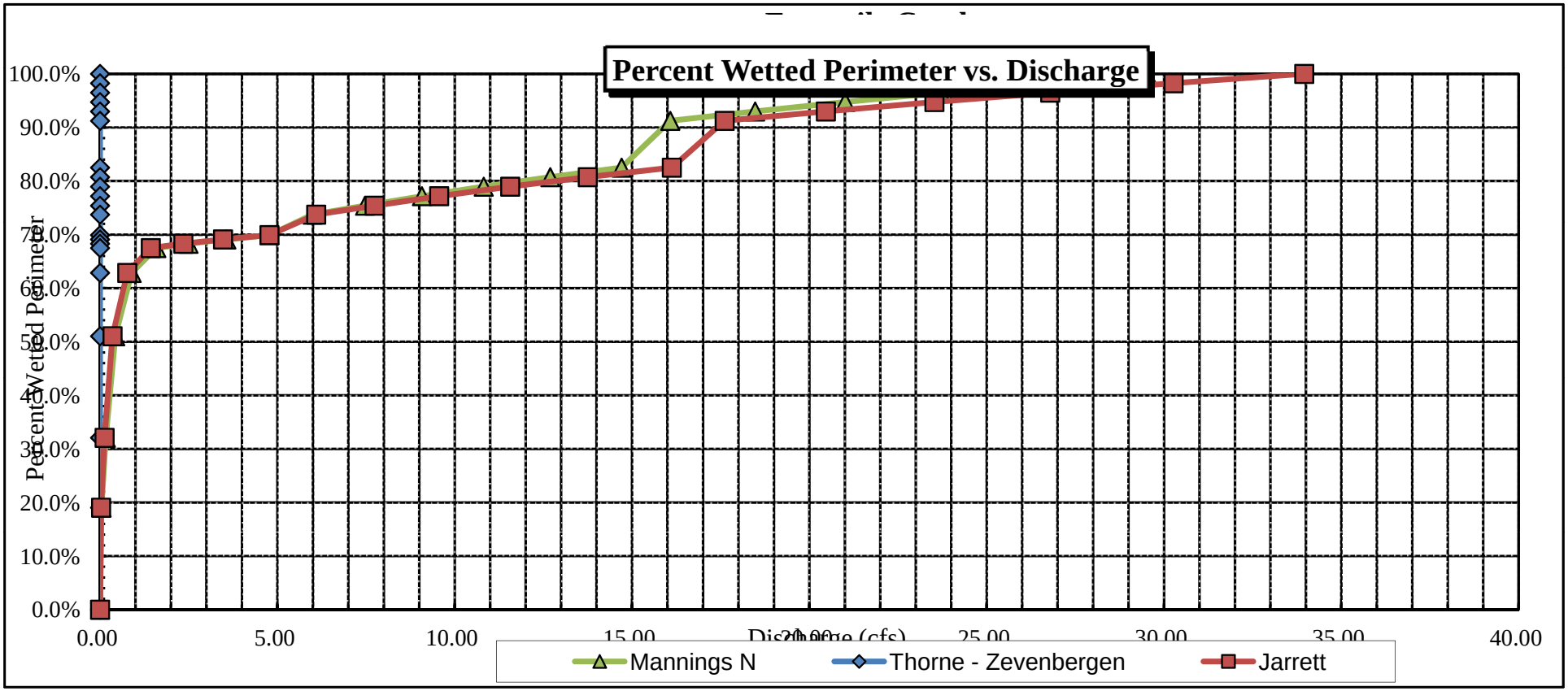
CWCB REVIEW BY: ..…………………………....………………………………………………...…............. DATE:..................…………….....

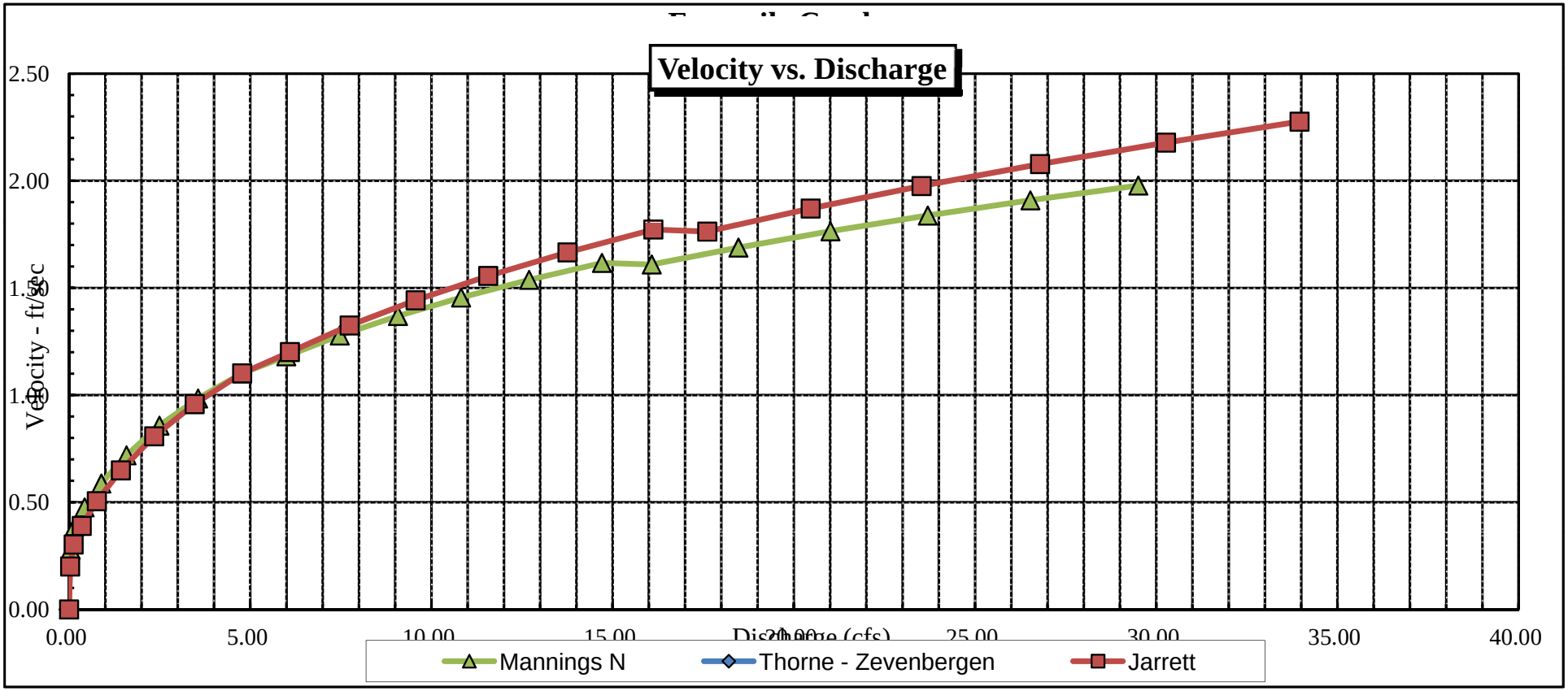
STREAM NAME: Fourmile Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

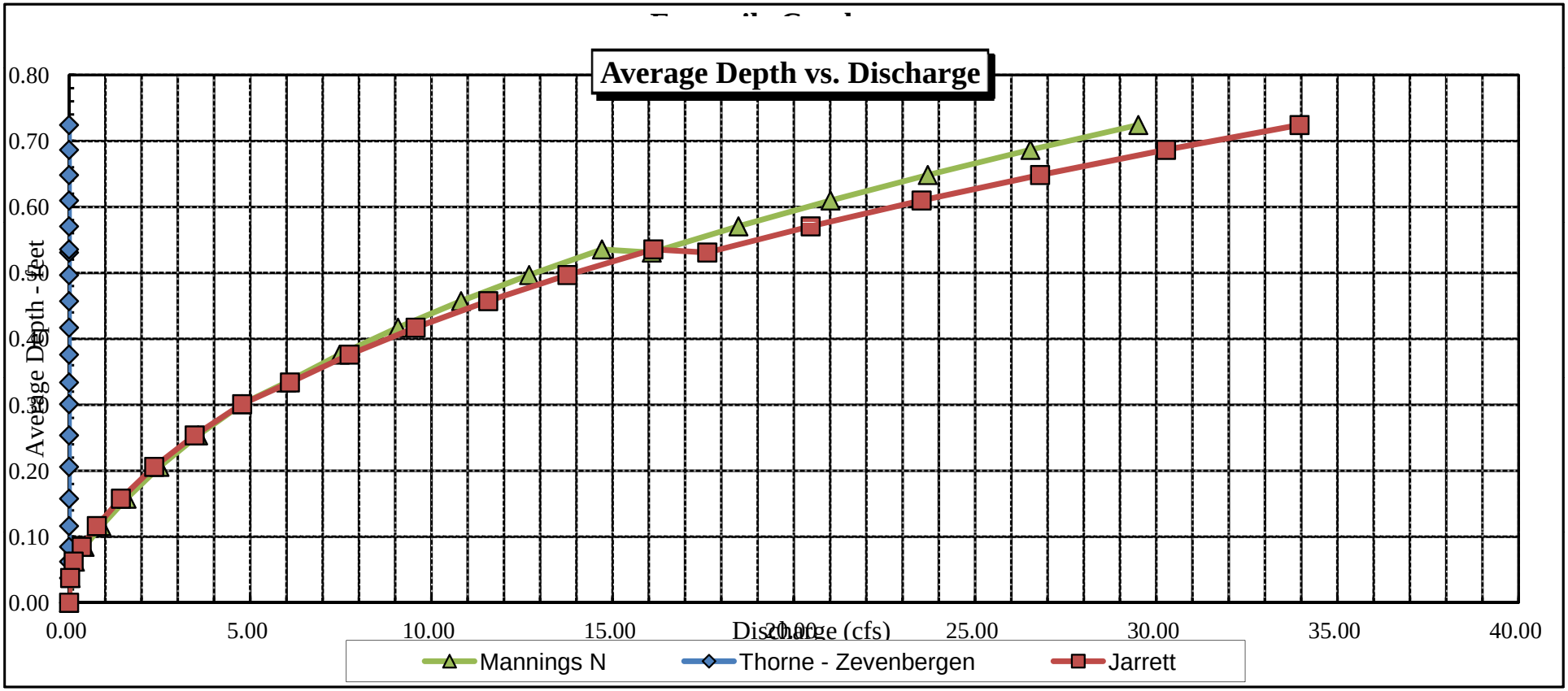
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

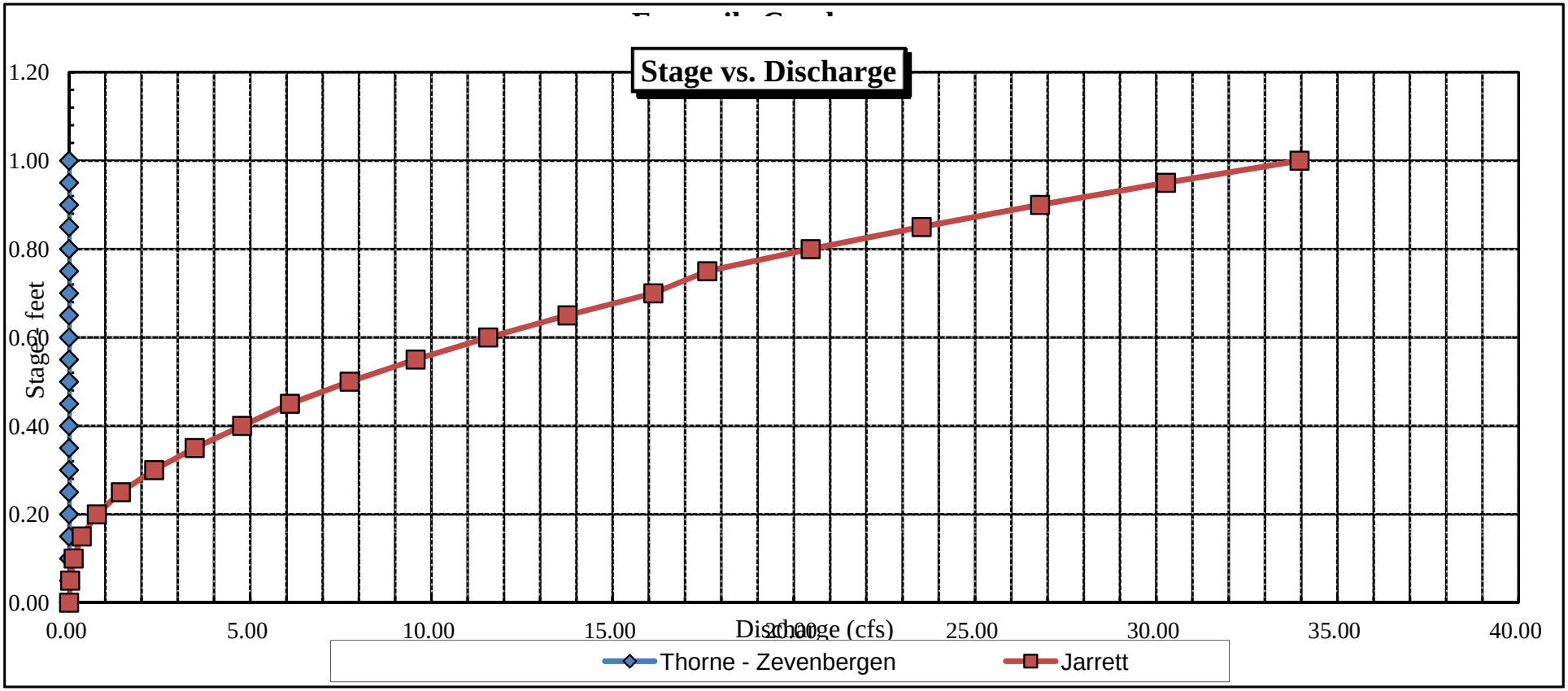
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.30	20.60	0.72	1.00	14.92	21.14	100.0%	0.71	33.95	2.28
	4.30	20.60	0.72	1.00	14.92	21.14	100.0%	0.71	33.95	2.28
	4.35	20.24	0.69	0.95	13.90	20.77	98.2%	0.67	30.27	2.18
	4.40	19.89	0.65	0.90	12.89	20.40	96.5%	0.63	26.79	2.08
	4.45	19.53	0.61	0.85	11.91	20.03	94.7%	0.59	23.52	1.98
	4.50	19.17	0.57	0.80	10.94	19.66	93.0%	0.56	20.46	1.87
	4.55	18.82	0.53	0.75	9.99	19.29	91.2%	0.52	17.61	1.76
	4.60	16.98	0.54	0.70	9.10	17.44	82.5%	0.52	16.12	1.77
	4.65	16.62	0.50	0.65	8.26	17.07	80.7%	0.48	13.75	1.67
	4.70	16.26	0.46	0.60	7.43	16.69	78.9%	0.45	11.57	1.56
	4.75	15.90	0.42	0.55	6.63	16.32	77.2%	0.41	9.56	1.44
	4.80	15.54	0.38	0.50	5.84	15.94	75.4%	0.37	7.74	1.32
	4.85	15.20	0.33	0.45	5.07	15.59	73.7%	0.33	6.09	1.20
WL	4.90	14.40	0.30	0.40	4.33	14.78	69.9%	0.29	4.78	1.10
	4.95	14.26	0.25	0.35	3.62	14.61	69.1%	0.25	3.47	0.96
	5.00	14.12	0.21	0.30	2.91	14.44	68.3%	0.20	2.35	0.81
	5.05	13.99	0.16	0.25	2.21	14.27	67.5%	0.15	1.43	0.65
	5.10	13.06	0.12	0.20	1.52	13.29	62.9%	0.11	0.77	0.51
	5.15	10.63	0.08	0.15	0.90	10.79	51.0%	0.08	0.35	0.39
	5.20	6.70	0.06	0.10	0.42	6.78	32.1%	0.06	0.13	0.30
	5.25	4.00	0.04	0.05	0.15	4.02	19.0%	0.04	0.03	0.20
	5.30	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


CROSS SECTION DATA ANALYSIS
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
VERTICAL DEPTH (FT)
LS
G
W
W
G
RS
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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
5.00
10.00
15.00
Discharge (cfs)
25.00
30.00
35.00
40.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage, feet
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Fourmile Creek

CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: At BLM-USFS boundary

DATE: 7-8-15

OBSERVERS: R. Smith, E. Scharff

LEGAL DESCRIPTION

¼ SECTION: NE

SECTION: 13

TOWNSHIP: 10 (N)/S

RANGE: 90 E/(W)

PM: Sixth

COUNTY: Moffat

WATERSHED: Little Snake

WATER DIVISION: 6

DOW WATER CODE: 21173

MAP(S):

USGS:

USFS: 295038
4521742

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: 2" cobble to 1-foot boulders

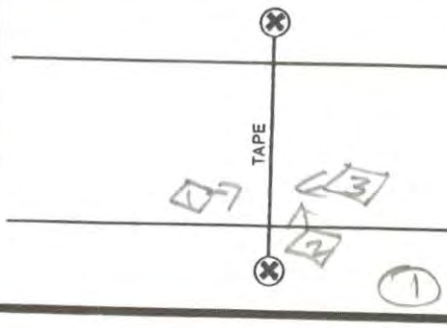
PHOTOGRAPHS TAKEN: (YES)/NO

NUMBER OF PHOTOGRAPHS: 3

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.05 / 5.05
② WS Upstream	7.6	5.22
③ WS Downstream	14.4	5.85
SLOPE	0.63 / 22.0 = 0.029	

SKETCH



LEGEND:

Stake ⊗

Station ①

Photo ◇→

Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/(NO)

DISTANCE ELECTROFISHED: _____ ft

FISH CAUGHT: YES/NO

WATER CHEMISTRY SAMPLED: YES/(NO)

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

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

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

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Fourmile Creek	CROSS-SECTION NO.: 1	DATE: 7-8-15	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 2:35 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		2.86								
G	2.0		3.74								
	3.1		4.97								
	5.5		4.97					∅			
W	6.0		5.05	∅							
	6.5		5.15	.1				.27			
	7		5.25	.2				.19			
	7.5		5.10	.05				.59			
	8		5.25	.2				.51			
	8.5		5.20	.15				.49			
	9		5.30	.25				.88			
	9.5		5.25	.25				1.03			
	10		5.30	.25				.89			
	10.5		5.25	.2				.53			
	11		5.05	∅				∅			
	11.5		5.30	.25				1.02			
	12		5.2	.15				.23			
	12.5		5.2	.15				.61			
	13		5.2	.15				.58			
	13.5		5.2	.15				.37			
	14		5.25	.2				.71			
	14.5		5.05	∅				∅			
	15		5.2	.15				.92			
	15.5		5.2	.15				.83			
	16		5.2	.15				.94			
	16.5		5.15	.10				.90			
	16.75		5.35	.3				1.03			
	17		5.25	.2				.81			
W	17.2		5.05	∅				∅			
	18.9		4.34								
	20.7		3.98								
RS+G	22.5		3.69								
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:	Fourmile Creek
XS LOCATION:	At BLM-USFS boundary
XS NUMBER:	1
DATE:	8-Jul-15
OBSERVERS:	R. Smith, E. Scherff
1/4 SEC:	NE
SECTION:	13
TWP:	10N
RANGE:	90W
PM:	Sixth
COUNTY:	Moffat
WATERSHED:	Little Snake
DIVISION:	6
DOW CODE:	21173
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.029

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

ASSIGNED TO: ….....…….....DATE.....

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

DATA POINTS= 32

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
LS	0.00	2.86			0.00		0.00	0.00	0.0%
1 G	2.00	3.74			0.00		0.00	0.00	0.0%
	3.10	4.97			0.00		0.00	0.00	0.0%
	5.50	4.97			0.00		0.00	0.00	0.0%
W	6.00	5.05	0.00	0.00	0.00		0.00	0.00	0.0%
	6.50	5.15	0.10	0.27	0.51	0.10	0.05	0.01	1.1%
	7.00	5.25	0.20	0.19	0.51	0.20	0.10	0.02	1.6%
	7.50	5.10	0.05	0.59	0.52	0.05	0.03	0.01	1.2%
	8.00	5.25	0.20	0.51	0.52	0.20	0.10	0.05	4.3%
	8.50	5.20	0.15	0.49	0.50	0.15	0.08	0.04	3.1%
	9.00	5.30	0.25	0.88	0.51	0.25	0.13	0.11	9.2%
	9.50	5.25	0.20	1.03	0.50	0.20	0.10	0.10	8.6%
	10.00	5.30	0.25	0.89	0.50	0.25	0.13	0.11	9.3%
	10.50	5.25	0.20	0.53	0.50	0.20	0.10	0.05	4.4%
	11.00	5.05	0.00	0.00	0.54		0.00	0.00	0.0%
	11.50	5.30	0.25	1.02	0.56	0.25	0.13	0.13	10.7%
	12.00	5.20	0.15	0.23	0.51	0.15	0.08	0.02	1.4%
	12.50	5.20	0.15	0.61	0.50	0.15	0.08	0.05	3.8%
	13.00	5.20	0.15	0.58	0.50	0.15	0.08	0.04	3.6%
	13.50	5.20	0.15	0.37	0.50	0.15	0.08	0.03	2.3%
	14.00	5.25	0.20	0.71	0.50	0.20	0.10	0.07	5.9%
	14.50	5.05	0.00	0.00	0.54		0.00	0.00	0.0%
	15.00	5.20	0.15	0.92	0.52	0.15	0.08	0.07	5.8%
	15.50	5.20	0.15	0.83	0.50	0.15	0.08	0.06	5.2%
	16.00	5.20	0.15	0.94	0.50	0.15	0.08	0.07	5.9%
	16.50	5.15	0.10	0.90	0.50	0.10	0.04	0.03	2.8%
	16.75	5.35	0.30	1.03	0.32	0.30	0.08	0.08	6.5%
	17.00	5.25	0.20	0.81	0.27	0.20	0.04	0.04	3.1%
W	17.20	5.05	0.00	0.00	0.28		0.00	0.00	0.0%
	18.90	4.34			0.00		0.00	0.00	0.0%
	20.70	3.98			0.00		0.00	0.00	0.0%
1 RS & G	22.50	3.69			0.00		0.00	0.00	0.0%
TOTALS ----------					11.63	0.3 (Max.)	1.71	1.19	100.0%

Manning's n = 0.1007
Hydraulic Radius= 0.14683216

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

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.71	1.71	0.0%
4.80	1.71	5.11	199.2%
4.82	1.71	4.81	181.8%
4.84	1.71	4.52	164.5%
4.86	1.71	4.22	147.3%
4.88	1.71	3.93	130.2%
4.90	1.71	3.64	113.2%
4.92	1.71	3.35	96.2%
4.94	1.71	3.06	79.3%
4.96	1.71	2.77	62.5%
4.98	1.71	2.51	47.2%
5.00	1.71	2.28	33.4%
5.01	1.71	2.16	26.6%
5.02	1.71	2.05	19.9%
5.03	1.71	1.93	13.2%
5.04	1.71	1.82	6.6%
5.05	1.71	1.71	0.0%
5.06	1.71	1.60	-6.5%
5.07	1.71	1.49	-12.9%
5.08	1.71	1.38	-19.2%
5.09	1.71	1.27	-25.5%
5.10	1.71	1.17	-31.6%
5.12	1.71	0.96	-43.5%
5.14	1.71	0.77	-54.8%
5.16	1.71	0.59	-65.6%
5.18	1.71	0.42	-75.6%
5.20	1.71	0.26	-84.9%
5.22	1.71	0.17	-90.1%
5.24	1.71	0.10	-94.2%
5.26	1.71	0.05	-97.1%
5.28	1.71	0.02	-99.0%
5.30	1.71	0.00	-99.7%

WATERLINE AT ZERO
AREA ERROR = 5.050

STREAM NAME: Fourmile 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	3.74	20.19	1.15	1.61	23.20	21.37	100.0%	1.09	61.59	2.65
	4.05	18.07	0.96	1.30	17.28	19.09	89.3%	0.91	40.64	2.35
	4.10	17.78	0.92	1.25	16.38	18.77	87.8%	0.87	37.61	2.30
	4.15	17.48	0.89	1.20	15.50	18.45	86.3%	0.84	34.70	2.24
	4.20	17.19	0.85	1.15	14.64	18.12	84.8%	0.81	31.90	2.18
	4.25	16.89	0.82	1.10	13.78	17.80	83.3%	0.77	29.21	2.12
	4.30	16.60	0.78	1.05	12.95	17.48	81.8%	0.74	26.63	2.06
	4.35	16.33	0.74	1.00	12.12	17.18	80.4%	0.71	24.15	1.99
	4.40	16.17	0.70	0.95	11.31	16.99	79.5%	0.67	21.68	1.92
	4.45	16.00	0.66	0.90	10.51	16.79	78.6%	0.63	19.32	1.84
	4.50	15.84	0.61	0.85	9.71	16.59	77.6%	0.59	17.08	1.76
	4.55	15.67	0.57	0.80	8.92	16.40	76.7%	0.54	14.95	1.68
	4.60	15.51	0.53	0.75	8.14	16.20	75.8%	0.50	12.94	1.59
	4.65	15.34	0.48	0.70	7.37	16.00	74.9%	0.46	11.05	1.50
	4.70	15.18	0.44	0.65	6.61	15.81	74.0%	0.42	9.29	1.41
	4.75	15.02	0.39	0.60	5.85	15.61	73.0%	0.38	7.65	1.31
	4.80	14.85	0.34	0.55	5.11	15.41	72.1%	0.33	6.15	1.20
	4.85	14.69	0.30	0.50	4.37	15.22	71.2%	0.29	4.78	1.09
	4.90	14.52	0.25	0.45	3.64	15.02	70.3%	0.24	3.56	0.98
	4.95	14.36	0.20	0.40	2.92	14.82	69.3%	0.20	2.48	0.85
	5.00	11.63	0.20	0.35	2.28	12.08	56.5%	0.19	1.88	0.83
WL	5.05	11.20	0.15	0.30	1.71	11.63	54.4%	0.15	1.19	0.70
	5.10	10.38	0.11	0.25	1.17	10.75	50.3%	0.11	0.67	0.57
	5.15	9.23	0.07	0.20	0.68	9.52	44.5%	0.07	0.29	0.43
	5.20	5.02	0.05	0.15	0.26	5.21	24.4%	0.05	0.09	0.34
	5.25	2.48	0.03	0.10	0.07	2.56	12.0%	0.03	0.02	0.23
	5.30	0.19	0.02	0.05	0.00	0.21	1.0%	0.02	0.00	0.20

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

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.19	cfs
CALCULATED FLOW (Qc)=	1.19	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.05	ft
CALCULATED WATERLINE (WLc)=	5.05	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.70	ft/sec
MANNING'S N=	0.101	
SLOPE=	0.029	ft/ft
.4 * Qm =	0.5	cfs
2.5 * Qm=	3.0	cfs

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

FLOW (CFS)	PERIOD
___________	___________
___________	___________
___________	___________
___________	___________

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

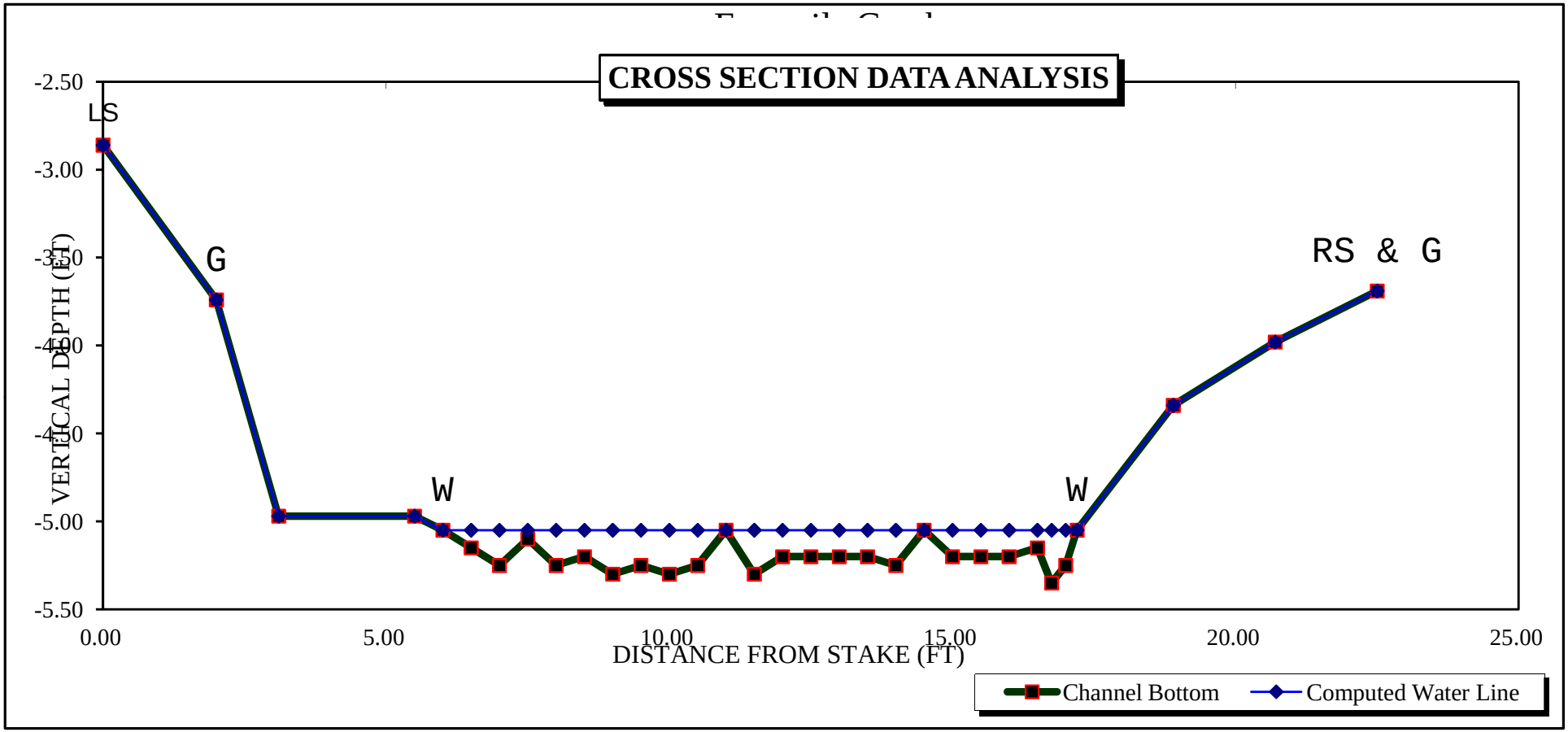
RECOMMENDATION BY: ……………………...……….……................................ AGENCY..……………………….....……...…...…….…...... DATE:.......…...….......……………

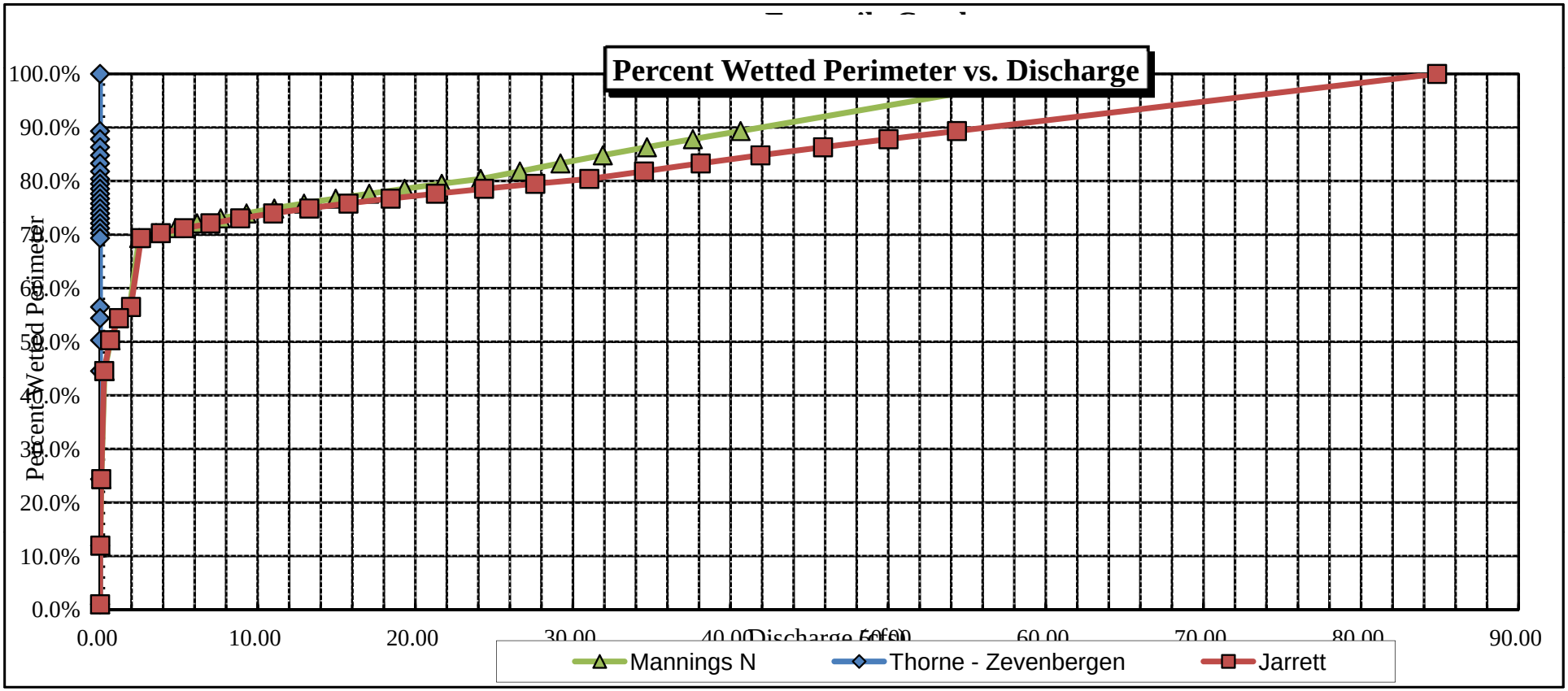
CWCB REVIEW BY: ..……………………………....…………………………………………………...…............. DATE:.................……………...…

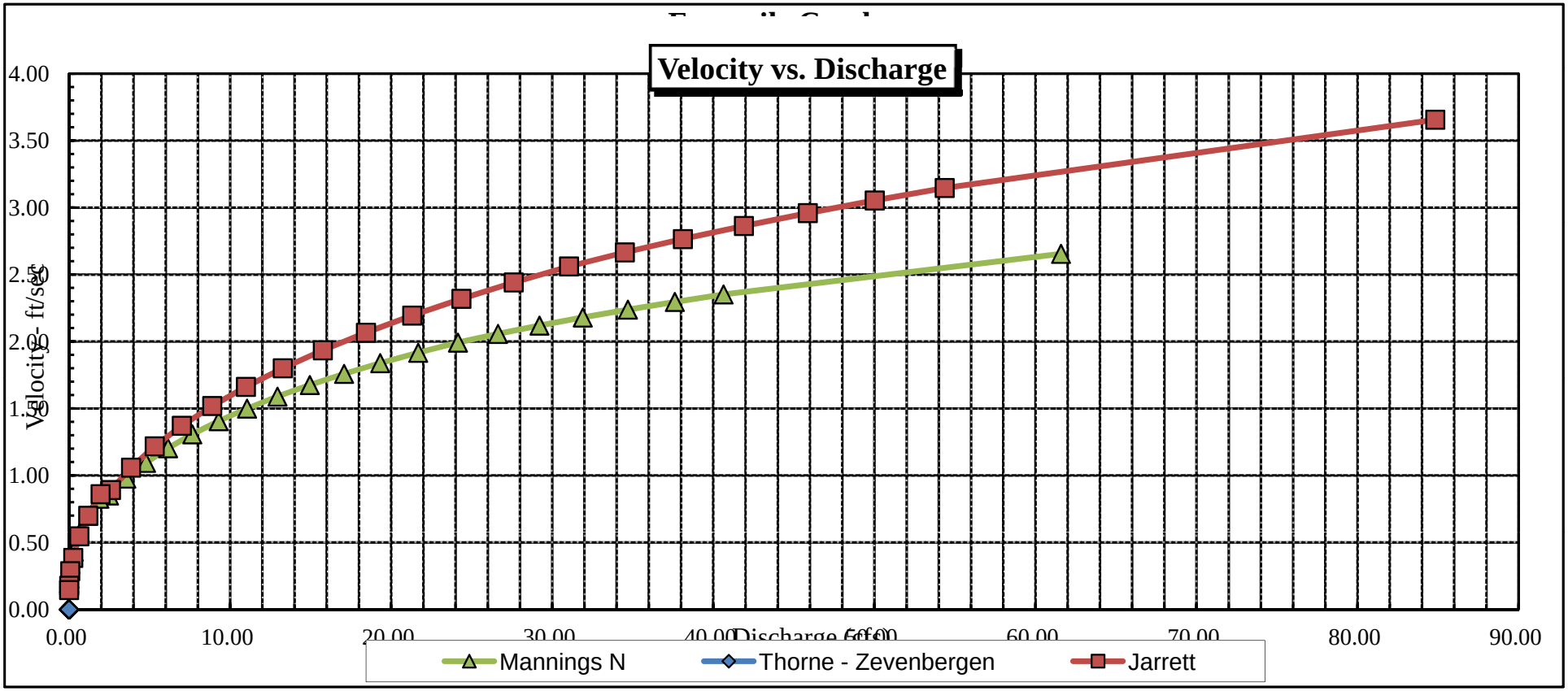
STREAM NAME: Fourmile Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

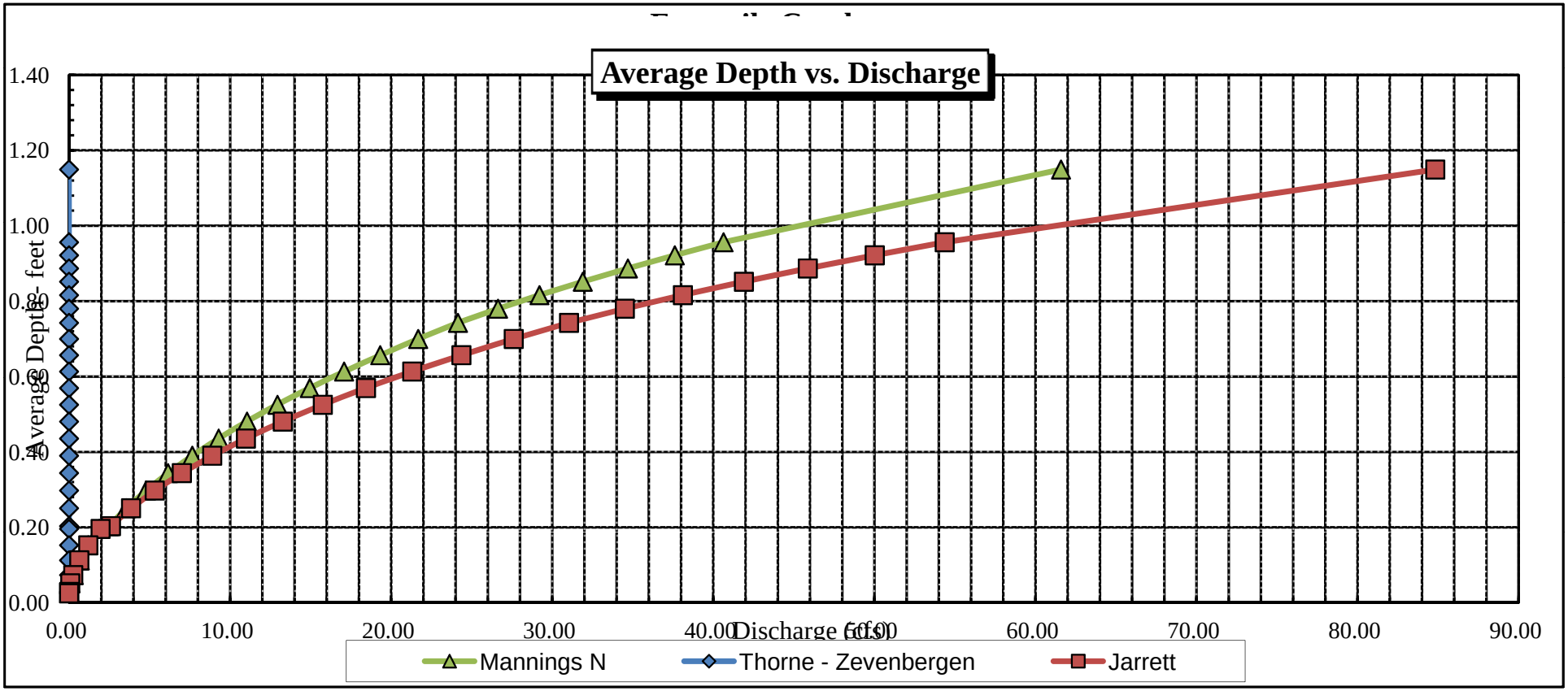
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

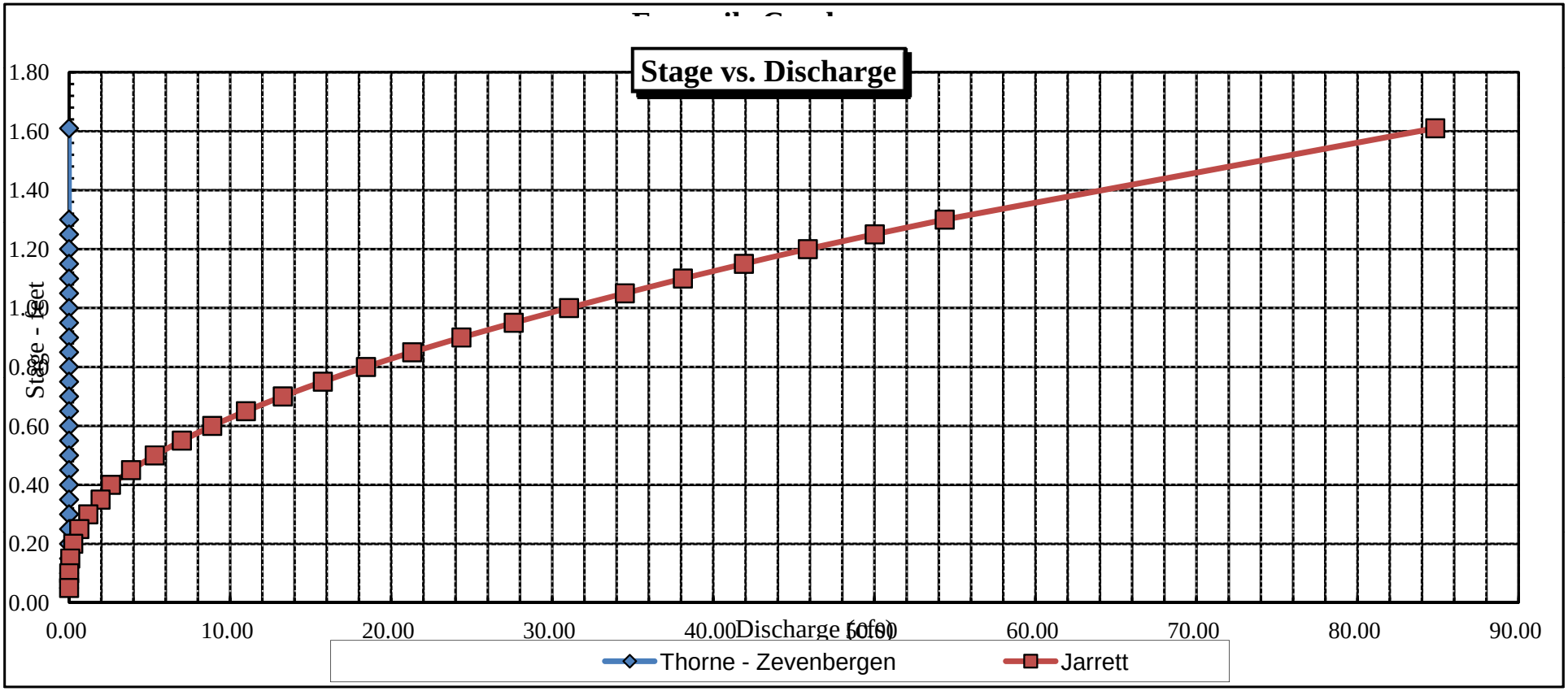
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.74	20.19	1.15	1.61	23.20	21.37	100.0%	1.09	84.82	3.66
	4.05	18.07	0.96	1.30	17.28	19.09	89.3%	0.91	54.36	3.15
	4.10	17.78	0.92	1.25	16.38	18.77	87.8%	0.87	50.02	3.05
	4.15	17.48	0.89	1.20	15.50	18.45	86.3%	0.84	45.87	2.96
	4.20	17.19	0.85	1.15	14.64	18.12	84.8%	0.81	41.90	2.86
	4.25	16.89	0.82	1.10	13.78	17.80	83.3%	0.77	38.11	2.76
	4.30	16.60	0.78	1.05	12.95	17.48	81.8%	0.74	34.50	2.67
	4.35	16.33	0.74	1.00	12.12	17.18	80.4%	0.71	31.04	2.56
	4.40	16.17	0.70	0.95	11.31	16.99	79.5%	0.67	27.61	2.44
	4.45	16.00	0.66	0.90	10.51	16.79	78.6%	0.63	24.36	2.32
	4.50	15.84	0.61	0.85	9.71	16.59	77.6%	0.59	21.30	2.19
	4.55	15.67	0.57	0.80	8.92	16.40	76.7%	0.54	18.43	2.07
	4.60	15.51	0.53	0.75	8.14	16.20	75.8%	0.50	15.76	1.93
	4.65	15.34	0.48	0.70	7.37	16.00	74.9%	0.46	13.27	1.80
	4.70	15.18	0.44	0.65	6.61	15.81	74.0%	0.42	10.98	1.66
	4.75	15.02	0.39	0.60	5.85	15.61	73.0%	0.38	8.89	1.52
	4.80	14.85	0.34	0.55	5.11	15.41	72.1%	0.33	7.00	1.37
	4.85	14.69	0.30	0.50	4.37	15.22	71.2%	0.29	5.32	1.22
	4.90	14.52	0.25	0.45	3.64	15.02	70.3%	0.24	3.85	1.06
	4.95	14.36	0.20	0.40	2.92	14.82	69.3%	0.20	2.60	0.89
	5.00	11.63	0.20	0.35	2.28	12.08	56.5%	0.19	1.96	0.86
WL	5.05	11.20	0.15	0.30	1.71	11.63	54.4%	0.15	1.19	0.70
	5.10	10.38	0.11	0.25	1.17	10.75	50.3%	0.11	0.64	0.55
	5.15	9.23	0.07	0.20	0.68	9.52	44.5%	0.07	0.26	0.38
	5.20	5.02	0.05	0.15	0.26	5.21	24.4%	0.05	0.07	0.29
	5.25	2.48	0.03	0.10	0.07	2.56	12.0%	0.03	0.01	0.18
	5.30	0.19	0.02	0.05	0.00	0.21	1.0%	0.02	0.00	0.14


CROSS SECTION DATA ANALYSIS
LS
G
W
W
RS & G
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
60.00
70.00
80.00
90.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - 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
Discharge (cfs)
60.00
70.00
80.00
90.00
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Little Snake Field Office Stream Surveys
July 2008

Fourmile Creek - Water Code #21173

Fourmile Creek, north of Craig, CO and located on BLM lands managed by the Little Snake Field Office and USFS lands managed by the Routt National Forest was sampled on July 29, 2008. Fourmile Creek is tributary to the Little Snake River. Presence/absence sampling was done to collect fin clips from suspected Colorado River cutthroat trout to determine genetic purity. Sampling was conducted via backpack electro-shocker and two sites were sampled – see map below. Personnel present were Gregor Dekleva, BLM, and Rick Henderson and Chris Carroll, USFS.

Fourmile creek lower site

Colorado River cutthroat trout

Colorado River cutthroat trout

STREAM SURVEY FISH SAMPLING FORM

WATER Fourmile Creek H2O CODE 21173 DATE 7/29/08

GEAR BPE EFFORT ~250ft STATION # 1 PASS # 1

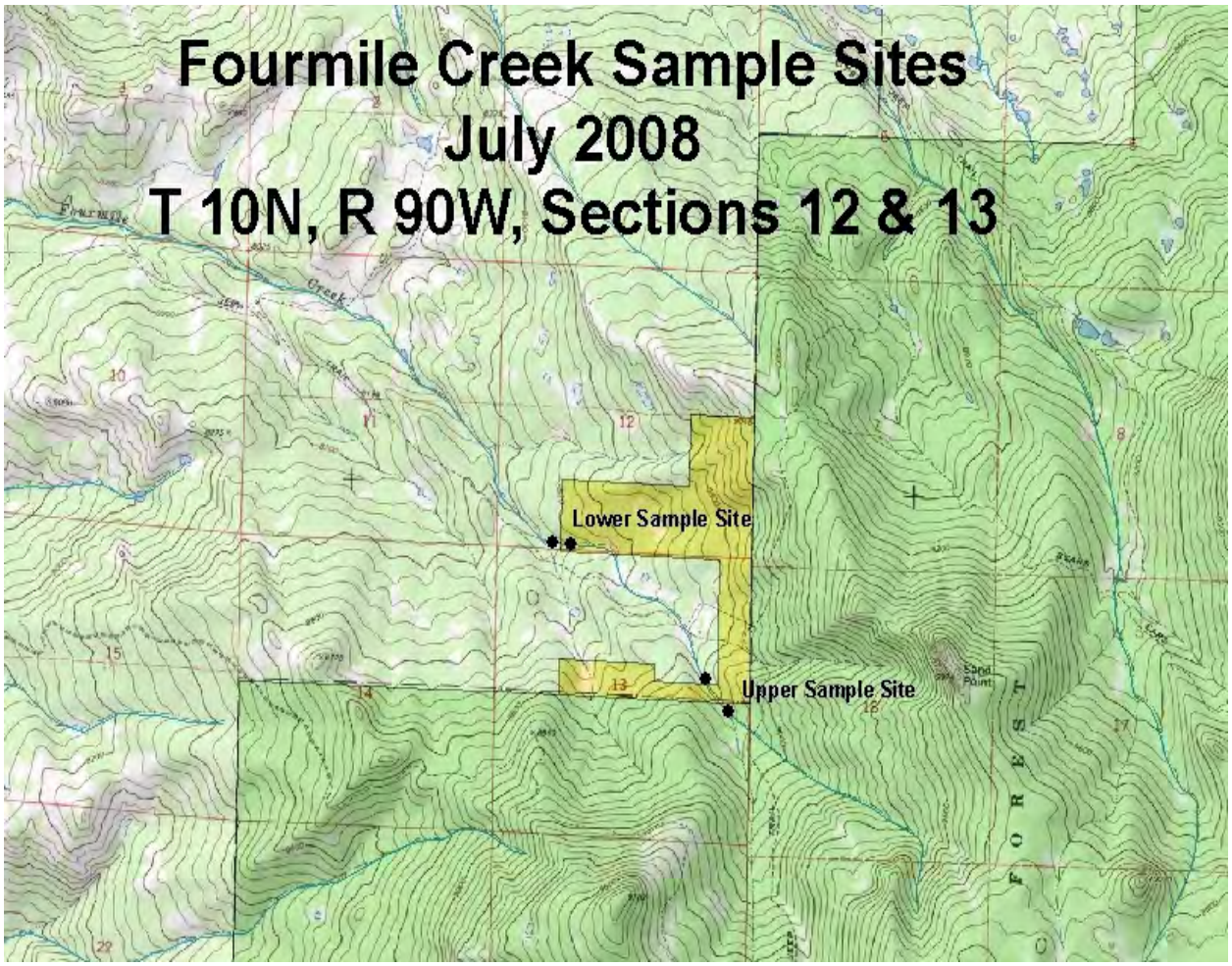
CREW Dekleva, Carroll, Womble DRAINAGE Yampa LOCATION GPS

Pass	species	length	weight		species	length	weight	Pass
1	CRN	91	5					
1	CRN	90	5					
1	CRN	92	5					
1	CRN	120	24					
1	CRN	125	26					
1	CRN	150	32					
1	CRN	190	61					
1	CRN	100	24					
1	CRN	180	58					
1	CRN	140	26					
1	CRN	120	21					
1	CRN	235	120					
1	CRN	230	110					
1	CRN	90	6					
1	CRN	90	6					
1	CRN	200	87					
1	CRN	175	54					
1	CRN	170	47					
1	CRN	160	39					

GPS Location: MAP

Notes: Stream Width 5 ft. Sample Reach ~250 ft.

Conductivity: Electroshocker settings



Discussion:
Fourmile Creek was sampled near the headwaters on BLM and USFS lands. The stream appears to be in good condition. Riparian vegetation is in excellent shape with a good diversity of plant species present including willows, sedges, aspen, and spruce. Stream cover was good and there are several beaver ponds located on private land between the two BLM sections. The stream contains a good mix of micro-habitats with adequate pools present for oversummer and overwinter survival.

Of the nineteen Colorado River cutthroat trout collected, 14 had fin clips taken – all from the lower sample area. At least three age classes of fish were observed. In the upper sample site one Colorado River cutthroat trout was seen but not netted. Fish appeared healthy and aquatic insects were abundant consisting primarily of caddis and mayflies.

Recommendations:

- Conduct additional sampling of the creek to determine upper and lower distribution limits of cutthroat
- Complete a population estimate
- Collect a minimum of fifteen more adult fish for fin clip genetic analysis