United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7093
www.blm.gov/co

TAKE PRIDE IN AMERICA

In Reply Refer To:
7250 (CO-932)

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 instream flow water rights on Forrester Creek, located in Water Division 1.

Location and Land Status: Forrester Creek is tributary to the Laramie River approximately four miles south of the Colorado-Wyoming border. This recommendation covers the stream reach beginning at the headwaters (106° 4' 37.57" W, 40°51' 43.39" N) and extending downstream to the headgate of the Forrester Creek Ditch, a distance of approximately 6.9 miles. Approximately 0.9 miles of this stream reach are managed by the BLM, and 4.7 miles are managed by the U.S. Forest Service. Approximately 1.3 miles are under private ownership

Biological Summary: Forrester Creek is a cold-water stream with moderate gradient, functional floodplains, and active beaver dams. The stream has a good mix of riffle, run, and deep pool habitats. Fish surveys show that Forrester Creek supports naturally reproducing brook trout population. Intensive macroinvertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, stonefly, caddisfly and midge.

The riparian community occupies most of the floodplain area and is comprised primarily of willows, alders, and sedges. The healthy riparian community has resulted in normal width-to-depth ratios, sinuosity, and bank stability.

R2Cross Analysis: The BLM collected the following R2Cross data from Forrester 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)
08/02/2010 #1	1.26 cfs	5.33 feet	0.61 cfs	1.79 cfs
08/02/2010 #2	1.14 cfs	6.79 feet	0.77 cfs	1.64 cfs
		Averages:	0.69 cfs	1.72 cfs

The 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.

> 1.70 cubic feet per second is recommended for the snowmelt runoff period from May 1 through August 31. This recommendation is driven by the average depth criteria. It is important to maintain adequate depth in the riffles in this creek, because the creek has limited riffle habitat available for spawning.
>
> 1.1 cubic feet per second is recommended during the late summer and early fall period, from September 1 to October 31. This recommendation has been reduced because of water availability concerns. This flow rate will meet the wetted perimeter and velocity criteria, while providing an average depth of 0.15 feet.
>
> 0.70 cubic feet per second is recommended during the cold temperature period, from November 1 to April 30. This recommendation is driven by the wetted perimeter criteria and depth criteria. During winter, this flow rate should provide sufficient velocity and depth to prevent icing of all physical habitat within the stream.

Water Availability: For water availability analysis, the BLM recommends analysis of U.S. Geological Survey stream gage 06657500 (Laramie River near Glendevey, CO). This gage has a long period of record between 1904 and 1982, and the State of Colorado has continued to operate the gage from 1982 to the present. This gage is located in a different part of the Laramie River watershed than Forrester Creek. However, this gage should provide an excellent indication of the volume of runoff to be expected per acre within this watershed, along with an indication of the timing and distribution of that runoff. When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter.

The BLM is not aware of any decreed water rights that operate within the recommended stream reach.

Relationship to Land Management Plans: The BLM considers the creeks it manages on the west side of the Laramie River watershed to be in very good condition. The streams possess largely intact natural hydrology. Grazing management has been significantly improved during the last 20 years. Impacts from roads, timber management, and other surface disturbances are very light. The BLM believes it is important to protect flow rates on these creeks and prevent hydrologic stresses, because these creeks will experience other stresses within the watershed as the pine beetle epidemic changes the vegetation community.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with the BLM's draft recommendation in February 2011. 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, Water Rights Specialist at (303) 239-3940.

Sincerely,

for Leigh D. Espy
Deputy State Director, Resources and Fire

cc: Dave Stout, Kremmling FO
Paula Belcher, Kremmling FO

DRAFT INSTREAM FLOW RECOMMENDATION

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1313 Sherman Street, Room 721
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		Averages:	0.69 cfs	1.72 cfs

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

1.70 cubic feet per second is recommended for the snowmelt runoff period from April 1 through July 15. This recommendation is driven by the average depth

criteria. It is important to maintain adequate depth in the riffles in this creek, because the creek has limited riffle habitat available for spawning.

1.1 cubic feet per second is recommended during the late summer and early fall period, from July 16 to October 31. This recommendation has been preliminarily reduced because of water availability concerns. This flow rate will meet the wetted perimeter and velocity criteria, while providing an average depth of 0.15 feet.

0.70 cubic feet per second is recommended during the cold temperature period, from November 1 to March 31. This recommendation is driven by the wetted perimeter criteria and depth criteria. During winter, this flow rate should provide sufficient velocity and depth to prevent icing of all physical habitat within the stream.

Water Availability. For water availability analysis, BLM recommends analysis of U.S. Geological Survey stream gage 06657500 (Laramie River near Glendevey, CO). This gage has a long period of record between 1904 and 1982, and the State of Colorado has continued to operate the gage from 1982 to the present. This gage is located in a different part of the Laramie River watershed than Forrester Creek. However, this gage should provide an excellent indication of the volume of runoff to be expected per acre within this watershed, along with an indication of the timing and distribution of that runoff. When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter.

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

Sincerely,

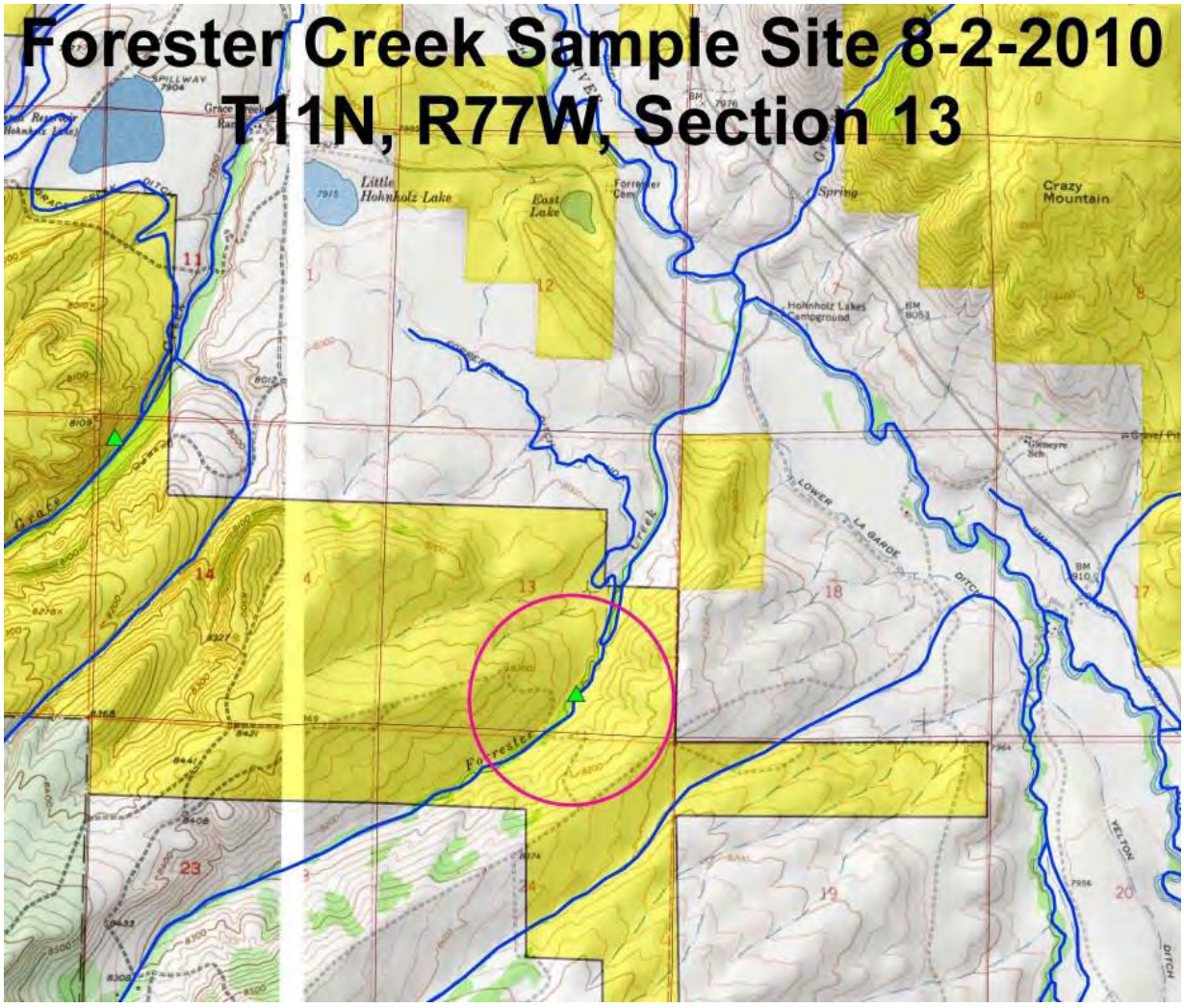
Leigh Espy
Deputy State Director
Resources and Fire

Cc: Dave Stout, Kremmling FO
Paula Belcher, Kremmling FO

Kremmling Field Office Stream Surveys
August 2010

Forrester Creek - Water Code #10950

Forrester Creek, located south of Hohnholz Lakes State Wildlife Area on BLM lands managed by the Kremmling Field Office, was sampled on August 2, 2010. Forrester Creek is tributary to the Laramie River. Sampling was done is support of the instream flow program and a two pass removal population estimate was completed. Brook trout were the only species seen or collected. Sampling was conducted via two backpack electro-shockers and a 305 foot station was sampled. Personnel present were Tom Fresques, Fish Biologist, and Gregor Dekleva and Kristy Wallner, Biological Technicians.



Forester Creek

Forester Creek

Forester Creek - Riparian

STREAM SURVEY FISH SAMPLING FORM

WATER _Forrester Creek_____ H2O CODE __10950_____ DATE _8/2/2010_

GEAR __Backpack Shocker__ EFFORT _____ STATION # _1_____ PASS # _1_____

CREW _Fresques, Wallner, Dekleva, Johnson__DRAINAGE Laramie River_ LOCATION GPS___

Pass	species	length	weight		species	length	weight	Pass
1	BRK	220	128		1	BRK	111	32
1	BRK	160	56		1	BRK	111	18
1	BRK	175	64		1	BRK	112	20
1	BRK	200	90		1	BRK	112	32
1	BRK	145	40		1	BRK	90	22
1	BRK	125	38		1	BRK	100	18
1	BRK	148	46		1	BRK	100	18
1	BRK	50	NW		1	BRK	60	6
1	BRK	63	NW		1	BRK	95	8
1	BRK	45	NW		1	BRK	100	22
1	BRK	90	20		1	BRK	84	4
1	BRK	172	68		1	BRK	60	NW
1	BRK	165	70		1	BRK	50	NW
1	BRK	166	54		1	BRK	44	NW
1	BRK	131	34		1	BRK	50	NW
1	BRK	143	48		1	BRK	60	NW
1	BRK	128	32		1	BRK	43	NW
1	BRK	166	53					
1	BRK	101	26					
1	BRK	102	25					
1	BRK	123	36					
1	BRK	88	18					
1	BRK	111	30					
1	BRK	140	30					
1	BRK	100	24					

GPS Location:

Notes: Stream Width __8.30_ ft. Sample Reach __305__ft.

Conductivity: ~100 ms Electroshocker settings

STREAM SURVEY FISH SAMPLING FORM

WATER _Forrester Creek_____ H2O CODE __10950_____ DATE _8/2/2010_

GEAR __Backpack Shocker__ EFFORT _____ STATION # _1_____ PASS # _2_____

CREW _Fresques, Wallner, Dekleva, Johnson__DRAINAGE Laramie River_ LOCATION GPS___

Pass	species	length	weight		Pass	species	length	weight
2	BRK	110	28		2	BRK	43	-
2	BRK	145	42					
2	BRK	125	90					
2	BRK	120	28					
2	BRK	50	-					
2	BRK	111	22					
2	BRK	111	28					
2	BRK	161	60					
2	BRK	110	26					
2	BRK	100	32					
2	BRK	101	26					
2	BRK	45	-					
2	BRK	58	-					
2	BRK	100	18					
2	BRK	93	26					
2	BRK	40	-					
2	BRK	40	-					
2	BRK	60	-					
2	BRK	50	-					
2	BRK	50	-					
2	BRK	60	-					
2	BRK	63	-					
2	BRK	53	-					
2	BRK	40	-					
2	BRK	40	-					

Discussion:

Forrester Creek was flowing at a rate of approximately 1.2 cfs and had a good mix of riffle, run, and pool habitats. The stream appeared to be a Rosgen C channel type. Riparian vegetation was abundant and consisted of thick willows, sedge, timothy, rush, alder, redtop, tufted hairgrass, poa, and thistle. The riparian area was approximately 75 feet wide. Based on limited visual observation, the stream contained caddis flies, midge larvae, stoneflies, and mayflies.

Brook trout of several age classes were the only species collected or seen. Conductivity was very low (approximately 100 ms) which made shocking difficult as voltage was high and fish response was fair.

Recommendations:

- Forrester Creek represents a significant resource on BLM lands, with more than one mile of fisheries habitat and a riparian zone in good condition that fills the entire channel bottom. This stream would benefit from an instream flow recommendation.

- Periodically monitor to ensure that stream habitats remain in good condition.

- Consider treating the thistle within the riparian area.

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

LOCATION INFORMATION

STREAM NAME:	Forrester Creek
XS LOCATION:	1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER:	1
DATE:	2-Aug-10
OBSERVERS:	R. Smith, P. Belcher
1/4 SEC:	SW SE
SECTION:	13
TWP:	11N
RANGE:	77W
PM:	6th
COUNTY:	Larimer
WATERSHED:	Laramie River
DIVISION:	1
DOW CODE:	10950
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.009

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

ASSIGNED TO: ….....…….....DATE.....

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 1

DATA POINTS= 24

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	0.00	4.94			0.00		0.00	0.00	0.0%
		1.50	5.44			0.00		0.00	0.00	0.0%
1	G	1.90	6.02			0.00		0.00	0.00	0.0%
	W	2.00	7.07	0.00	0.00	0.00		0.00	0.00	0.0%
		2.30	7.25	0.20	1.71	0.35	0.20	0.06	0.10	8.1%
		2.60	7.30	0.25	2.08	0.30	0.25	0.08	0.16	12.4%
		2.90	7.30	0.25	1.35	0.30	0.25	0.08	0.10	8.0%
		3.20	7.35	0.30	1.98	0.30	0.30	0.09	0.18	14.2%
		3.50	7.35	0.30	2.07	0.30	0.30	0.09	0.19	14.8%
		3.80	7.30	0.25	2.14	0.30	0.25	0.08	0.16	12.7%
		4.10	7.30	0.25	1.64	0.30	0.25	0.08	0.12	9.8%
		4.40	7.25	0.20	1.48	0.30	0.20	0.06	0.09	7.1%
		4.70	7.15	0.10	1.39	0.32	0.10	0.03	0.04	3.3%
		5.00	7.15	0.10	1.30	0.30	0.10	0.03	0.04	3.1%
		5.30	7.15	0.10	0.75	0.30	0.10	0.03	0.02	1.8%
		5.60	7.15	0.10	0.79	0.30	0.10	0.03	0.02	1.9%
		5.90	7.15	0.10	0.28	0.30	0.10	0.03	0.01	0.7%
		6.20	7.15	0.10	0.47	0.30	0.10	0.03	0.01	1.1%
		6.50	7.10	0.05	0.58	0.30	0.05	0.02	0.01	0.7%
		6.80	7.10	0.05	0.46	0.30	0.05	0.01	0.00	0.4%
	W	6.90	7.04	0.00	0.00	0.12		0.00	0.00	0.0%
		7.10	6.40			0.00		0.00	0.00	0.0%
1	G	7.30	5.82			0.00		0.00	0.00	0.0%
	LS	9.00	5.11			0.00		0.00	0.00	0.0%
	TOTALS ----------					5.00	0.3 (Max.)	0.81	1.26	100.0%

Manning's n = 0.0267
Hydraulic Radius= 0.16089077

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.81	0.78	-2.7%
6.81	0.81	2.02	150.9%
6.83	0.81	1.92	138.5%
6.85	0.81	1.82	126.1%
6.87	0.81	1.72	113.8%
6.89	0.81	1.62	101.4%
6.91	0.81	1.52	89.1%
6.93	0.81	1.42	76.8%
6.95	0.81	1.32	64.5%
6.97	0.81	1.23	52.2%
6.99	0.81	1.13	40.0%
7.01	0.81	1.03	27.8%
7.02	0.81	0.98	21.6%
7.03	0.81	0.93	15.5%
7.04	0.81	0.88	9.4%
7.05	0.81	0.83	3.4%
7.06	0.81	0.78	-2.7%
7.07	0.81	0.73	-8.8%
7.08	0.81	0.69	-14.8%
7.09	0.81	0.64	-20.8%
7.10	0.81	0.59	-26.7%
7.11	0.81	0.54	-32.4%
7.13	0.81	0.46	-43.2%
7.15	0.81	0.37	-53.6%
7.17	0.81	0.32	-60.8%
7.19	0.81	0.27	-66.9%
7.21	0.81	0.22	-72.8%
7.23	0.81	0.17	-78.4%
7.25	0.81	0.13	-83.8%
7.27	0.81	0.09	-88.8%
7.29	0.81	0.05	-93.3%
7.31	0.81	0.03	-96.8%

WATERLINE AT ZERO
AREA ERROR = 7.051

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
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	6.02	5.33	1.14	1.33	6.07	7.13	100.0%	0.85	28.85	4.75
	6.05	5.32	1.11	1.30	5.91	7.07	99.1%	0.84	27.74	4.69
	6.10	5.30	1.07	1.25	5.64	6.96	97.7%	0.81	25.95	4.60
	6.15	5.27	1.02	1.20	5.38	6.86	96.2%	0.78	24.19	4.50
	6.20	5.25	0.97	1.15	5.12	6.76	94.8%	0.76	22.48	4.39
	6.25	5.23	0.93	1.10	4.85	6.66	93.3%	0.73	20.80	4.29
	6.30	5.21	0.88	1.05	4.59	6.55	91.9%	0.70	19.17	4.17
	6.35	5.19	0.84	1.00	4.33	6.45	90.4%	0.67	17.59	4.06
	6.40	5.16	0.79	0.95	4.08	6.35	89.0%	0.64	16.04	3.94
	6.45	5.14	0.74	0.90	3.82	6.24	87.6%	0.61	14.54	3.81
	6.50	5.12	0.70	0.85	3.56	6.14	86.1%	0.58	13.10	3.68
	6.55	5.10	0.65	0.80	3.31	6.04	84.7%	0.55	11.70	3.54
	6.60	5.08	0.60	0.75	3.05	5.94	83.2%	0.51	10.35	3.39
	6.65	5.06	0.55	0.70	2.80	5.83	81.8%	0.48	9.06	3.24
	6.70	5.04	0.50	0.65	2.54	5.73	80.4%	0.44	7.83	3.08
	6.75	5.02	0.46	0.60	2.29	5.63	78.9%	0.41	6.66	2.91
	6.80	5.00	0.41	0.55	2.04	5.52	77.5%	0.37	5.56	2.72
	6.85	4.98	0.36	0.50	1.79	5.42	76.0%	0.33	4.53	2.53
	6.90	4.96	0.31	0.45	1.54	5.32	74.6%	0.29	3.58	2.32
	6.95	4.94	0.26	0.40	1.30	5.22	73.2%	0.25	2.71	2.09
	7.00	4.92	0.21	0.35	1.05	5.11	71.7%	0.21	1.93	1.84
WL	7.05	4.88	0.16	0.30	0.80	5.00	70.2%	0.16	1.26	1.56
	7.10	4.45	0.13	0.25	0.56	4.52	63.4%	0.12	0.74	1.32
	7.15	2.56	0.14	0.20	0.35	2.62	36.8%	0.13	0.49	1.39
	7.20	2.33	0.10	0.15	0.23	2.37	33.2%	0.10	0.26	1.12
	7.25	2.09	0.06	0.10	0.12	2.11	29.6%	0.06	0.09	0.78
	7.30	0.89	0.03	0.05	0.03	0.90	12.6%	0.03	0.02	0.54

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.26	cfs
CALCULATED FLOW (Qc)=	1.26	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	7.06	ft
CALCULATED WATERLINE (WLc)=	7.05	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	0.2	%
MEAN VELOCITY=	1.56	ft/sec
MANNING'S N=	0.027	
SLOPE=	0.009	ft/ft
.4 * Qm =	0.5	cfs
2.5 * Qm=	3.1	cfs

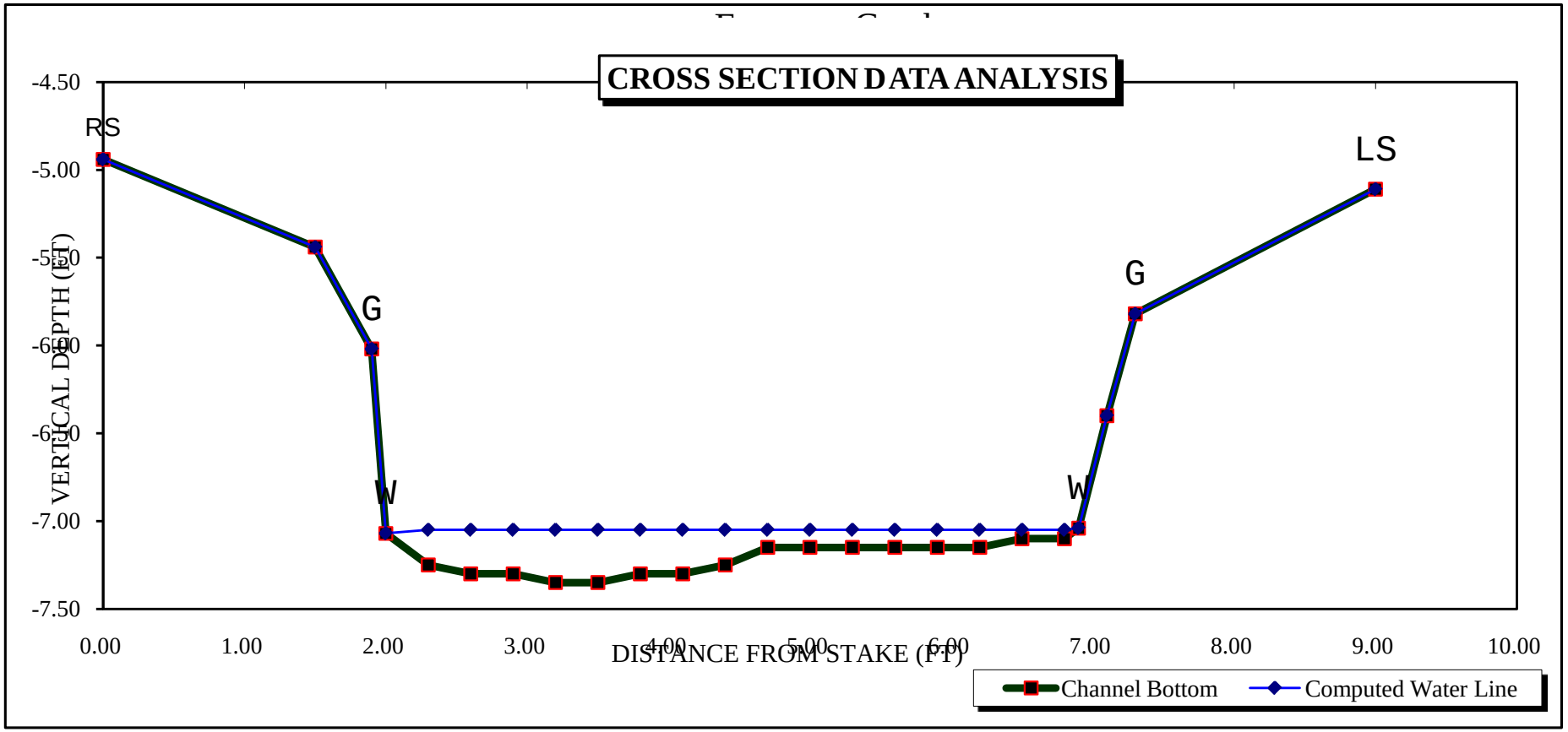
RECOMMENDED INSTREAM FLOW:
=============================

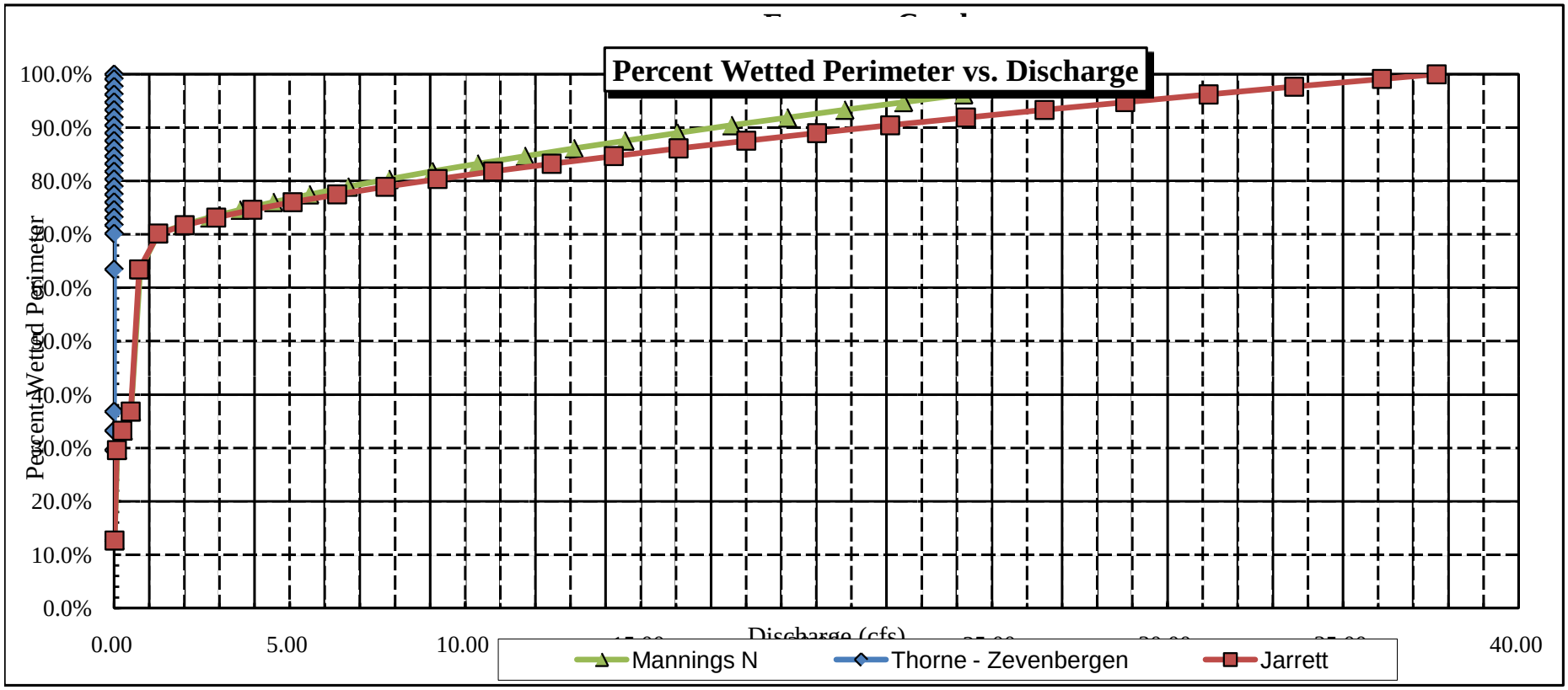
FLOW (CFS)	PERIOD
___________	________

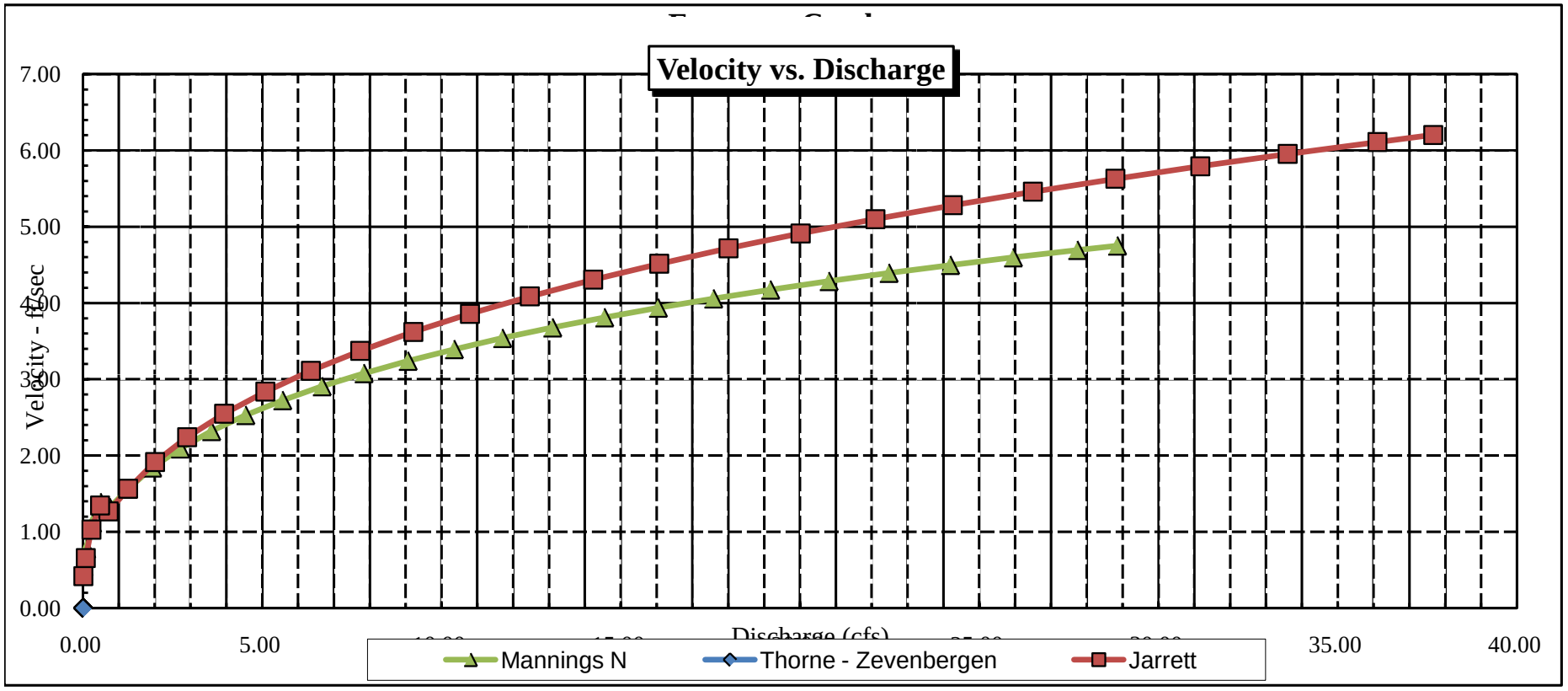
RATIONALE FOR RECOMMENDATION:
=============================

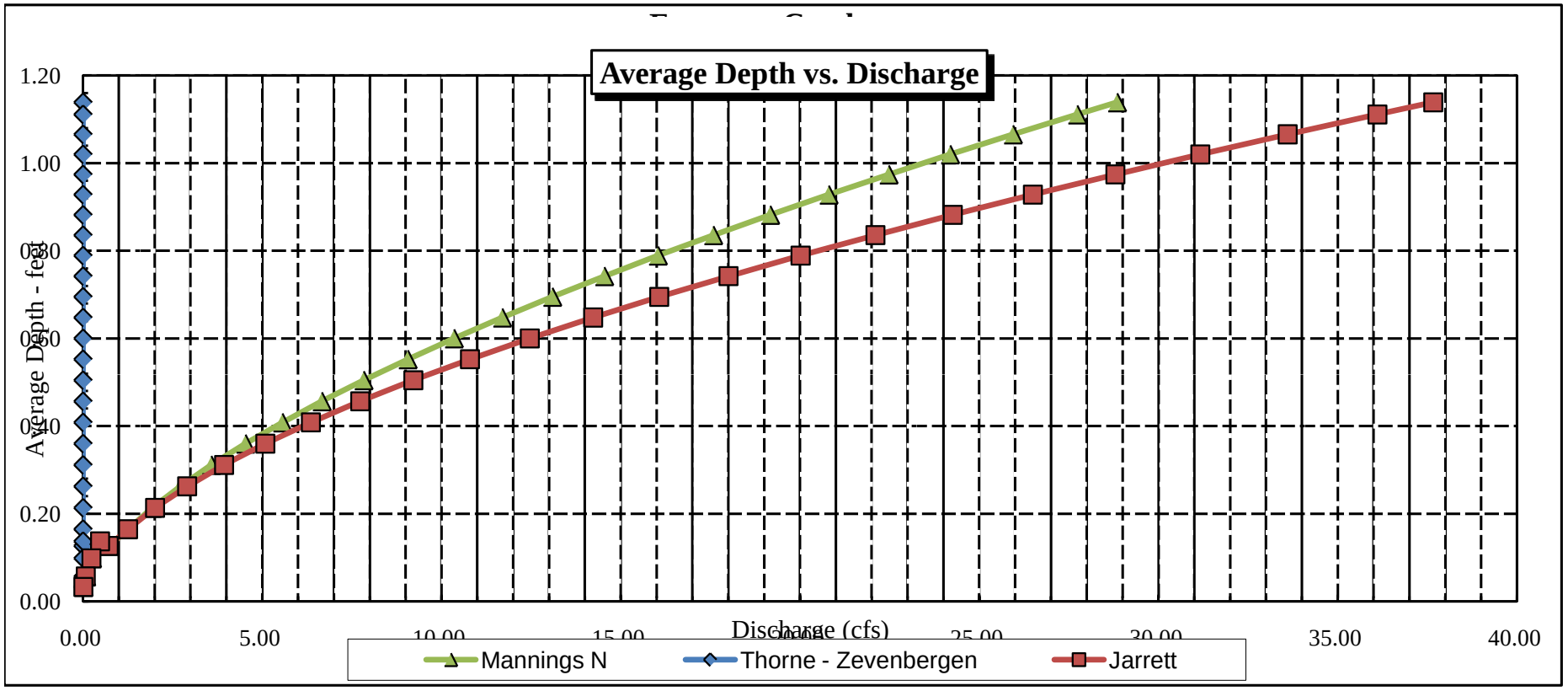
RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………......…....…....……...... DATE:......…...…......……………

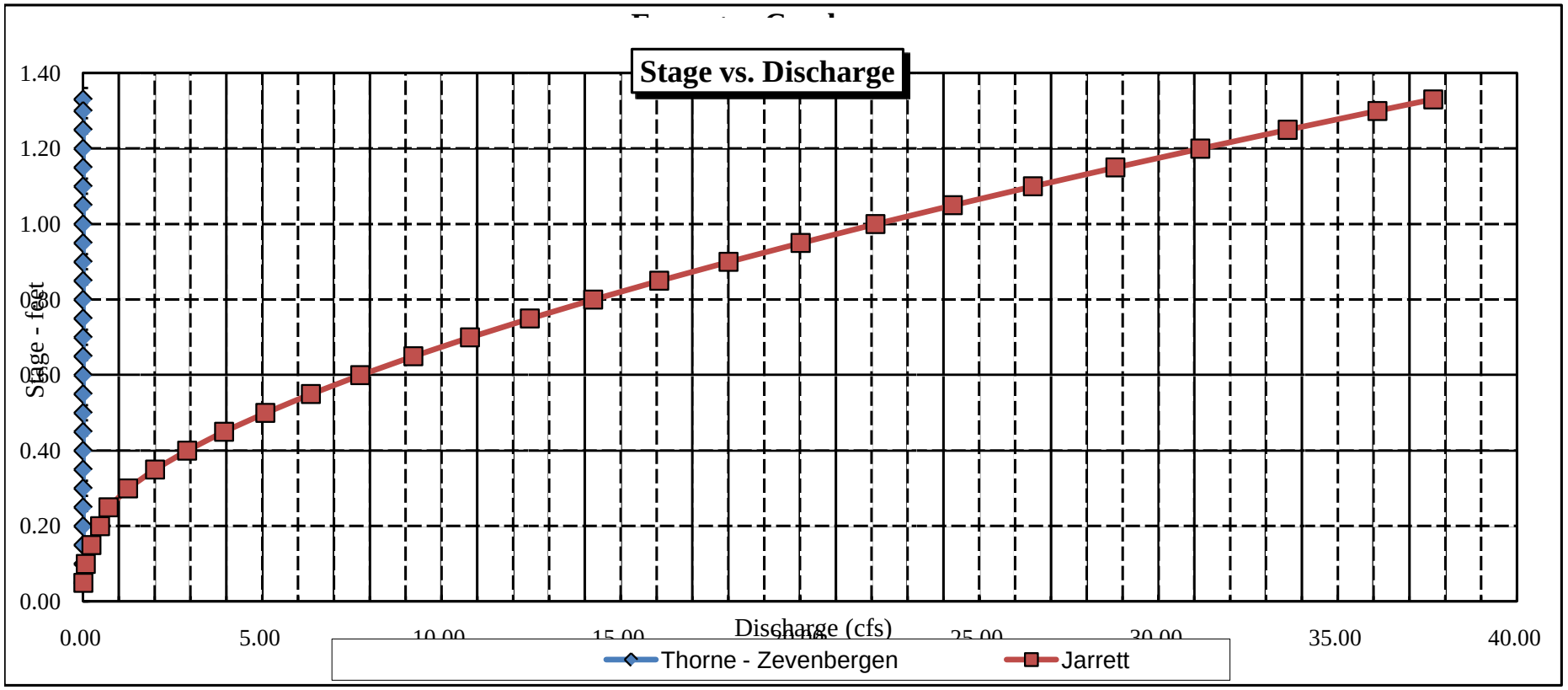
CWCB REVIEW BY: ..……………………….....……………………………………………...…............. DATE:.................…………….....


CROSS SECTION DATA ANALYSIS
RS
G
W
G
W
LS
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
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


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
40.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
5.00
35.00
40.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
5.00
10.00
15.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
5.00
10.00
15.00
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: Forrester Creek					CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: 1/4 mile upstream from Forrester Ditch No. 1 headgate.						
DATE: 8-2-10	OBSERVERS: R. Smith, P. Belcher					
LEGAL DESCRIPTION	¼ SECTION: SW SE	SECTION: 13	TOWNSHIP: 11 (N) S	RANGE: 77 E (W)	PM: 6th	
COUNTY: Larmer	WATERSHED: Laramie R.	WATER DIVISION: 1	DOW WATER CODE: 10950			
MAP(S): USGS:	GPS: 417286					
USFS:	4527967					

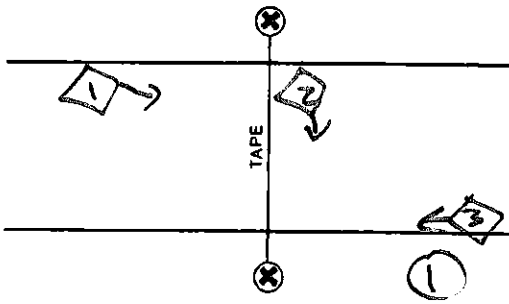
SUPPLEMENTAL DATA

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: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobble	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	7.04 / 7.07
② WS Upstream	27.0	6.78
③ WS Downstream	11.0	7.24
SLOPE	0.46/48.0 = .009	

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
see report																	

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:
caddisfly, mayfly, stonefly

COMMENTS

Ph: 8.1 TDS: 100 Temp: 17.5°
Willow-alder-rose riparian community.

FED 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Forrester Creek | CROSS-SECTION NO.: 1 | DATE: 8-2-10 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: ____ ft | TIME: 3:30

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	0.0		4.94								
	1.5		5.44								
G	1.9		6.02								
W	2.0		7.07	0				0			
	2.3		7.25	.20	-			1.71			
	2.6		7.30	.25				2.08			
	2.9		7.30	.25				1.35			
	3.2		7.35	.30				1.98			
	3.5		7.35	.30				2.07			
	3.8		7.30	.25				2.14			
	4.1		7.30	.25				1.64			
	4.4		7.25	.20				1.48			
	4.7		7.15	.10				1.39			
	5.0		7.15	.10				1.30			
	5.3		7.15	.10				.75			
	5.6		7.15	.10				.79			
	5.9		7.15	.10				.28			
	6.2		7.15	.10				.47			
	6.5		7.10	.05				.58			
	6.8		7.10	.05				.46			
W	6.9		7.04								
	7.1		6.40								
G	7.3		5.82								
LS	9.0		5.11								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Forrester Creek						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: 1/4 mile upstream from Forrester Ditch No. 1 headgate.						
DATE: 8-2-10	OBSERVERS: R. Smith, P. Belcher					
LEGAL DESCRIPTION	¼ SECTION: SW SE	SECTION: 13	TOWNSHIP: 11 (N)/S	RANGE: 77 E/(W)	PM: 6th	
COUNTY: Larimer	WATERSHED: Laramie R.	WATER DIVISION: 1	DOW WATER CODE: 10950			
MAP(S): USGS:						
USFS:						

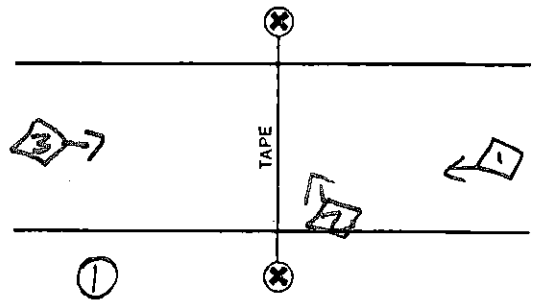
SUPPLEMENTAL DATA

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: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobbles	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	6.70 / 6.73
② WS Upstream	8.0	6.58
③ WS Downstream	25.0	6.84
SLOPE	0.26/33.0 = .007	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ①→
- Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: (YES)/NO	DISTANCE ELECTROFISHED: ____ ft	FISH CAUGHT: (YES)/NO	WATER CHEMISTRY SAMPLED: (YES)/NO

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

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

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

caddisfly, mayfly, stonefly

COMMENTS

pH = 8.1 TDS = 100 Temp = 17.5°C.

Willow - alder - rose riparian community.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Forrester Creek	CROSS-SECTION NO.: 2	DATE: 8-2-10	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 4:30

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		4.84								
	0.9		5.06								
G	1.2	←1.25	5.47 ↓	0.70							
W →	1.3		6.95	.25				1.5			
	1.6		6.90	.20	-			1.76			
	1.9		6.8	.10				1.48			
	2.2		6.8	.10				1.24			
	2.5		6.8	.10				1.24			
	2.8		6.8	.10				.72			
	3.1		6.8	.10				1.10			
	3.4		6.95	.15				.37			
	3.7		6.90	.20				.62			
	4.0		6.85	.15				1.41			
	4.3		6.90	.20				1.24			
	4.6		6.95	.25				2.10			
	4.9		6.90	.20				2.04			
	5.2		6.90	.20				1.33			
	5.5		6.90	.20				1.45			
	5.8		6.85	.15				1.18			
	6.1		6.90	.20				.74			
	6.4		6.90	.20				.58			
	6.7		7.00	.30				.23			
	7.0		6.75	.05				.18			
W	7.3		6.70								
G	8.1		5.28								
	8.5		4.52								
RS	9.2		4.24								
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:	Forrester Creek
XS LOCATION:	1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER:	2
DATE:	2-Aug-10
OBSERVERS:	R. Smith, P. Belcher
1/4 SEC:	SW SE
SECTION:	13
TWP:	11N
RANGE:	77W
PM:	6th
COUNTY:	Larimer
WATERSHED:	Laramie
DIVISION:	1
DOW CODE:	10950
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:	0.007

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

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

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 2

DATA POINTS= 28

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	4.84			0.00		0.00	0.00	0.0%
	0.90	5.06			0.00		0.00	0.00	0.0%
1 G	1.20	5.47			0.00		0.00	0.00	0.0%
W	1.25	6.70	0.00	0.00	0.00		0.00	0.00	0.0%
	1.30	6.95	0.25	1.50	0.25	0.25	0.04	0.07	5.8%
	1.60	6.90	0.20	1.76	0.30	0.20	0.06	0.11	9.3%
	1.90	6.80	0.10	1.48	0.32	0.10	0.03	0.04	3.9%
	2.20	6.80	0.10	1.24	0.30	0.10	0.03	0.04	3.3%
	2.50	6.80	0.10	1.24	0.30	0.10	0.03	0.04	3.3%
	2.80	6.80	0.10	0.72	0.30	0.10	0.03	0.02	1.9%
	3.10	6.80	0.10	1.10	0.30	0.10	0.03	0.03	2.9%
	3.40	6.95	0.15	0.37	0.34	0.15	0.05	0.02	1.5%
	3.70	6.90	0.20	0.62	0.30	0.20	0.06	0.04	3.3%
	4.00	6.85	0.15	1.41	0.30	0.15	0.05	0.06	5.6%
	4.30	6.90	0.20	1.24	0.30	0.20	0.06	0.07	6.5%
	4.60	6.95	0.25	2.10	0.30	0.25	0.08	0.16	13.8%
	4.90	6.90	0.20	2.04	0.30	0.20	0.06	0.12	10.7%
	5.20	6.90	0.20	1.33	0.30	0.20	0.06	0.08	7.0%
	5.50	6.90	0.20	1.45	0.30	0.20	0.06	0.09	7.6%
	5.80	6.85	0.15	1.18	0.30	0.15	0.05	0.05	4.7%
	6.10	6.90	0.20	0.74	0.30	0.20	0.06	0.04	3.9%
	6.40	6.90	0.20	0.58	0.30	0.20	0.06	0.03	3.1%
	6.70	7.00	0.30	0.23	0.32	0.30	0.09	0.02	1.8%
	7.00	6.75	0.05	0.18	0.39	0.05	0.02	0.00	0.2%
W	7.30	6.70	0.00	0.00	0.30		0.00	0.00	0.0%
1 G	8.10	5.28			0.00		0.00	0.00	0.0%
	8.50	4.52			0.00		0.00	0.00	0.0%
RS	9.20	4.24			0.00		0.00	0.00	0.0%
TOTALS ----------					6.45	0.3 (Max.)	0.99	1.14	100.0%

Manning's n = 0.0309
Hydraulic Radius= 0.15328097

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.99	1.02	3.0%
6.45	0.99	2.55	157.9%
6.47	0.99	2.43	145.4%
6.49	0.99	2.30	132.9%
6.51	0.99	2.18	120.4%
6.53	0.99	2.06	107.9%
6.55	0.99	1.93	95.5%
6.57	0.99	1.81	83.1%
6.59	0.99	1.69	70.7%
6.61	0.99	1.57	58.4%
6.63	0.99	1.44	46.0%
6.65	0.99	1.32	33.7%
6.66	0.99	1.26	27.6%
6.67	0.99	1.20	21.4%
6.68	0.99	1.14	15.3%
6.69	0.99	1.08	9.2%
6.70	0.99	1.02	3.0%
6.71	0.99	0.96	-3.1%
6.72	0.99	0.90	-9.1%
6.73	0.99	0.84	-15.0%
6.74	0.99	0.78	-20.9%
6.75	0.99	0.72	-26.8%
6.77	0.99	0.61	-38.4%
6.79	0.99	0.50	-49.9%
6.81	0.99	0.39	-60.1%
6.83	0.99	0.31	-68.9%
6.85	0.99	0.22	-77.4%
6.87	0.99	0.15	-85.2%
6.89	0.99	0.08	-91.8%
6.91	0.99	0.04	-96.2%
6.93	0.99	0.02	-98.4%
6.95	0.99	0.01	-99.5%

WATERLINE AT ZERO
AREA ERROR = 6.705

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
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	5.47	6.79	1.31	1.53	8.92	9.09	100.0%	0.98	35.39	3.97
	5.70	6.65	1.10	1.30	7.34	8.59	94.4%	0.85	26.57	3.62
	5.75	6.62	1.06	1.25	7.01	8.48	93.3%	0.83	24.80	3.54
	5.80	6.59	1.01	1.20	6.68	8.37	92.1%	0.80	23.08	3.46
	5.85	6.56	0.97	1.15	6.35	8.27	90.9%	0.77	21.40	3.37
	5.90	6.53	0.92	1.10	6.02	8.16	89.7%	0.74	19.76	3.28
	5.95	6.50	0.88	1.05	5.69	8.05	88.5%	0.71	18.17	3.19
	6.00	6.47	0.83	1.00	5.37	7.94	87.4%	0.68	16.63	3.10
	6.05	6.44	0.78	0.95	5.05	7.84	86.2%	0.64	15.13	3.00
	6.10	6.41	0.74	0.90	4.73	7.73	85.0%	0.61	13.69	2.90
	6.15	6.38	0.69	0.85	4.41	7.62	83.8%	0.58	12.29	2.79
	6.20	6.35	0.64	0.80	4.09	7.51	82.6%	0.54	10.95	2.68
	6.25	6.32	0.60	0.75	3.77	7.41	81.5%	0.51	9.67	2.56
	6.30	6.29	0.55	0.70	3.46	7.30	80.3%	0.47	8.44	2.44
	6.35	6.26	0.50	0.65	3.14	7.19	79.1%	0.44	7.27	2.32
	6.40	6.23	0.45	0.60	2.83	7.08	77.9%	0.40	6.17	2.18
	6.45	6.20	0.41	0.55	2.52	6.98	76.7%	0.36	5.14	2.04
	6.50	6.17	0.36	0.50	2.21	6.87	75.5%	0.32	4.17	1.89
	6.55	6.14	0.31	0.45	1.90	6.76	74.4%	0.28	3.28	1.73
	6.60	6.11	0.26	0.40	1.60	6.65	73.2%	0.24	2.48	1.55
	6.65	6.08	0.21	0.35	1.29	6.55	72.0%	0.20	1.76	1.36
WL	6.70	6.02	0.16	0.30	0.99	6.42	70.5%	0.15	1.14	1.16
	6.75	5.73	0.12	0.25	0.70	6.08	66.9%	0.11	0.66	0.95
	6.80	4.44	0.09	0.20	0.42	4.73	52.0%	0.09	0.33	0.80
	6.85	4.00	0.05	0.15	0.20	4.21	46.3%	0.05	0.11	0.53
	6.90	1.58	0.03	0.10	0.05	1.69	18.6%	0.03	0.02	0.36
	6.95	0.19	0.02	0.05	0.00	0.21	2.3%	0.02	0.00	0.30

STREAM NAME: Forrester Creek
XS LOCATION: 1/4 mile u/s fr Forrester Ditch No. 1 hg
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.14	cfs
CALCULATED FLOW (Qc)=	1.14	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	6.70	ft
CALCULATED WATERLINE (WLc)=	6.70	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	1.7	%
MEAN VELOCITY=	1.16	ft/sec
MANNING'S N=	0.031	
SLOPE=	0.007	ft/ft
.4 * Qm =	0.5	cfs
2.5 * Qm=	2.8	cfs

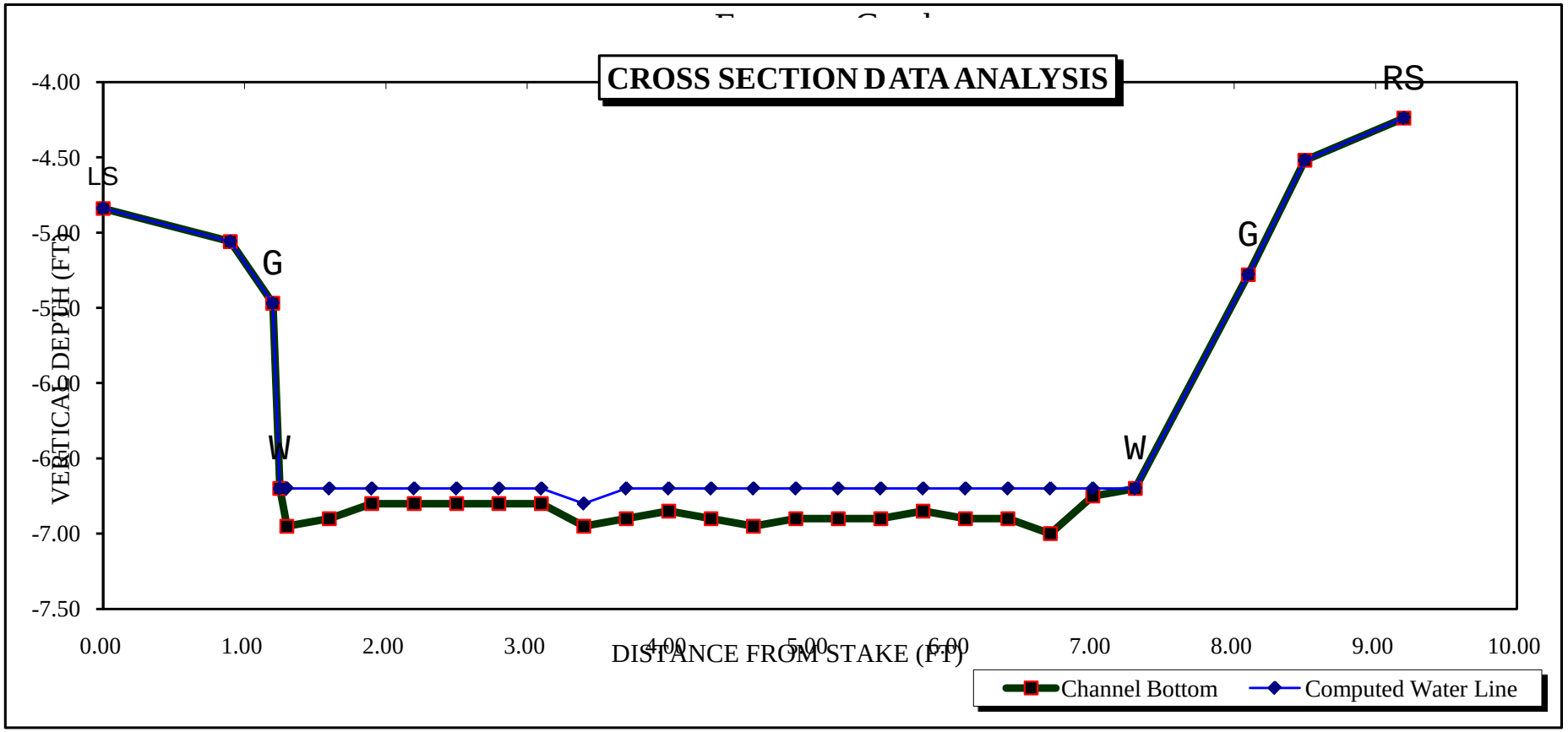
RECOMMENDED INSTREAM FLOW:
============================

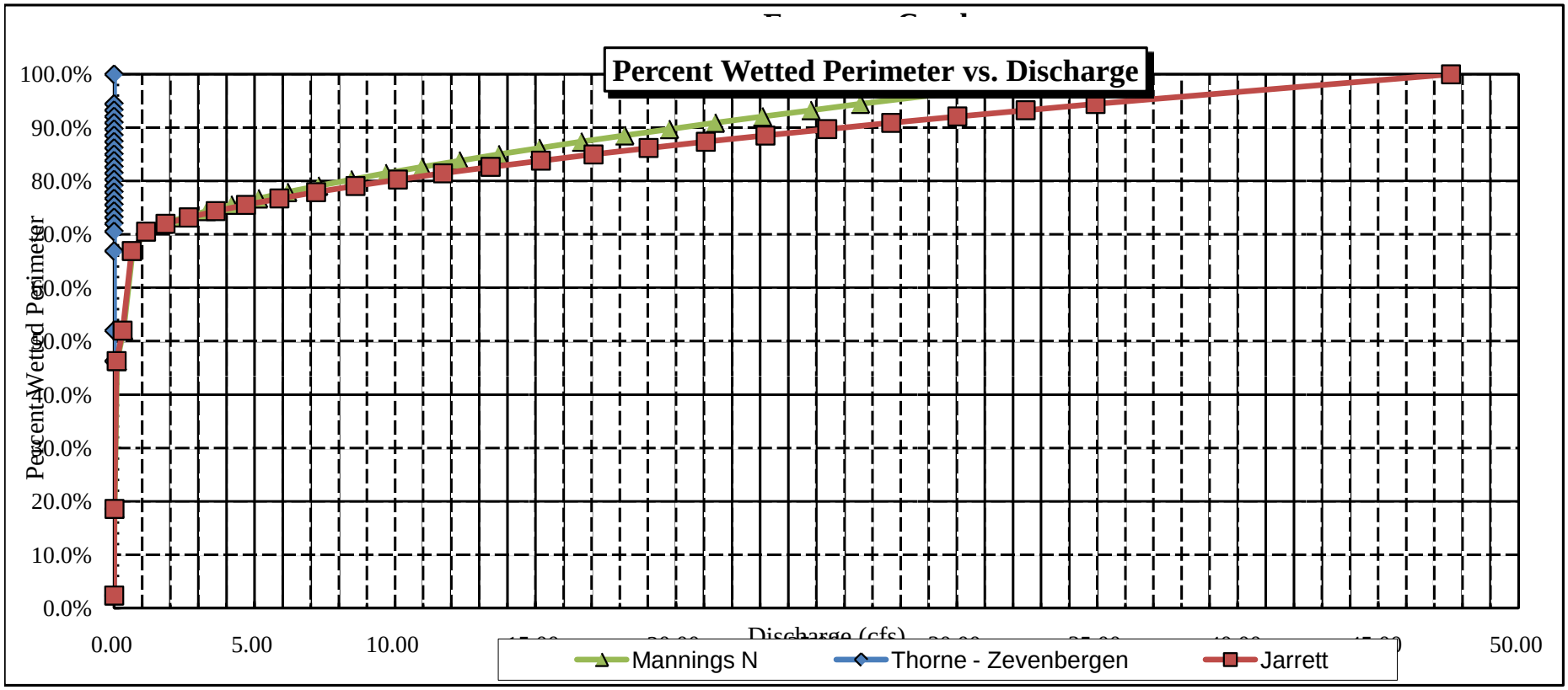
FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

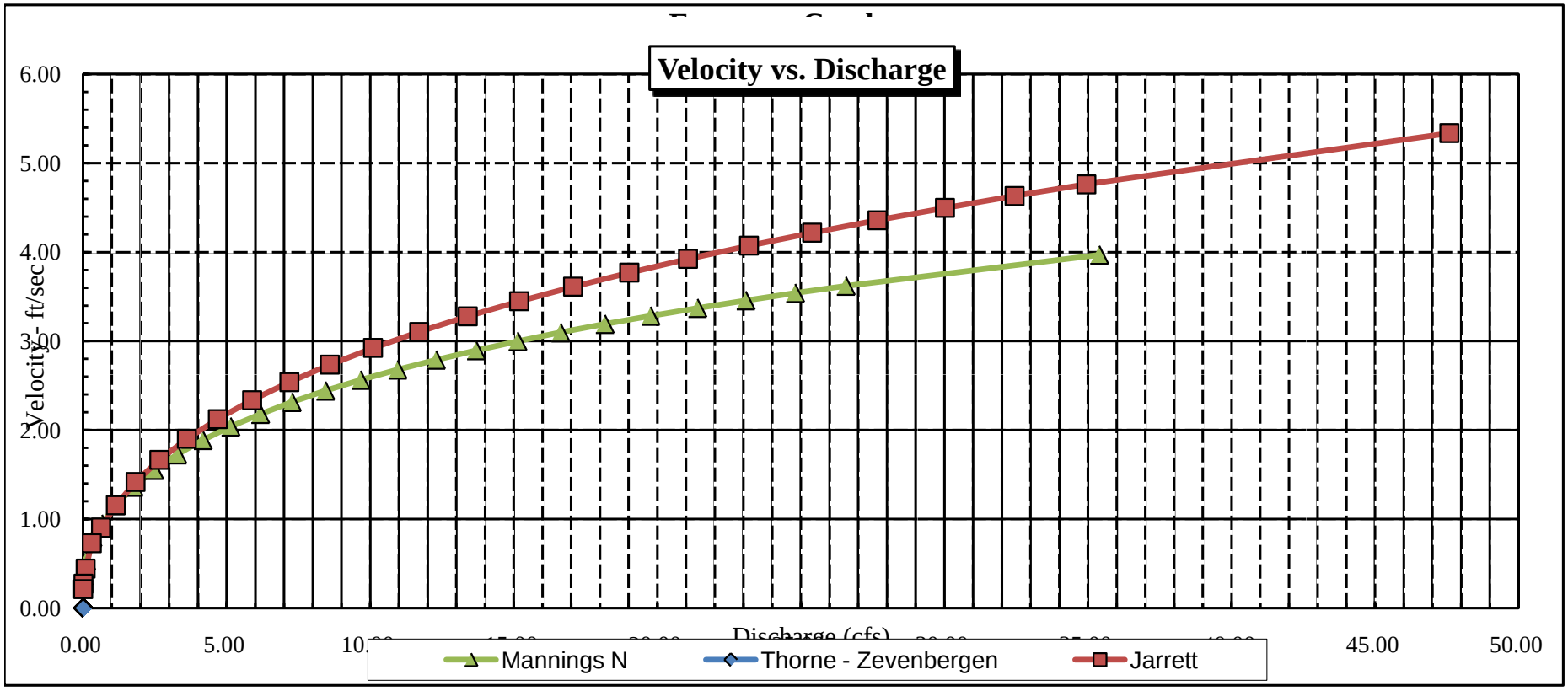
RATIONALE FOR RECOMMENDATION:
============================

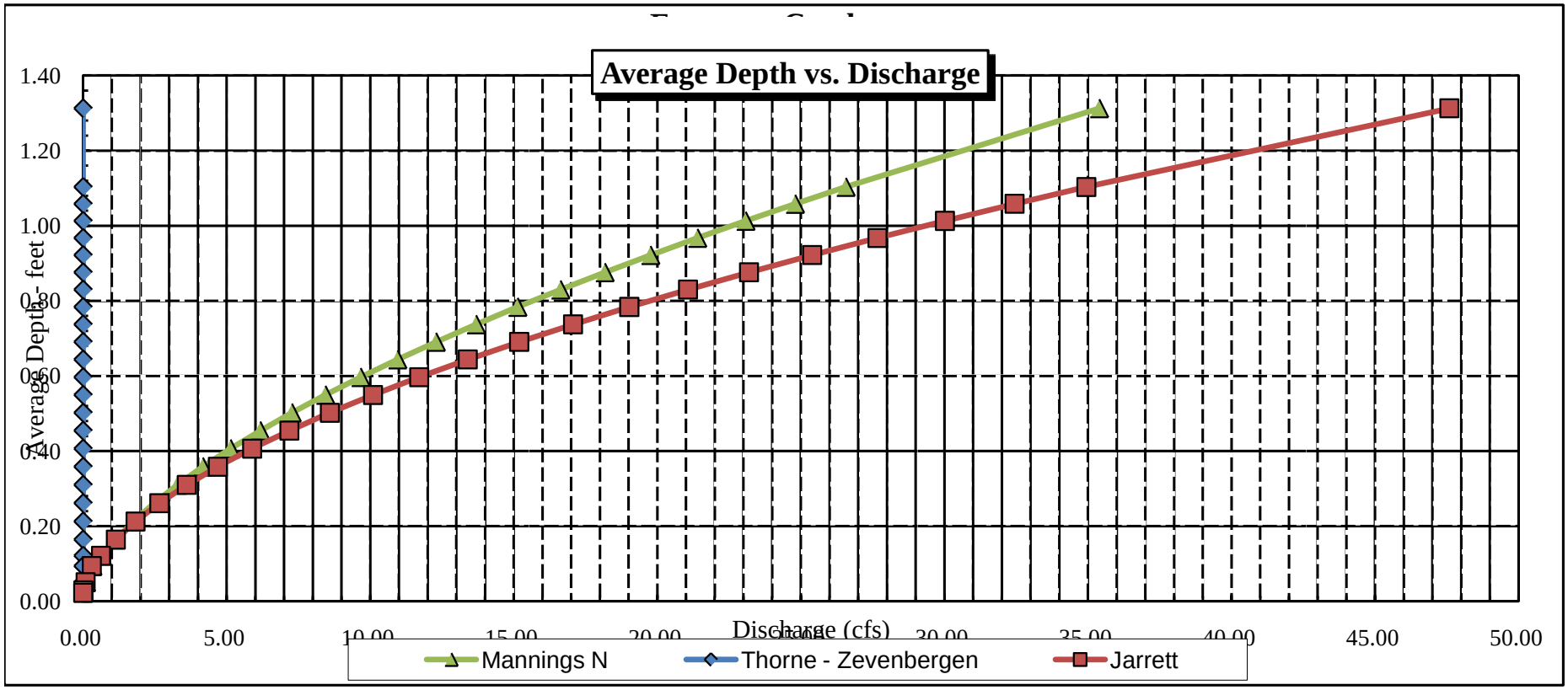
RECOMMENDATION BY: …………………….. AGENCY……………………………........ DATE:…………………

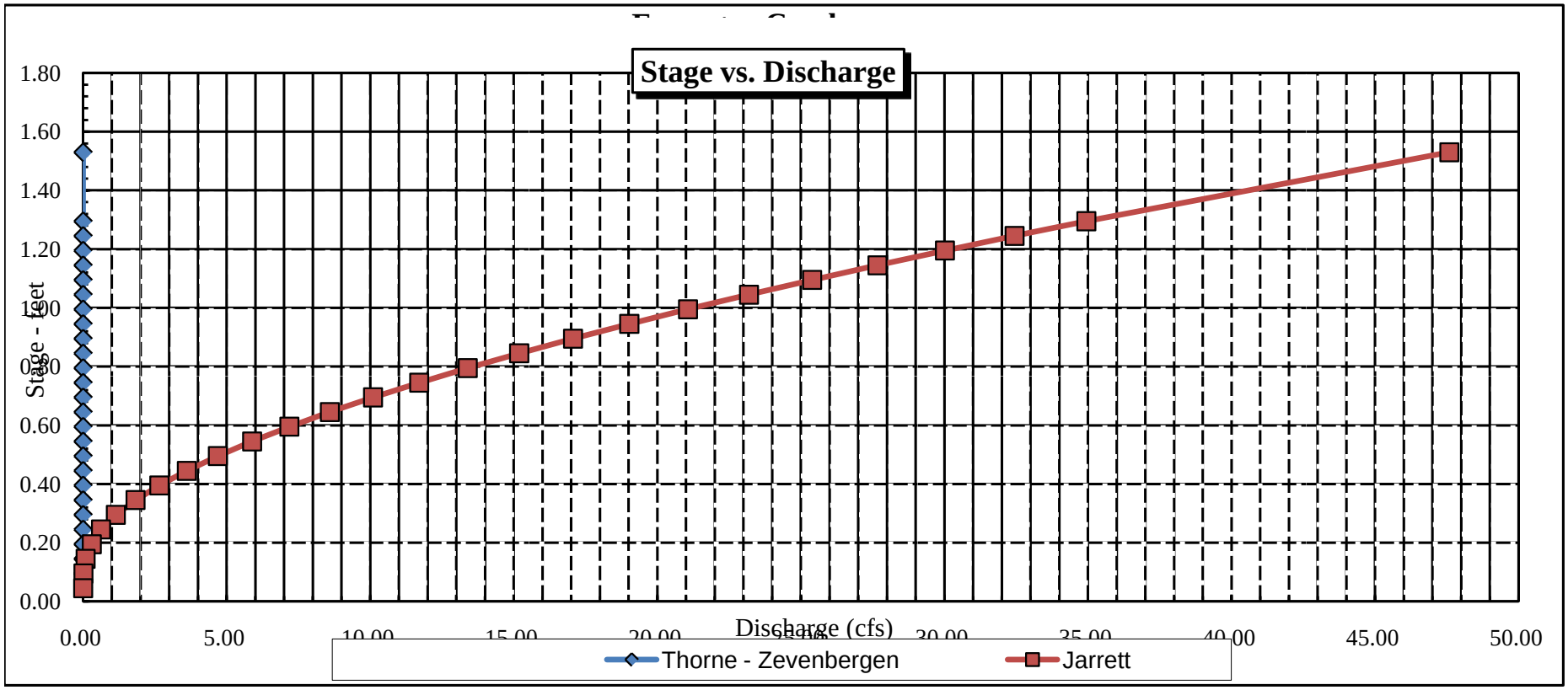
CWCB REVIEW BY: ………………………………………………………………………………........................ DATE:…………………


CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
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


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
50.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
5.00
45.00
50.00
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
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett