DRAFT RECOMMENDATION– January 2015 Version

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 West Hawxhurst Creek, located in Water Division 5.

Location and Land Status. West Hawxhurst Creek originates on the south side of Battlement Mesa, approximately nine miles northeast of Collbran. This reach begins at the headwaters of the creek and extends downstream to the confluence with ~~East~~ Hawxhurst Creek, a distance of approximately 4.5 miles. The BLM manages approximately 1.5 miles of this reach, while 3.0 miles are managed by the U.S. Forest Service.

Biological Summary. West Hawxhurst Creek is a cold-water, high gradient stream. The stream is confined by bedrock in most locations. The stream generally has medium-sized substrate, consisting of gravels and small cobbles, and small boulders. The stream has a good mix of pools, small riffles, and runs. While deep pool habitat is absent, the existing pools are sufficient for overwintering fish.

Fisheries surveys have revealed a self-sustaining population of hybridized native cutthroat trout and rainbow trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

The riparian community is very diverse and is comprised of box elder, red osier dogwood, birch, willow species, and alder. The riparian community is in very good condition, and provides abundant shading and cover for fish habitat.

R2Cross Analysis. The BLM collected the following R2Cross data from West Hawxhurst 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)
10/04/2011 #1	1.15 cfs	13.60 feet	1.51 cfs	2.01 cfs
07/22/2014 #1	1.22 cfs	8.50 feet	0.95 cfs	0.97 cfs
07/22/2014 #2	1.10 cfs	10.34 feet	1.24 cfs	1.91 cfs
		Averages:	1.23 cfs	1.63 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.

> 1.60 cubic feet per second is recommended during the snowmelt runoff period and summer, from April 1 to September 30. This recommendation is driven by the wetted perimeter criteria. This creek is very steep and has limited usable habitat, so it is important to protect a flow rate that makes a high percentage of this habitat available to the fish population while they are completing critical life history functions during the warm weather months.
>
> 0.90 cubic feet per second is recommended during the cold weather period from October 1 to March 31. This recommendation is driven by limited water availability. This flow rate 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.

Water Availability. The BLM recommends relying upon three sources of data for water availability analysis. USGS Gage 09097600 (Brush Creek near Collbran, CO) measures flow from another watershed within the larger Plateau Creek watershed that has roughly similar watershed characteristics. A basin apportionment analysis could be performed to derive flow rates for West Hawxhurst Creek. In addition, Streamstats should be consulted. The Streamstats model produces similar estimates of base flow as a basin apportionment calculation, but BLM believes the Streamstats model, when using the mountain region assumptions, may overestimate snowmelt runoff flows. Finally, diversion records for downstream diversions can be consulted to confirm flows available during base flow periods. These ditches include the McCurry Highline Ditch, McCurry Ditch, Hawxhurst Ditch, and Dunlap Ditch.

The BLM is aware of one water right within the proposed instream flow reach:

Hawxhurst Smalley Ditch – 4.8 cfs

Relationship to Land Management Plans. BLM's land use plan calls for West Hawxhurst Creek to be managed to maintain, restore, or improve riparian conditions, such that proper functioning conditions are achieved. It also specifies that instream flow appropriations will be pursued on fishery streams to ensure sufficient flows rates for fisheries protection. Appropriation of an instream flow water right would assist BLM in long-term management of outstanding riparian values and important fishery values.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2015. 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

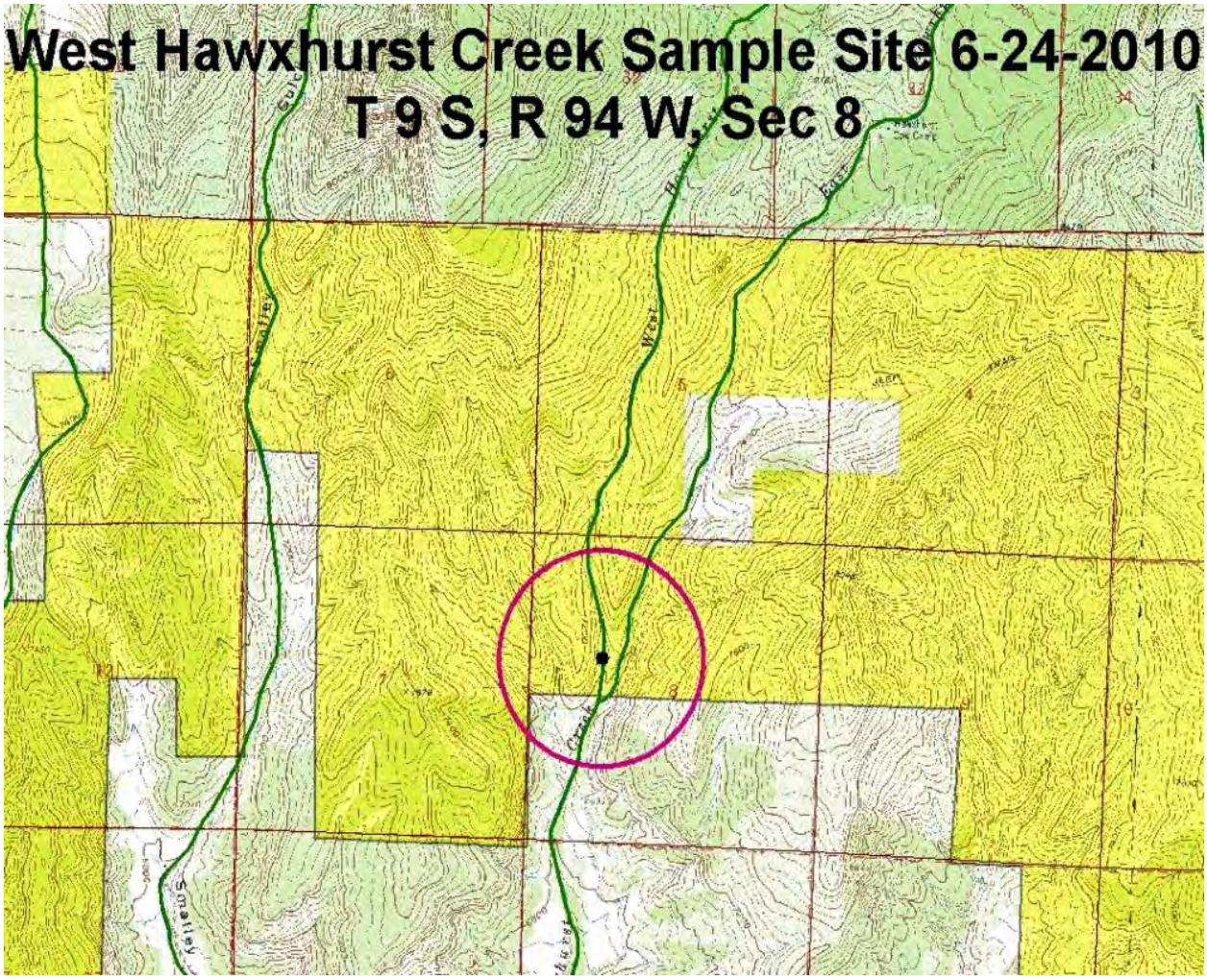
Cc:

Katie Stevens, Grand Junction Field Office
Hydrologist, Grand Junction Field Office
Joseph Meyer, Northwest District Office

Grand Junction Field Office Stream Surveys
June 2010

West Hawxhurst Creek - Water Code #27981

West Hawxhurst Creek, located east of Colbran, Colorado on lands managed by the BLM's Grand Junction Field Office, was sampled on June 24, 2010. West Hawxhurst is tributary to Hawxhurst Creek, Buzzard Creek, and then Plateau Creek. The stream was sampled via a backpack electroshocker. Sampling was conducted to determine if greenback lineage cutthroat trout reside on BLM lands as a known population of these fish exists upstream on USFS lands. Personnel present included Gregor Dekleva and Tom Fresques, BLM, and Lori Martin and Danielle Tremblay, Colorado Division of Wildlife.



West Hawxhurst Creek

Rainbow trout


Cutthroat trout

Discussion:
The BLM segment of the stream contained a mix of both cutthroat trout and rainbow trout and some specimens that looked to be hybrids. Fish density was low as few fish were seen or collected. Fin clips were obtained from those fish collected and will be analyzed to determine the genetic status of cutthroat on BLM managed lands within the watershed.

The stream contained a good mix of runs, riffles, and pools. Riparian habitat was in excellent condition with an overstory of large cottonwood trees and a diverse understory consisting of willow, alder, birch, red osier dogwood, boxelder, horsetail, sedges, rush, houndstongue, and thistle.

Given the condition of instream habitat and lush, diverse riparian vegetation, it is not readily apparent as to why the stream contained low fish densities. It could be that low seasonal flows impair fish and stream productivity.

Recommendations:

- Await genetic results and then meet with CDOW and USFS to discuss data and future management of this watershed

- Look at barriers within the creek and options for maintaining genetically pure cutthroat trout given the presence of rainbow trout within the drainage

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

LOCATION INFORMATION

STREAM NAME:	West Hawxhurst Creek
XS LOCATION:	400' upst fr conf w East Hawxhurst Ck.
XS NUMBER:	1
DATE:	4-Oct-11
OBSERVERS:	N. Dieterich, C. Ewing
1/4 SEC:	NW
SECTION:	8
TWP:	9S
RANGE:	94W
PM:	Sixth
COUNTY:	Mesa
WATERSHED:	Buzzard Creek
DIVISION:	4
DOW CODE:	27981
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:	0.061

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

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

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 400' upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

DATA POINTS= 33

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	6.09			0.00		0.00	0.00	0.0%
		0.70	7.05			0.00		0.00	0.00	0.0%
	W	1.30	7.02	0.00	0.00	0.00		0.00	0.00	0.0%
		2.00	7.04	0.02	0.00	0.70	0.02	0.01	0.00	0.0%
		2.30	6.98	0.00	0.00	0.31		0.00	0.00	0.0%
		2.60	7.08	0.06	0.00	0.32	0.06	0.02	0.00	0.0%
		2.90	7.15	0.13	0.00	0.31	0.13	0.04	0.00	0.0%
		3.20	7.12	0.10	0.64	0.30	0.10	0.03	0.02	1.7%
		3.50	7.27	0.25	0.01	0.34	0.25	0.08	0.00	0.1%
		3.80	7.21	0.19	0.00	0.31	0.19	0.06	0.00	0.0%
		4.10	7.22	0.20	0.01	0.30	0.20	0.06	0.00	0.1%
		4.40	7.44	0.42	1.37	0.37	0.42	0.13	0.17	15.0%
		4.70	7.56	0.54	1.78	0.32	0.54	0.16	0.29	25.1%
		5.00	7.51	0.49	1.62	0.30	0.49	0.15	0.24	20.7%
		5.30	7.58	0.56	1.32	0.31	0.56	0.17	0.22	19.3%
		5.60	7.54	0.52	0.43	0.30	0.52	0.16	0.07	5.8%
		5.90	7.49	0.47	0.54	0.30	0.47	0.14	0.08	6.6%
		6.20	7.19	0.17	0.89	0.42	0.17	0.05	0.05	4.0%
		6.50	7.15	0.13	0.47	0.30	0.13	0.04	0.02	1.6%
		6.80	7.07	0.03	0.00	0.31	0.03	0.01	0.00	0.0%
	R	7.10	6.89	0.00	0.00	0.35		0.00	0.00	0.0%
		7.40	7.18	0.16	0.01	0.42	0.16	0.05	0.00	0.0%
		7.70	7.21	0.16	0.00	0.30	0.16	0.03	0.00	0.0%
		7.80	7.22	0.19	0.00	0.10	0.19	0.02	0.00	0.0%
	W	7.90	7.02	0.00	0.00	0.22		0.00	0.00	0.0%
		8.20	6.49			0.00		0.00	0.00	0.0%
		9.00	6.50			0.00		0.00	0.00	0.0%
		10.00	6.58			0.00		0.00	0.00	0.0%
		11.00	6.79			0.00		0.00	0.00	0.0%
		12.00	6.27			0.00		0.00	0.00	0.0%
		13.00	6.15			0.00		0.00	0.00	0.0%
1	G	13.60	6.09			0.00		0.00	0.00	0.0%
	LS	14.00	6.04			0.00		0.00	0.00	0.0%
	TOTALS ----------					7.22	0.56 (Max.)	1.39	1.15	100.0%

Manning's n = 0.1475
Hydraulic Radius= 0.19216481

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 400' upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.39	1.39	0.0%
6.77	1.39	3.21	131.1%
6.79	1.39	3.05	120.2%
6.81	1.39	2.90	109.3%
6.83	1.39	2.75	98.5%
6.85	1.39	2.60	87.8%
6.87	1.39	2.46	77.1%
6.89	1.39	2.31	66.4%
6.91	1.39	2.16	55.8%
6.93	1.39	2.02	45.3%
6.95	1.39	1.87	35.0%
6.97	1.39	1.73	24.7%
6.98	1.39	1.66	19.6%
6.99	1.39	1.59	14.6%
7.00	1.39	1.52	9.7%
7.01	1.39	1.45	4.8%
7.02	1.39	1.39	0.0%
7.03	1.39	1.33	-4.4%
7.04	1.39	1.27	-8.4%
7.05	1.39	1.22	-12.1%
7.06	1.39	1.17	-15.6%
7.07	1.39	1.12	-19.1%
7.09	1.39	1.03	-26.0%
7.11	1.39	0.94	-32.5%
7.13	1.39	0.85	-38.8%
7.15	1.39	0.77	-44.4%
7.17	1.39	0.70	-49.6%
7.19	1.39	0.63	-54.4%
7.21	1.39	0.57	-58.8%
7.23	1.39	0.52	-62.4%
7.25	1.39	0.48	-65.7%
7.27	1.39	0.44	-68.6%

WATERLINE AT ZERO
AREA ERROR = 7.020

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 400' upst fr conf w East Hawxhurst Ck.
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	6.09	13.60	0.77	1.49	10.54	15.18	100.0%	0.69	20.55	1.95
	6.12	13.28	0.76	1.46	10.13	14.84	97.8%	0.68	19.54	1.93
	6.17	12.77	0.74	1.41	9.48	14.31	94.3%	0.66	17.93	1.89
	6.22	12.32	0.72	1.36	8.85	13.83	91.1%	0.64	16.36	1.85
	6.27	11.87	0.70	1.31	8.25	13.34	87.9%	0.62	14.89	1.81
	6.32	11.74	0.65	1.26	7.66	13.17	86.8%	0.58	13.27	1.73
	6.37	11.60	0.61	1.21	7.08	13.00	85.7%	0.54	11.73	1.66
	6.42	11.47	0.57	1.16	6.50	12.83	84.6%	0.51	10.27	1.58
	6.47	11.34	0.52	1.11	5.93	12.66	83.4%	0.47	8.89	1.50
	6.52	10.14	0.53	1.06	5.39	11.41	75.2%	0.47	8.13	1.51
	6.57	9.35	0.52	1.01	4.90	10.55	69.5%	0.46	7.31	1.49
	6.62	8.88	0.50	0.96	4.45	10.01	65.9%	0.44	6.44	1.45
	6.67	8.48	0.47	0.91	4.01	9.53	62.8%	0.42	5.61	1.40
	6.72	8.08	0.45	0.86	3.60	9.06	59.7%	0.40	4.84	1.34
	6.77	7.68	0.42	0.81	3.20	8.59	56.6%	0.37	4.13	1.29
	6.82	7.48	0.38	0.76	2.83	8.33	54.9%	0.34	3.42	1.21
	6.87	7.42	0.33	0.71	2.46	8.21	54.1%	0.30	2.73	1.11
	6.92	7.27	0.29	0.66	2.09	7.99	52.7%	0.26	2.12	1.02
	6.97	7.07	0.24	0.61	1.73	7.70	50.8%	0.22	1.59	0.92
WL	7.02	6.54	0.21	0.56	1.39	7.08	46.6%	0.20	1.16	0.84
	7.07	4.82	0.23	0.51	1.12	5.26	34.7%	0.21	0.99	0.89
	7.12	4.35	0.20	0.46	0.89	4.73	31.2%	0.19	0.73	0.82
	7.17	3.48	0.20	0.41	0.70	3.79	25.0%	0.18	0.56	0.81
	7.22	2.42	0.23	0.36	0.54	2.66	17.5%	0.20	0.47	0.86
	7.27	1.95	0.22	0.31	0.44	2.14	14.1%	0.20	0.37	0.86
	7.32	1.83	0.19	0.26	0.34	1.99	13.1%	0.17	0.26	0.77
	7.37	1.72	0.15	0.21	0.25	1.83	12.1%	0.14	0.17	0.66
	7.42	1.60	0.11	0.16	0.17	1.67	11.0%	0.10	0.09	0.54
	7.47	1.44	0.06	0.11	0.09	1.49	9.8%	0.06	0.04	0.39
	7.52	1.02	0.03	0.06	0.03	1.04	6.8%	0.03	0.01	0.22
	7.57	0.12	0.00	0.01	0.00	0.12	0.8%	0.00	0.00	0.07

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 400' upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.15	cfs
CALCULATED FLOW (Qc)=	1.16	cfs
(Qm-Qc)/Qm * 100 =	-1.3	%
MEASURED WATERLINE (WLm)=	7.02	ft
CALCULATED WATERLINE (WLc)=	7.02	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.56	ft
MAX CALCULATED DEPTH (Dc)=	0.56	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.84	ft/sec
MANNING'S N=	0.148	
SLOPE=	0.061	ft/ft
.4 * Qm =	0.5	cfs
2.5 * Qm=	2.9	cfs

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

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

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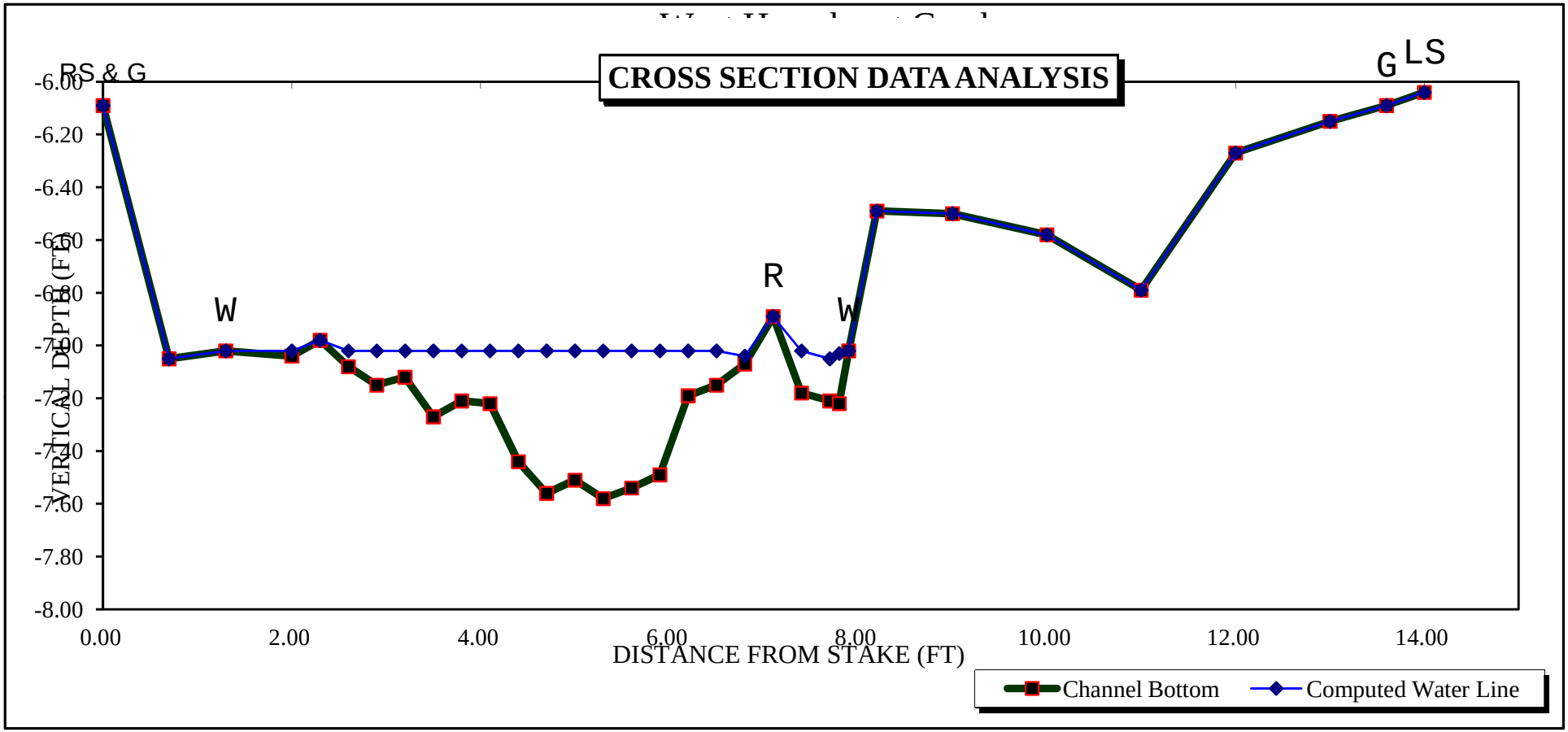
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

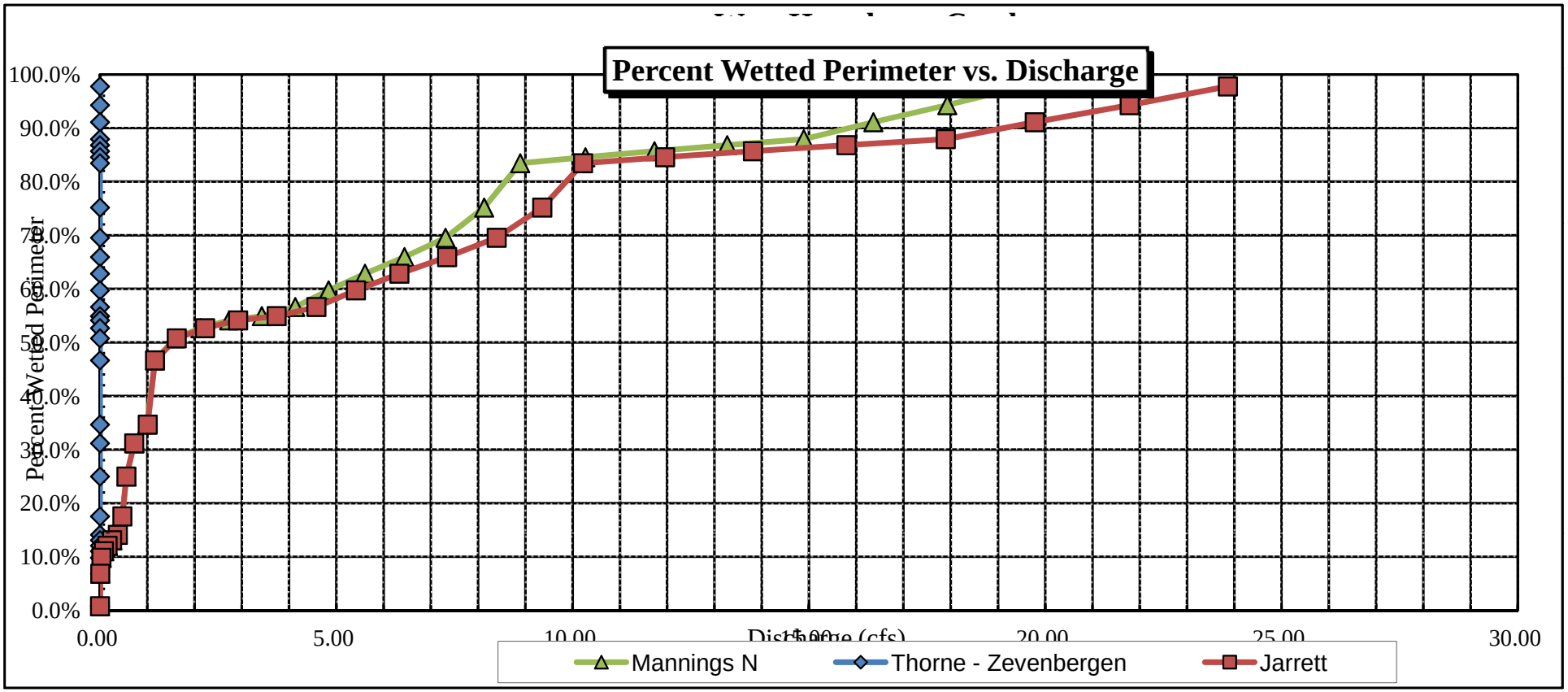
CWCB REVIEW BY: ..... DATE:.....

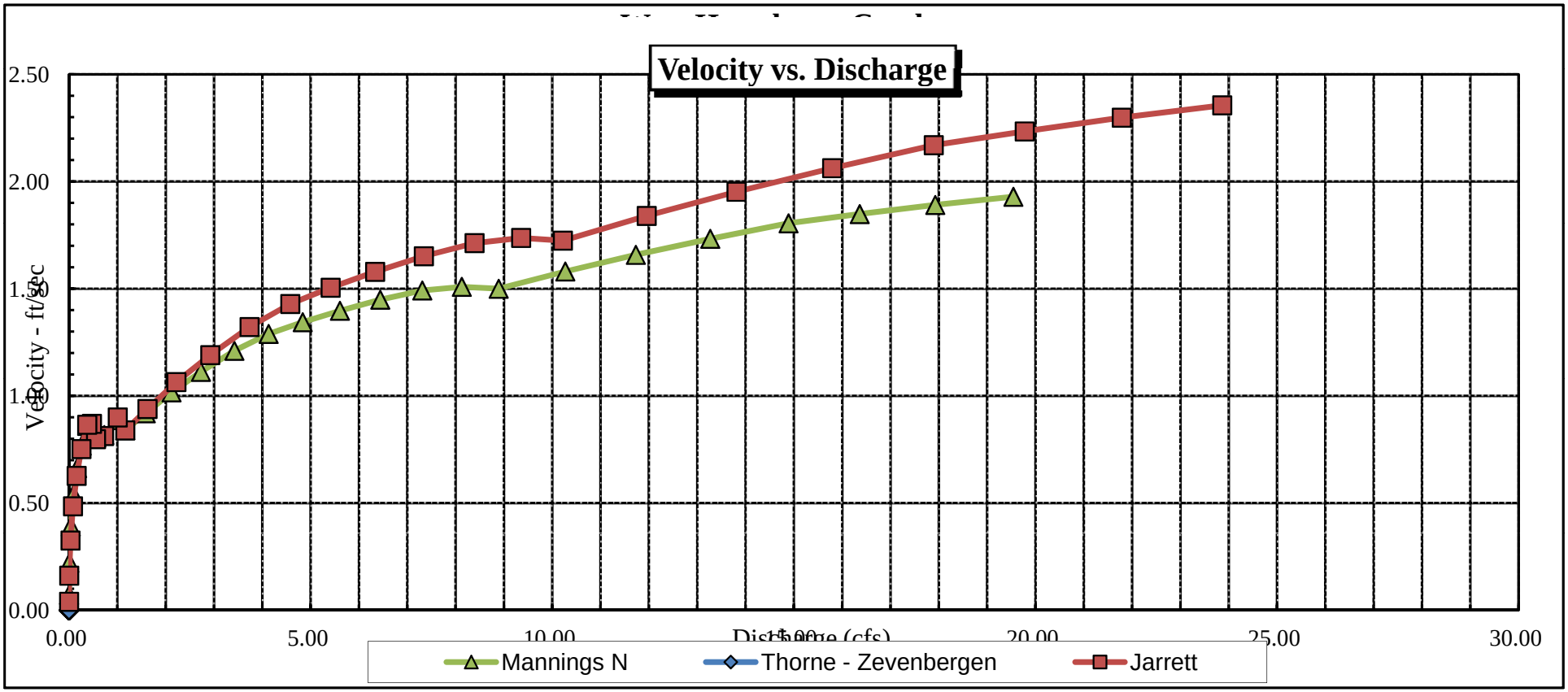
STREAM NAME: West Hawxhurst Creek
XS LOCATION: 400' upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

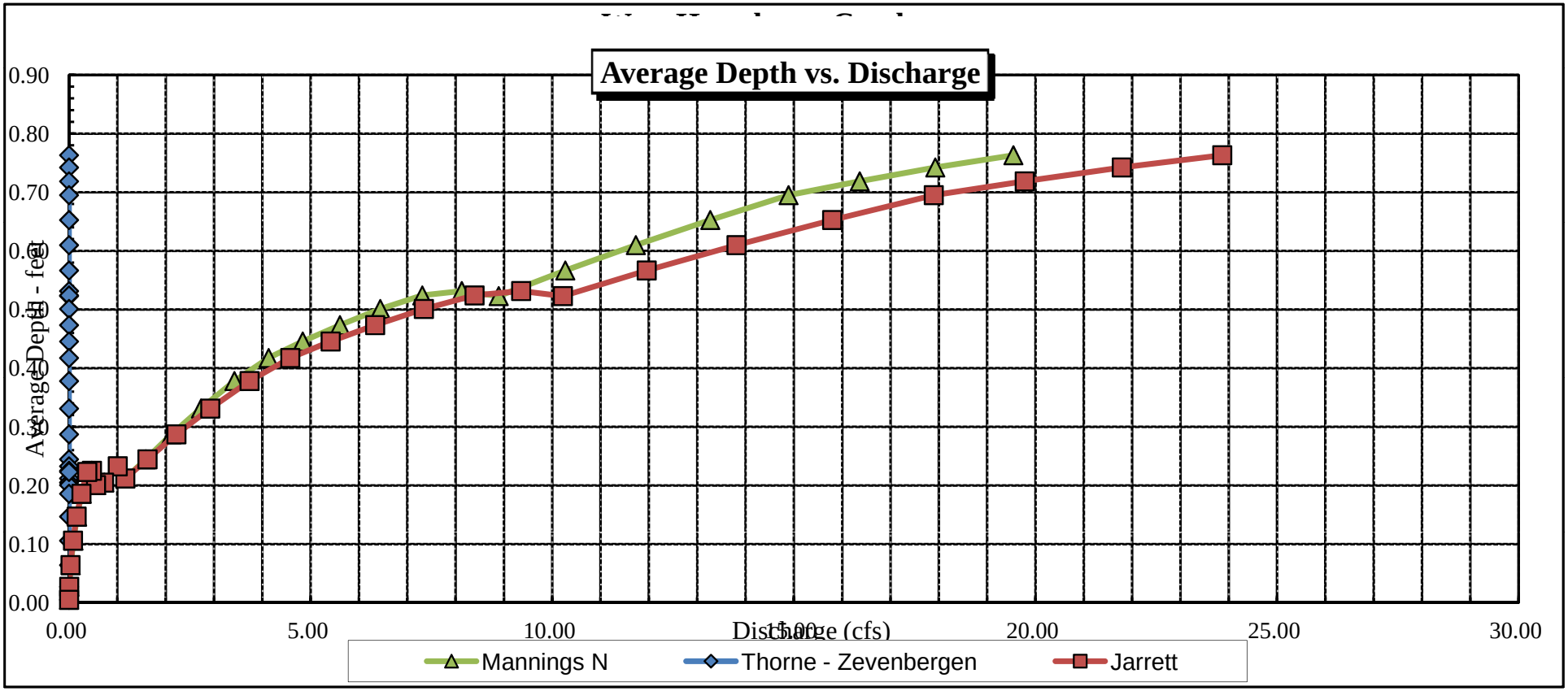
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

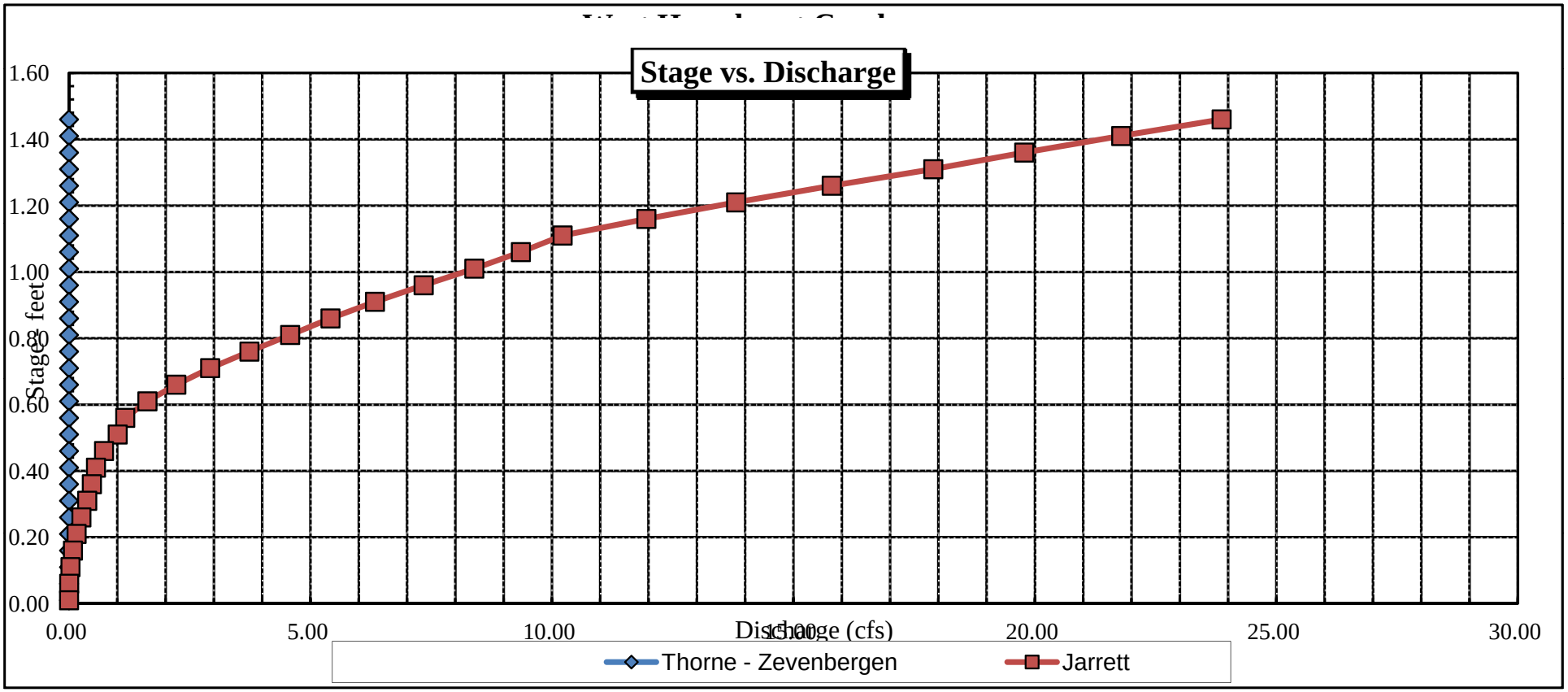
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.09	13.60	0.77	1.49	10.54	15.18	100.0%	0.69	25.16	2.39
	6.12	13.28	0.76	1.46	10.13	14.84	97.8%	0.68	23.86	2.36
	6.17	12.77	0.74	1.41	9.48	14.31	94.3%	0.66	21.79	2.30
	6.22	12.32	0.72	1.36	8.85	13.83	91.1%	0.64	19.78	2.23
	6.27	11.87	0.70	1.31	8.25	13.34	87.9%	0.62	17.90	2.17
	6.32	11.74	0.65	1.26	7.66	13.17	86.8%	0.58	15.79	2.06
	6.37	11.60	0.61	1.21	7.08	13.00	85.7%	0.54	13.81	1.95
	6.42	11.47	0.57	1.16	6.50	12.83	84.6%	0.51	11.96	1.84
	6.47	11.34	0.52	1.11	5.93	12.66	83.4%	0.47	10.22	1.72
	6.52	10.14	0.53	1.06	5.39	11.41	75.2%	0.47	9.36	1.74
	6.57	9.35	0.52	1.01	4.90	10.55	69.5%	0.46	8.39	1.71
	6.62	8.88	0.50	0.96	4.45	10.01	65.9%	0.44	7.34	1.65
	6.67	8.48	0.47	0.91	4.01	9.53	62.8%	0.42	6.34	1.58
	6.72	8.08	0.45	0.86	3.60	9.06	59.7%	0.40	5.41	1.50
	6.77	7.68	0.42	0.81	3.20	8.59	56.6%	0.37	4.58	1.43
	6.82	7.48	0.38	0.76	2.83	8.33	54.9%	0.34	3.74	1.32
	6.87	7.42	0.33	0.71	2.46	8.21	54.1%	0.30	2.92	1.19
	6.92	7.27	0.29	0.66	2.09	7.99	52.7%	0.26	2.22	1.06
	6.97	7.07	0.24	0.61	1.73	7.70	50.8%	0.22	1.62	0.94
WL	7.02	6.54	0.21	0.56	1.39	7.08	46.6%	0.20	1.16	0.84
	7.07	4.82	0.23	0.51	1.12	5.26	34.7%	0.21	1.01	0.90
	7.12	4.35	0.20	0.46	0.89	4.73	31.2%	0.19	0.72	0.81
	7.17	3.48	0.20	0.41	0.70	3.79	25.0%	0.18	0.56	0.80
	7.22	2.42	0.23	0.36	0.54	2.66	17.5%	0.20	0.47	0.87
	7.27	1.95	0.22	0.31	0.44	2.14	14.1%	0.20	0.38	0.87
	7.32	1.83	0.19	0.26	0.34	1.99	13.1%	0.17	0.26	0.75
	7.37	1.72	0.15	0.21	0.25	1.83	12.1%	0.14	0.16	0.63
	7.42	1.60	0.11	0.16	0.17	1.67	11.0%	0.10	0.08	0.49
	7.47	1.44	0.06	0.11	0.09	1.49	9.8%	0.06	0.03	0.33
	7.52	1.02	0.03	0.06	0.03	1.04	6.8%	0.03	0.00	0.16
	7.57	0.12	0.00	0.01	0.00	0.12	0.8%	0.00	0.00	0.04


CROSS SECTION DATA ANALYSIS
RS & G
LS
W
R
W
-6.00
-6.20
-6.40
-6.60
-6.80
-7.00
-7.20
-7.40
-7.60
-7.80
-8.00
VERTICAL DEPTHS (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
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
20.00
25.00
30.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


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


Average Depth vs. Discharge
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Average Depth - feet
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


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
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	West Hawxhurst Creek
XS LOCATION:	500 ft upst fr conf w East Hawxhurst Ck
XS NUMBER:	2
DATE:	22-Jul-14
OBSERVERS:	N. Dieterich, K. Jones
1/4 SEC:	NW
SECTION:	8
TWP:	9S
RANGE:	94W
PM:	Sixth
COUNTY:	Mesa
WATERSHED:	Buzzard Creek
DIVISION:	5
DOW CODE:	27981
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.062

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

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

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck
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
S	0.00	5.37			0.00		0.00	0.00	0.0%
	1.30	5.54			0.00		0.00	0.00	0.0%
	2.00	5.85			0.00		0.00	0.00	0.0%
1 G	2.20	5.91			0.00		0.00	0.00	0.0%
	2.50	5.50			0.00		0.00	0.00	0.0%
	4.00	6.90			0.00		0.00	0.00	0.0%
	6.00	6.26			0.00		0.00	0.00	0.0%
	7.00	6.33			0.00		0.00	0.00	0.0%
W	7.90	6.75	0.00	0.00	0.00		0.00	0.00	0.0%
	8.20	6.91	0.15	1.20	0.34	0.15	0.05	0.05	4.9%
	8.50	6.99	0.20	1.63	0.31	0.20	0.06	0.10	8.9%
	8.80	6.83	0.10	1.90	0.34	0.10	0.03	0.06	5.2%
	9.10	7.11	0.35	0.86	0.41	0.35	0.11	0.09	8.2%
	9.40	7.24	0.35	0.42	0.33	0.35	0.11	0.04	4.0%
	9.70	7.18	0.40	1.21	0.31	0.40	0.12	0.15	13.1%
	10.00	7.25	0.45	0.76	0.31	0.45	0.14	0.10	9.3%
	10.30	7.25	0.10	1.18	0.30	0.10	0.03	0.04	3.2%
	10.60	7.12	0.40	1.95	0.33	0.40	0.12	0.23	21.2%
	10.90	7.16	0.45	0.56	0.30	0.45	0.14	0.08	6.8%
	11.20	7.17	0.40	0.60	0.30	0.40	0.12	0.07	6.5%
	11.50	7.16	0.30	0.90	0.30	0.30	0.09	0.08	7.3%
	11.80	6.96	0.10	0.52	0.36	0.10	0.03	0.02	1.4%
W	12.10	6.72	0.00	0.00	0.38		0.00	0.00	0.0%
	12.50	6.47			0.00		0.00	0.00	0.0%
	13.00	6.19			0.00		0.00	0.00	0.0%
1 G	13.30	5.93			0.00		0.00	0.00	0.0%
	13.50	5.33			0.00		0.00	0.00	0.0%
S	15.00	5.33			0.00		0.00	0.00	0.0%
TOTALS ----------					4.62	0.45 (Max.)	1.13	1.10	100.0%

Manning's n = 0.1470
Hydraulic Radius= 0.24369159

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.13	1.49	32.4%
6.49	1.13	2.96	163.4%
6.51	1.13	2.83	151.3%
6.53	1.13	2.69	139.5%
6.55	1.13	2.56	128.0%
6.57	1.13	2.44	116.7%
6.59	1.13	2.31	105.7%
6.61	1.13	2.19	95.0%
6.63	1.13	2.08	84.6%
6.65	1.13	1.96	74.5%
6.67	1.13	1.85	64.7%
6.69	1.13	1.74	55.1%
6.70	1.13	1.69	50.4%
6.71	1.13	1.64	45.8%
6.72	1.13	1.59	41.3%
6.73	1.13	1.54	36.8%
6.74	1.13	1.49	32.4%
6.75	1.13	1.44	28.1%
6.76	1.13	1.39	23.9%
6.77	1.13	1.35	19.7%
6.78	1.13	1.30	15.5%
6.79	1.13	1.25	11.5%
6.81	1.13	1.16	3.5%
6.83	1.13	1.08	-4.1%
6.85	1.13	1.00	-11.5%
6.87	1.13	0.92	-18.5%
6.89	1.13	0.84	-25.2%
6.91	1.13	0.77	-31.5%
6.93	1.13	0.70	-37.5%
6.95	1.13	0.64	-43.3%
6.97	1.13	0.58	-48.7%
6.99	1.13	0.52	-53.9%

WATERLINE AT ZERO
AREA ERROR = 6.814

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck
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	5.93	10.34	0.78	1.32	8.04	11.58	100.0%	0.69	15.86	1.97
	5.96	10.26	0.75	1.29	7.68	11.47	99.1%	0.67	14.80	1.93
	6.01	10.15	0.71	1.24	7.17	11.32	97.8%	0.63	13.32	1.86
	6.06	10.04	0.66	1.19	6.67	11.17	96.5%	0.60	11.90	1.78
	6.11	9.93	0.62	1.14	6.17	11.02	95.2%	0.56	10.54	1.71
	6.16	9.82	0.58	1.09	5.68	10.87	93.9%	0.52	9.26	1.63
	6.21	9.69	0.54	1.04	5.19	10.71	92.5%	0.48	8.05	1.55
	6.26	9.48	0.50	0.99	4.71	10.46	90.4%	0.45	6.96	1.48
	6.31	8.46	0.50	0.94	4.26	9.41	81.3%	0.45	6.32	1.48
	6.36	7.86	0.49	0.89	3.85	8.76	75.7%	0.44	5.61	1.46
	6.41	7.46	0.47	0.84	3.47	8.30	71.7%	0.42	4.88	1.41
	6.46	7.05	0.44	0.79	3.11	7.84	67.8%	0.40	4.22	1.36
	6.51	6.65	0.42	0.74	2.77	7.39	63.9%	0.37	3.61	1.31
	6.56	6.26	0.39	0.69	2.44	6.94	60.0%	0.35	3.06	1.25
	6.61	5.86	0.37	0.64	2.14	6.49	56.1%	0.33	2.57	1.20
	6.66	5.46	0.34	0.59	1.86	6.04	52.2%	0.31	2.13	1.15
	6.71	5.07	0.31	0.54	1.59	5.59	48.3%	0.28	1.74	1.09
	6.76	4.69	0.29	0.49	1.35	5.16	44.6%	0.26	1.39	1.03
WL	6.81	4.32	0.26	0.44	1.12	4.74	40.9%	0.24	1.09	0.97
	6.86	3.85	0.24	0.39	0.92	4.19	36.2%	0.22	0.84	0.92
	6.91	3.39	0.22	0.34	0.74	3.65	31.5%	0.20	0.64	0.87
	6.96	2.99	0.19	0.29	0.58	3.19	27.6%	0.18	0.47	0.81
	7.01	2.72	0.16	0.24	0.44	2.87	24.8%	0.15	0.31	0.72
	7.06	2.59	0.12	0.19	0.31	2.71	23.4%	0.11	0.18	0.59
	7.11	2.46	0.07	0.14	0.18	2.54	22.0%	0.07	0.08	0.43
	7.16	1.62	0.04	0.09	0.07	1.67	14.4%	0.04	0.02	0.31
	7.21	0.72	0.02	0.04	0.02	0.74	6.4%	0.02	0.00	0.21

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.10	cfs
CALCULATED FLOW (Qc)=	1.09	cfs
(Qm-Qc)/Qm * 100 =	1.7	%
MEASURED WATERLINE (WLm)=	6.74	ft
CALCULATED WATERLINE (WLc)=	6.81	ft
(WLm-WLc)/WLm * 100 =	-1.2	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.44	ft
(Dm-Dc)/Dm * 100	3.2	%
MEAN VELOCITY=	0.97	ft/sec
MANNING'S N=	0.147	
SLOPE=	0.062	ft/ft
.4 * Qm =	0.4	cfs
2.5 * Qm=	2.8	cfs

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

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

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

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

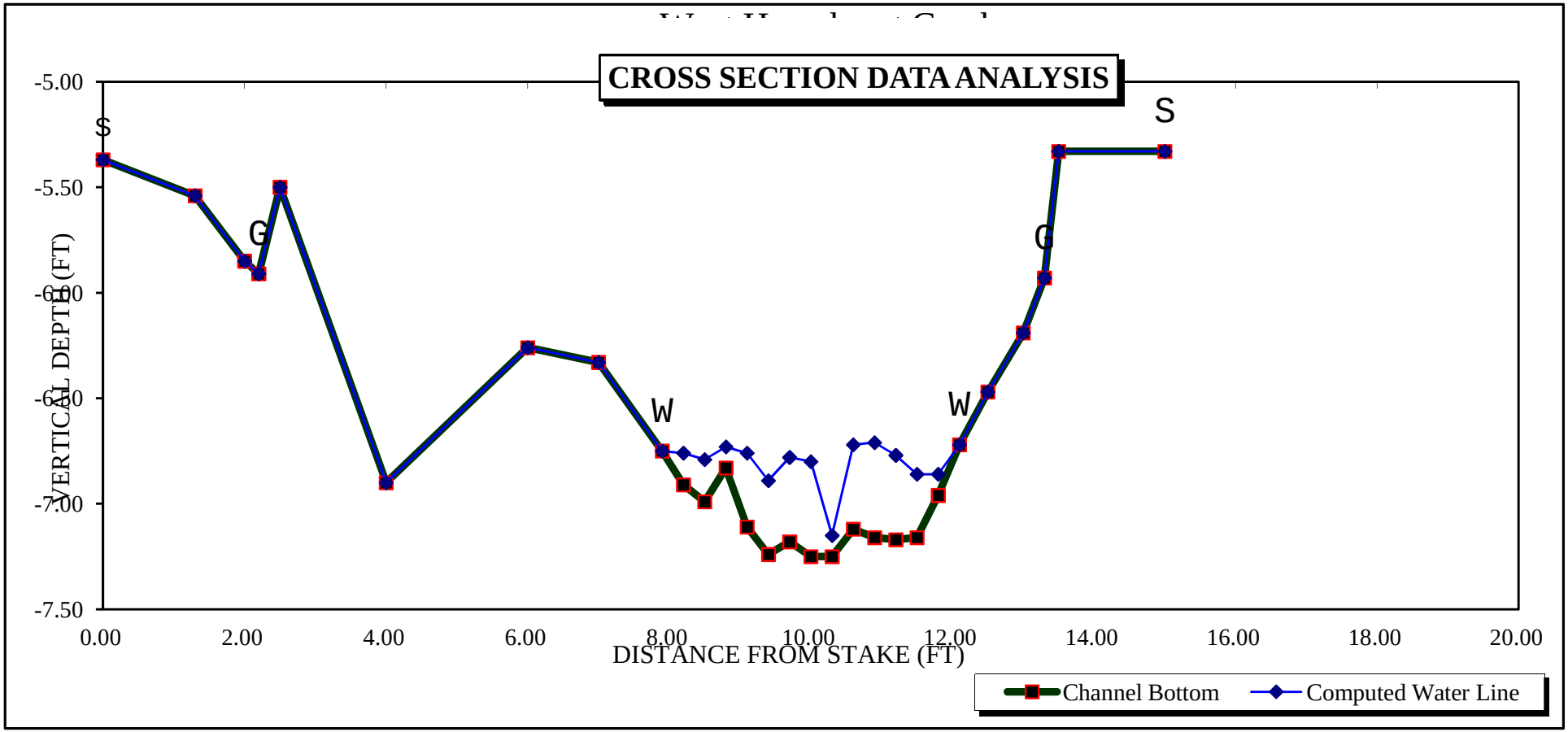
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

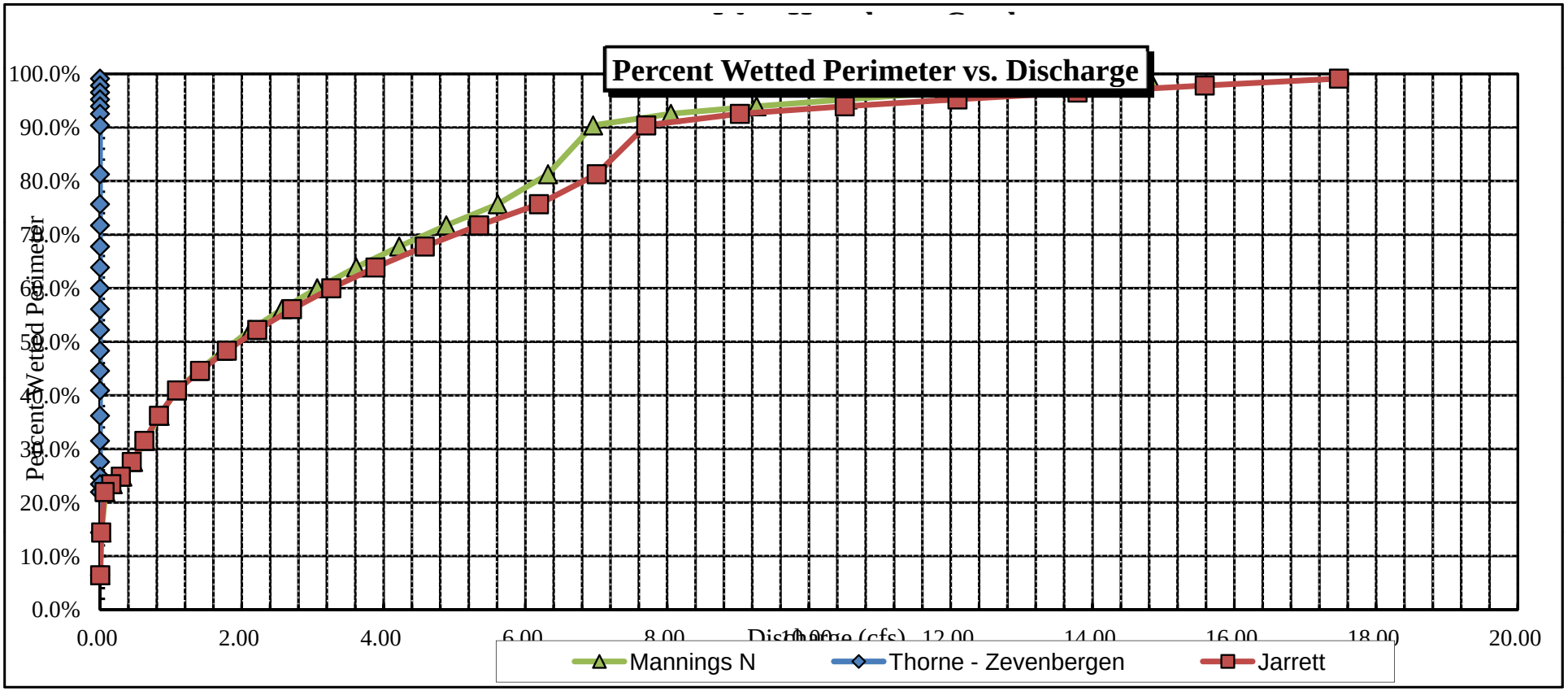
CWCB REVIEW BY: ..... DATE:.....

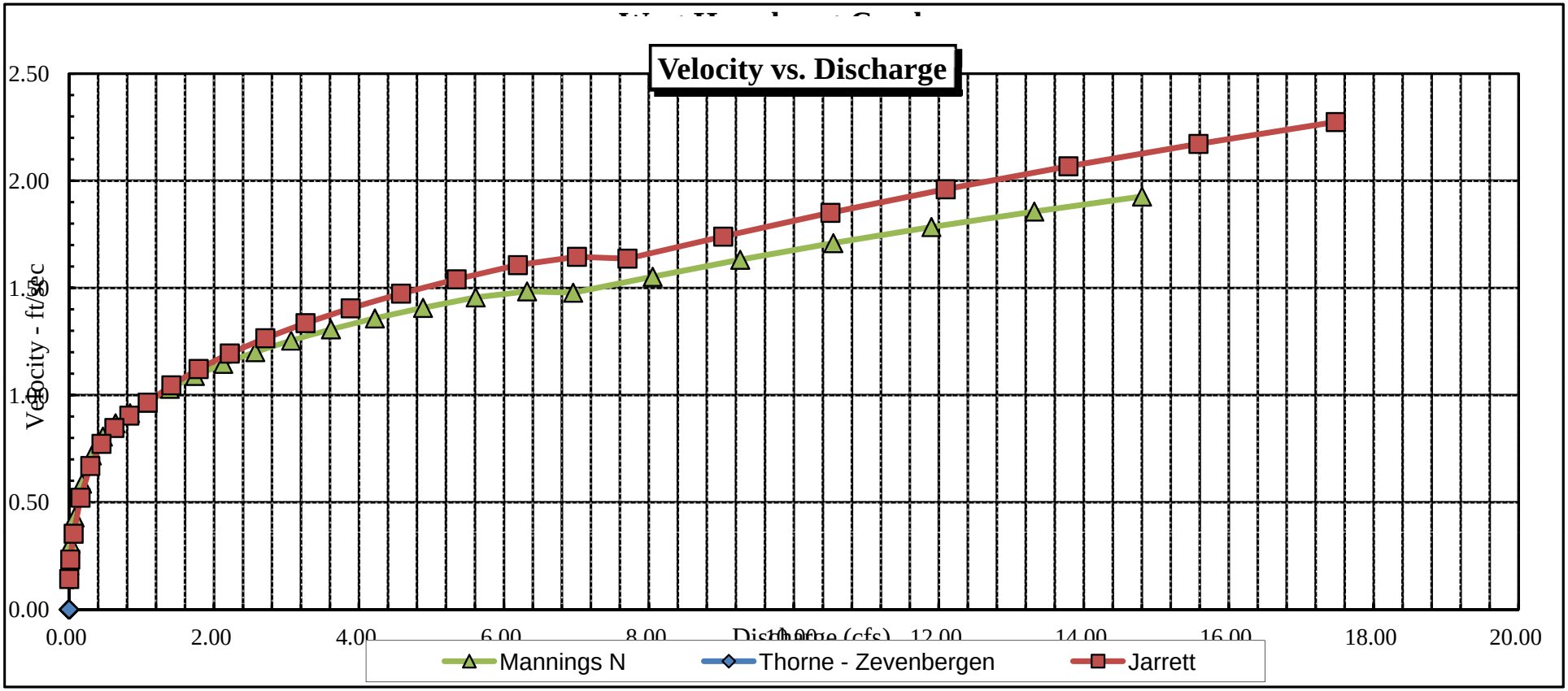
STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

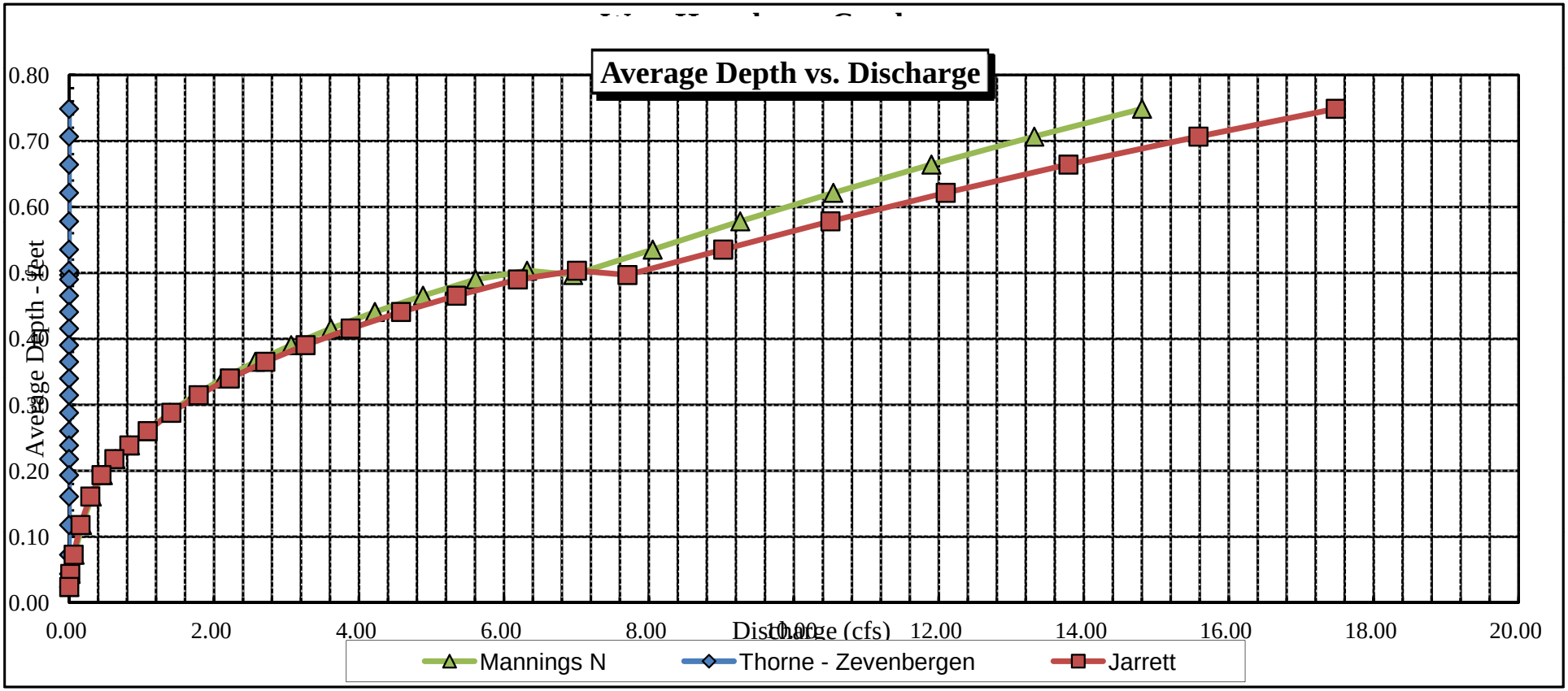
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

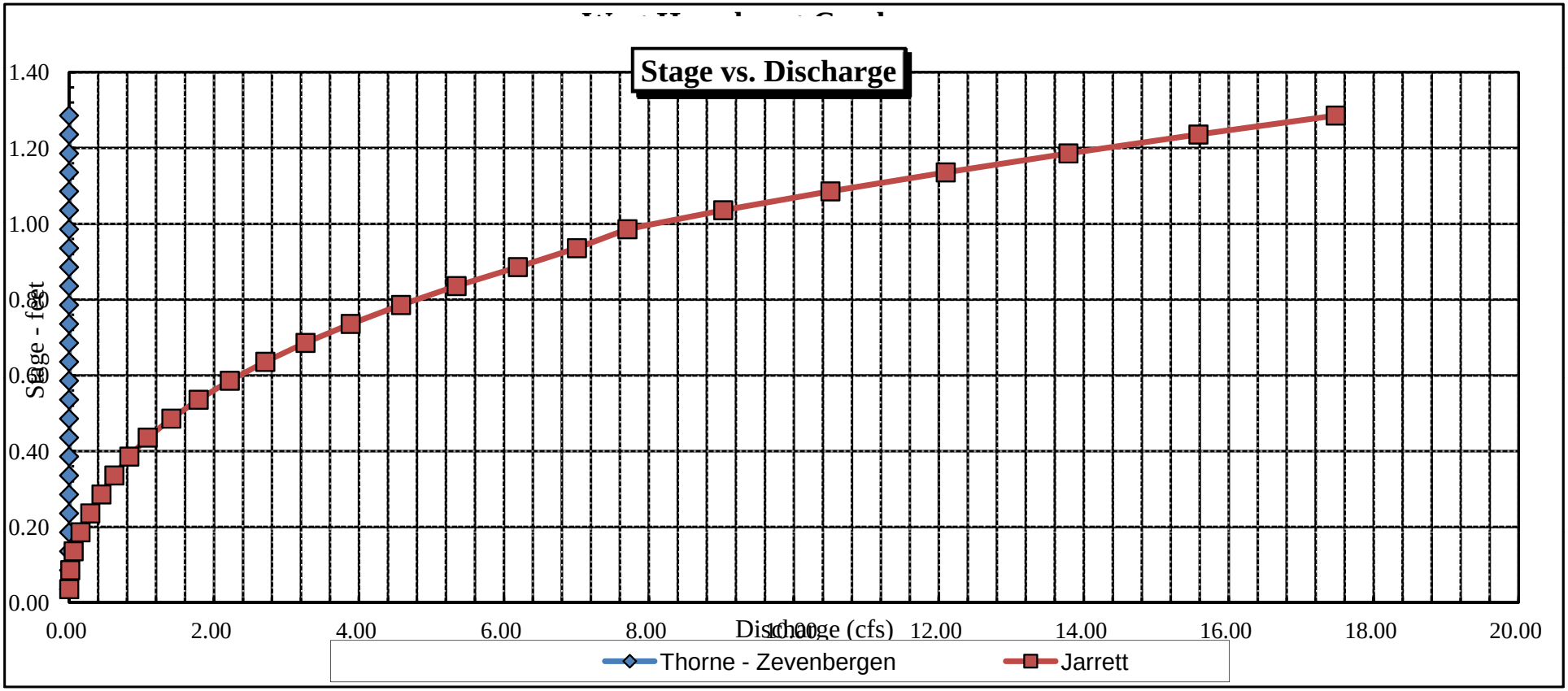
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.93	10.34	0.78	1.32	8.04	11.58	100.0%	0.69	18.83	2.34
	5.96	10.26	0.75	1.29	7.68	11.47	99.1%	0.67	17.48	2.27
	6.01	10.15	0.71	1.24	7.17	11.32	97.8%	0.63	15.58	2.17
	6.06	10.04	0.66	1.19	6.67	11.17	96.5%	0.60	13.79	2.07
	6.11	9.93	0.62	1.14	6.17	11.02	95.2%	0.56	12.10	1.96
	6.16	9.82	0.58	1.09	5.68	10.87	93.9%	0.52	10.50	1.85
	6.21	9.69	0.54	1.04	5.19	10.71	92.5%	0.48	9.02	1.74
	6.26	9.48	0.50	0.99	4.71	10.46	90.4%	0.45	7.70	1.64
	6.31	8.46	0.50	0.94	4.26	9.41	81.3%	0.45	7.01	1.65
	6.36	7.86	0.49	0.89	3.85	8.76	75.7%	0.44	6.19	1.61
	6.41	7.46	0.47	0.84	3.47	8.30	71.7%	0.42	5.35	1.54
	6.46	7.05	0.44	0.79	3.11	7.84	67.8%	0.40	4.58	1.47
	6.51	6.65	0.42	0.74	2.77	7.39	63.9%	0.37	3.89	1.41
	6.56	6.26	0.39	0.69	2.44	6.94	60.0%	0.35	3.26	1.34
	6.61	5.86	0.37	0.64	2.14	6.49	56.1%	0.33	2.71	1.27
	6.66	5.46	0.34	0.59	1.86	6.04	52.2%	0.31	2.22	1.19
	6.71	5.07	0.31	0.54	1.59	5.59	48.3%	0.28	1.79	1.12
	6.76	4.69	0.29	0.49	1.35	5.16	44.6%	0.26	1.41	1.05
WL	6.81	4.32	0.26	0.44	1.12	4.74	40.9%	0.24	1.09	0.97
	6.86	3.85	0.24	0.39	0.92	4.19	36.2%	0.22	0.83	0.90
	6.91	3.39	0.22	0.34	0.74	3.65	31.5%	0.20	0.63	0.85
	6.96	2.99	0.19	0.29	0.58	3.19	27.6%	0.18	0.45	0.77
	7.01	2.72	0.16	0.24	0.44	2.87	24.8%	0.15	0.29	0.67
	7.06	2.59	0.12	0.19	0.31	2.71	23.4%	0.11	0.16	0.52
	7.11	2.46	0.07	0.14	0.18	2.54	22.0%	0.07	0.06	0.35
	7.16	1.62	0.04	0.09	0.07	1.67	14.4%	0.04	0.02	0.23
	7.21	0.72	0.02	0.04	0.02	0.74	6.4%	0.02	0.00	0.14


CROSS SECTION DATA ANALYSIS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
DISTANCE FROM STAKE (FT)
S
G
W
W
G
S
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
2.00
4.00
6.00
8.00
12.00
14.00
16.00
18.00
20.00
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
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
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
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	West Hawxhurst Creek
XS LOCATION:	500 ft upst fr conf w East Hawxhurst Ck.
XS NUMBER:	1
DATE:	22-Jul-14
OBSERVERS:	N. Dieterich, K. Jones
1/4 SEC:	NW
SECTION:	8
TWP:	9S
RANGE:	94W
PM:	Sixth
COUNTY:	Mesa
WATERSHED:	Buzzard Creek
DIVISION:	5
DOW CODE:	27981
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:	0.062

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

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

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

DATA POINTS= 30

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
S	0.00	9.11			0.00		0.00	0.00	0.0%
	2.00	9.89			0.00		0.00	0.00	0.0%
	5.00	10.53			0.00		0.00	0.00	0.0%
	7.00	10.96			0.00		0.00	0.00	0.0%
1 G	8.00	11.41			0.00		0.00	0.00	0.0%
W	8.10	12.37	0.00	0.00	0.00		0.00	0.00	0.0%
	8.30	12.58	0.10	0.42	0.29	0.10	0.03	0.01	0.9%
	8.60	12.59	0.20	0.43	0.30	0.20	0.06	0.03	2.1%
	8.90	12.67	0.20	0.95	0.31	0.20	0.06	0.06	4.7%
	9.20	12.65	0.25	0.90	0.30	0.25	0.08	0.07	5.5%
	9.50	12.68	0.10	0.24	0.30	0.10	0.03	0.01	0.6%
	9.80	12.56	0.05	0.00	0.32	0.05	0.02	0.00	0.0%
	10.10	12.61	0.25	0.00	0.30	0.25	0.08	0.00	0.0%
	10.40	12.61	0.25	0.00	0.30	0.25	0.08	0.00	0.0%
	10.70	12.59	0.20	0.16	0.30	0.20	0.06	0.01	0.8%
	11.00	12.78	0.30	1.88	0.36	0.30	0.09	0.17	13.8%
	11.30	12.81	0.50	1.96	0.30	0.50	0.15	0.29	24.1%
	11.60	12.80	0.50	1.99	0.30	0.50	0.15	0.30	24.4%
	11.90	12.85	0.50	1.47	0.30	0.50	0.15	0.22	18.0%
	12.20	12.40	0.10	0.79	0.54	0.10	0.03	0.02	1.9%
	12.50	12.41	0.05	0.47	0.30	0.05	0.02	0.01	0.6%
	12.80	12.58	0.20	0.50	0.34	0.20	0.06	0.03	2.5%
	13.10	12.44	0.10	0.04	0.33	0.10	0.03	0.00	0.1%
	13.40	12.39	0.05	0.00	0.30	0.05	0.02	0.00	0.0%
W	13.70	12.39	0.00	0.00	0.30		0.00	0.00	0.0%
	14.00	12.15			0.00		0.00	0.00	0.0%
	15.00	11.92			0.00		0.00	0.00	0.0%
1 G	16.50	11.41			0.00		0.00	0.00	0.0%
	17.00	11.22			0.00		0.00	0.00	0.0%
S	18.40	9.12			0.00		0.00	0.00	0.0%
TOTALS ----------					6.11	0.5 (Max.)	1.17	1.22	100.0%

Manning's n = 0.1168
Hydraulic Radius= 0.19058843

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.17	1.24	6.3%
12.13	1.17	2.68	130.4%
12.15	1.17	2.57	120.2%
12.17	1.17	2.45	110.0%
12.19	1.17	2.33	99.9%
12.21	1.17	2.21	89.9%
12.23	1.17	2.10	79.9%
12.25	1.17	1.98	69.9%
12.27	1.17	1.86	60.0%
12.29	1.17	1.75	50.1%
12.31	1.17	1.63	40.3%
12.33	1.17	1.52	30.5%
12.34	1.17	1.46	25.7%
12.35	1.17	1.41	20.8%
12.36	1.17	1.35	16.0%
12.37	1.17	1.29	11.1%
12.38	1.17	1.24	6.3%
12.39	1.17	1.18	1.5%
12.40	1.17	1.13	-3.0%
12.41	1.17	1.08	-7.3%
12.42	1.17	1.03	-11.4%
12.43	1.17	0.99	-15.4%
12.45	1.17	0.89	-23.3%
12.47	1.17	0.81	-30.9%
12.49	1.17	0.72	-38.3%
12.51	1.17	0.63	-45.6%
12.53	1.17	0.55	-52.6%
12.55	1.17	0.47	-59.5%
12.57	1.17	0.39	-66.2%
12.59	1.17	0.32	-72.2%
12.61	1.17	0.26	-77.3%
12.63	1.17	0.22	-81.1%

WATERLINE AT ZERO
AREA ERROR = 12.393

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck.
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	11.41	8.50	0.94	1.44	7.98	10.07	100.0%	0.79	21.65	2.71
	11.44	8.40	0.92	1.41	7.70	9.94	98.6%	0.78	20.58	2.67
	11.49	8.25	0.88	1.36	7.29	9.73	96.6%	0.75	19.03	2.61
	11.54	8.09	0.85	1.31	6.88	9.52	94.6%	0.72	17.53	2.55
	11.59	7.94	0.82	1.26	6.48	9.32	92.5%	0.70	16.09	2.48
	11.64	7.79	0.78	1.21	6.08	9.11	90.5%	0.67	14.71	2.42
	11.69	7.64	0.75	1.16	5.70	8.91	88.4%	0.64	13.39	2.35
	11.74	7.48	0.71	1.11	5.32	8.70	86.4%	0.61	12.13	2.28
	11.79	7.33	0.67	1.06	4.95	8.50	84.3%	0.58	10.93	2.21
	11.84	7.18	0.64	1.01	4.59	8.29	82.3%	0.55	9.79	2.13
	11.89	7.03	0.60	0.96	4.23	8.08	80.3%	0.52	8.70	2.06
	11.94	6.84	0.57	0.91	3.88	7.85	77.9%	0.49	7.70	1.98
	11.99	6.62	0.54	0.86	3.55	7.57	75.2%	0.47	6.77	1.91
	12.04	6.40	0.50	0.81	3.22	7.30	72.5%	0.44	5.91	1.84
	12.09	6.18	0.47	0.76	2.91	7.03	69.8%	0.41	5.11	1.76
	12.14	5.95	0.44	0.71	2.60	6.75	67.1%	0.39	4.37	1.68
	12.19	5.86	0.39	0.66	2.31	6.60	65.6%	0.35	3.63	1.57
	12.24	5.80	0.35	0.61	2.02	6.47	64.3%	0.31	2.94	1.46
	12.29	5.73	0.30	0.56	1.73	6.34	63.0%	0.27	2.30	1.33
	12.34	5.66	0.26	0.51	1.45	6.21	61.7%	0.23	1.73	1.20
WL	12.39	5.26	0.22	0.46	1.16	5.76	57.2%	0.20	1.27	1.09
	12.44	4.54	0.20	0.41	0.92	4.98	49.4%	0.19	0.95	1.03
	12.49	4.26	0.17	0.36	0.70	4.63	46.0%	0.15	0.64	0.90
	12.54	3.98	0.13	0.31	0.50	4.28	42.5%	0.12	0.38	0.75
	12.59	3.12	0.10	0.26	0.31	3.35	33.2%	0.09	0.20	0.65
	12.64	2.04	0.09	0.21	0.19	2.21	22.0%	0.09	0.12	0.62
	12.69	1.14	0.10	0.16	0.12	1.26	12.5%	0.09	0.08	0.65
	12.74	1.03	0.06	0.11	0.06	1.10	10.9%	0.06	0.03	0.47
	12.79	0.80	0.02	0.06	0.02	0.84	8.3%	0.02	0.00	0.22
	12.84	0.04	0.00	0.01	0.00	0.05	0.5%	0.00	0.00	0.07

STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.22	cfs
CALCULATED FLOW (Qc)=	1.27	cfs
(Qm-Qc)/Qm * 100 =	-4.0	%
MEASURED WATERLINE (WLm)=	12.38	ft
CALCULATED WATERLINE (WLc)=	12.39	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.46	ft
(Dm-Dc)/Dm * 100	8.7	%
MEAN VELOCITY=	1.09	ft/sec
MANNING'S N=	0.117	
SLOPE=	0.062	ft/ft
.4 * Qm =	0.5	cfs
2.5 * Qm=	3.1	cfs

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

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

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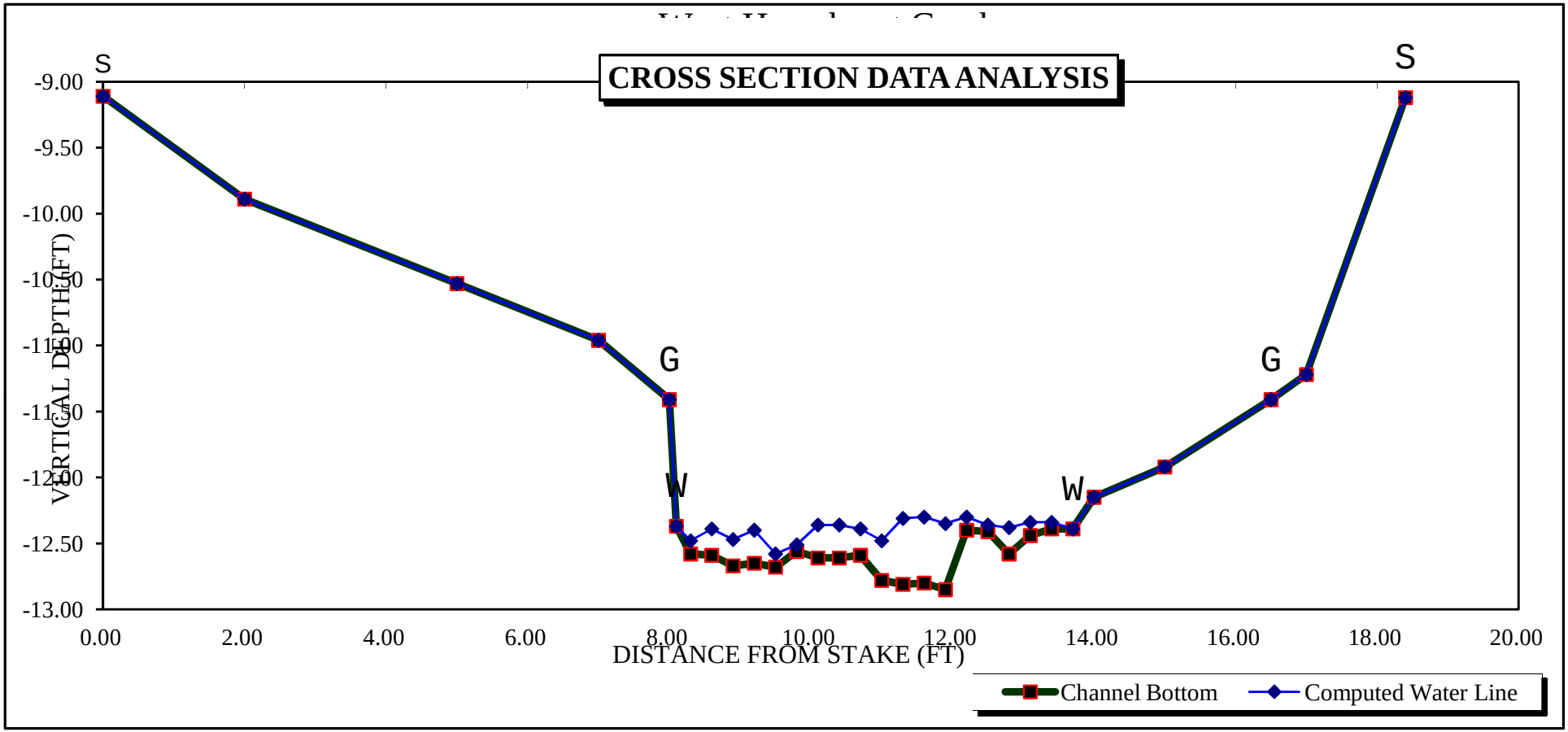
RECOMMENDATION BY: ………………….......................... AGENCY.............................. DATE:..............................

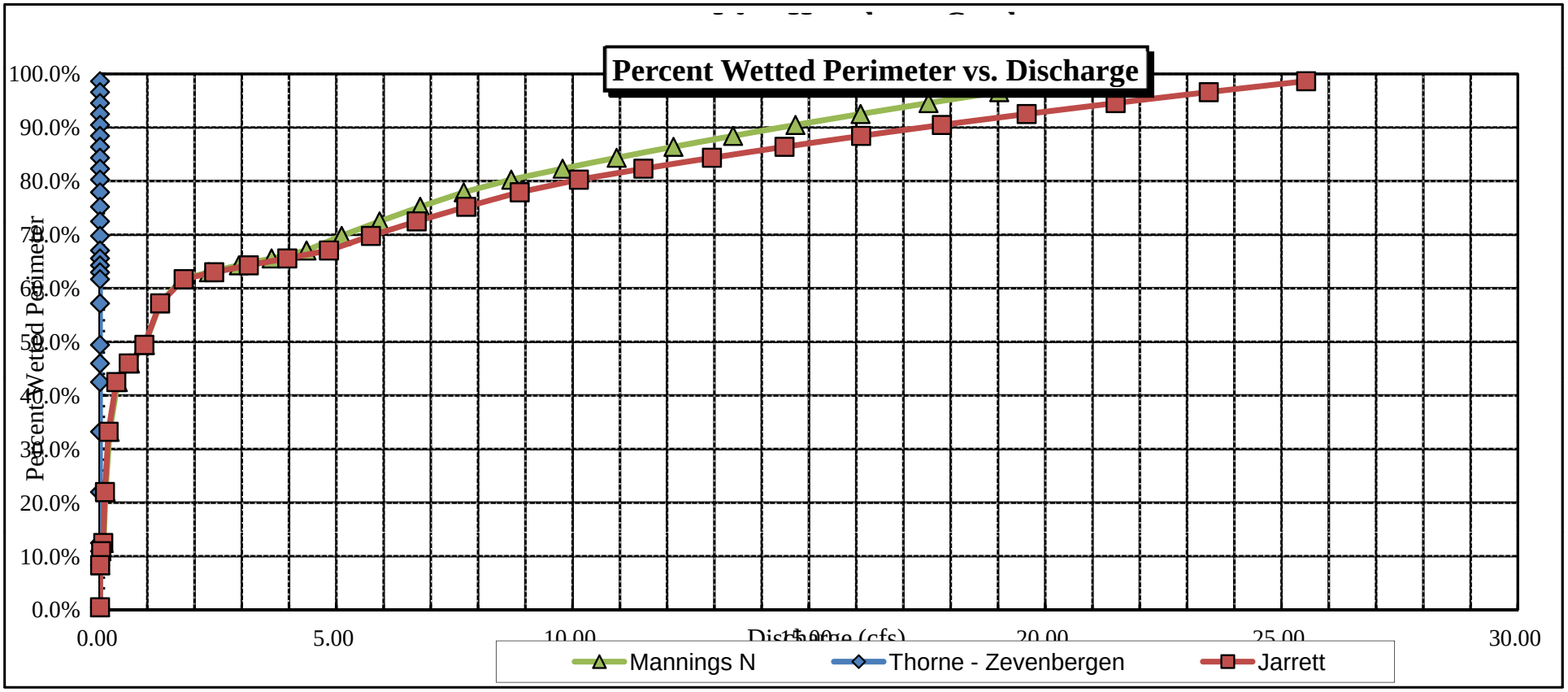
CWCB REVIEW BY: .... DATE:..............................

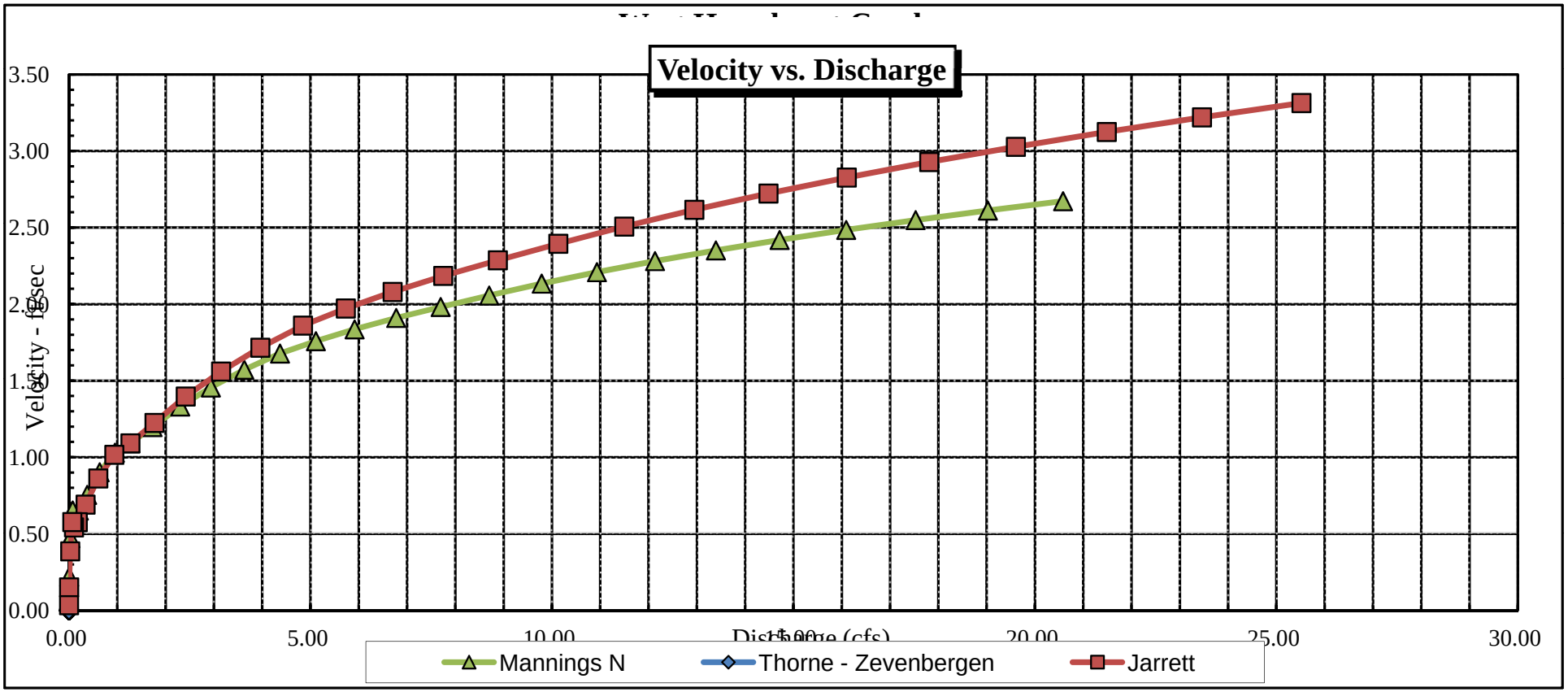
STREAM NAME: West Hawxhurst Creek
XS LOCATION: 500 ft upst fr conf w East Hawxhurst Ck.
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

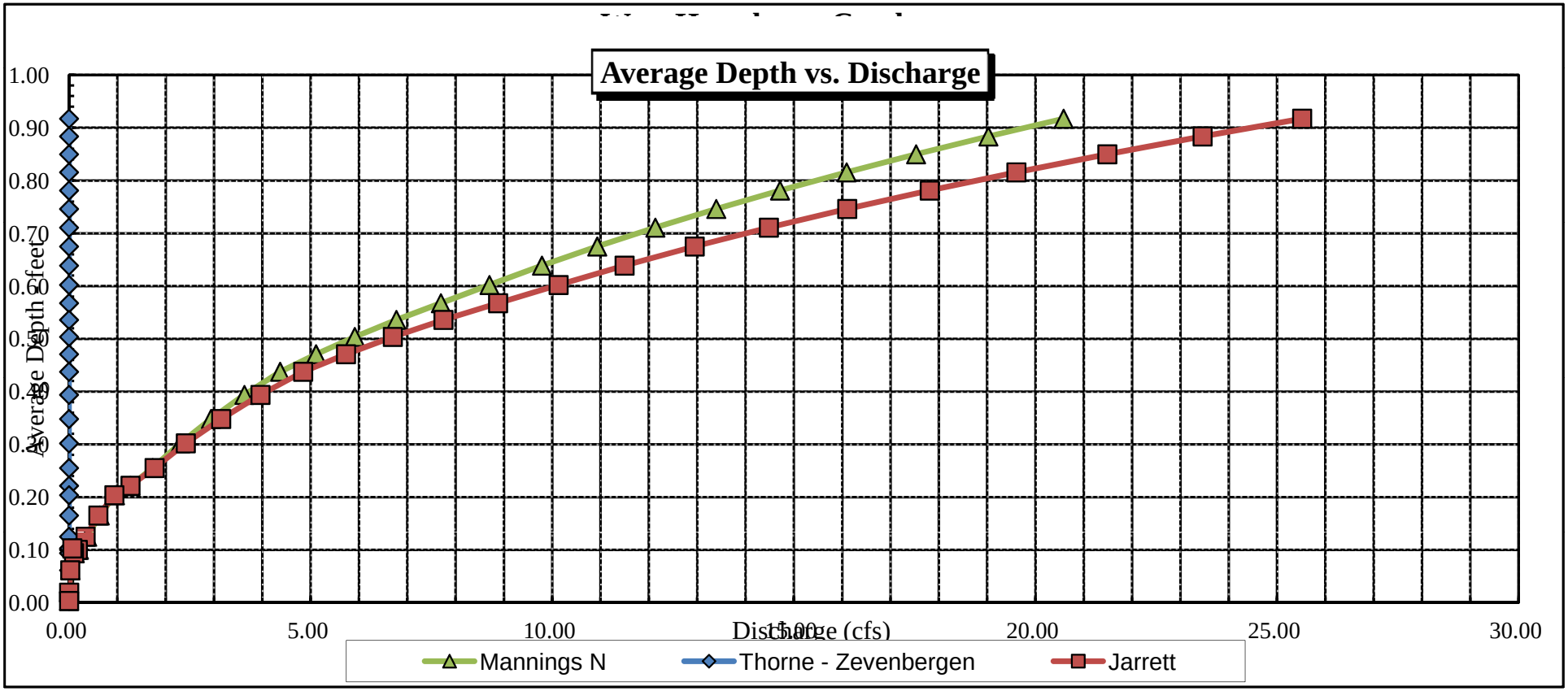
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

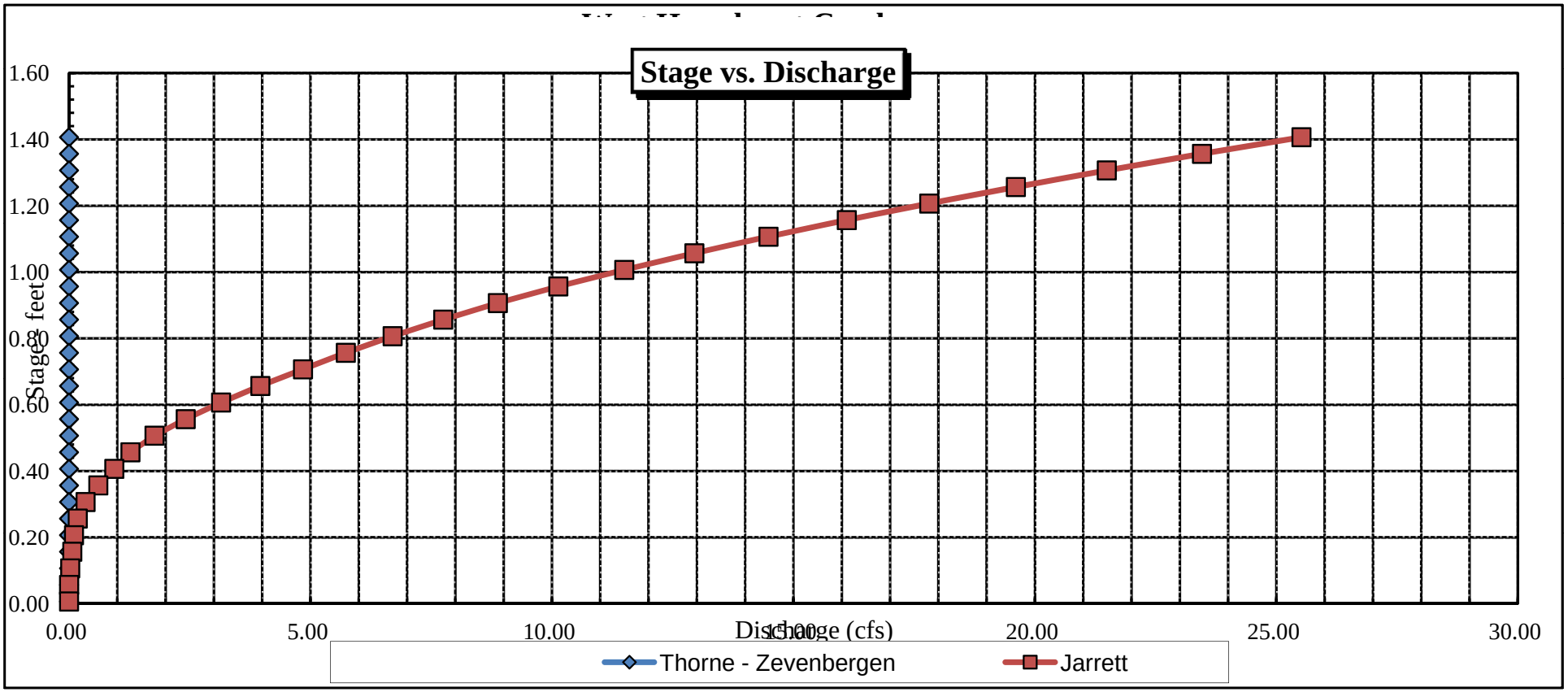
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	11.41	8.50	0.94	1.44	7.98	10.07	100.0%	0.79	26.94	3.37
	11.44	8.40	0.92	1.41	7.70	9.94	98.6%	0.78	25.52	3.31
	11.49	8.25	0.88	1.36	7.29	9.73	96.6%	0.75	23.46	3.22
	11.54	8.09	0.85	1.31	6.88	9.52	94.6%	0.72	21.49	3.12
	11.59	7.94	0.82	1.26	6.48	9.32	92.5%	0.70	19.61	3.03
	11.64	7.79	0.78	1.21	6.08	9.11	90.5%	0.67	17.81	2.93
	11.69	7.64	0.75	1.16	5.70	8.91	88.4%	0.64	16.10	2.83
	11.74	7.48	0.71	1.11	5.32	8.70	86.4%	0.61	14.48	2.72
	11.79	7.33	0.67	1.06	4.95	8.50	84.3%	0.58	12.95	2.62
	11.84	7.18	0.64	1.01	4.59	8.29	82.3%	0.55	11.50	2.51
	11.89	7.03	0.60	0.96	4.23	8.08	80.3%	0.52	10.13	2.39
	11.94	6.84	0.57	0.91	3.88	7.85	77.9%	0.49	8.88	2.29
	11.99	6.62	0.54	0.86	3.55	7.57	75.2%	0.47	7.75	2.18
	12.04	6.40	0.50	0.81	3.22	7.30	72.5%	0.44	6.70	2.08
	12.09	6.18	0.47	0.76	2.91	7.03	69.8%	0.41	5.73	1.97
	12.14	5.95	0.44	0.71	2.60	6.75	67.1%	0.39	4.84	1.86
	12.19	5.86	0.39	0.66	2.31	6.60	65.6%	0.35	3.96	1.72
	12.24	5.80	0.35	0.61	2.02	6.47	64.3%	0.31	3.15	1.56
	12.29	5.73	0.30	0.56	1.73	6.34	63.0%	0.27	2.42	1.40
	12.34	5.66	0.26	0.51	1.45	6.21	61.7%	0.23	1.77	1.22
WL	12.39	5.26	0.22	0.46	1.16	5.76	57.2%	0.20	1.27	1.09
	12.44	4.54	0.20	0.41	0.92	4.98	49.4%	0.19	0.94	1.02
	12.49	4.26	0.17	0.36	0.70	4.63	46.0%	0.15	0.61	0.86
	12.54	3.98	0.13	0.31	0.50	4.28	42.5%	0.12	0.34	0.69
	12.59	3.12	0.10	0.26	0.31	3.35	33.2%	0.09	0.18	0.58
	12.64	2.04	0.09	0.21	0.19	2.21	22.0%	0.09	0.10	0.54
	12.69	1.14	0.10	0.16	0.12	1.26	12.5%	0.09	0.07	0.58
	12.74	1.03	0.06	0.11	0.06	1.10	10.9%	0.06	0.02	0.39
	12.79	0.80	0.02	0.06	0.02	0.84	8.3%	0.02	0.00	0.15
	12.84	0.04	0.00	0.01	0.00	0.05	0.5%	0.00	0.00	0.03


CROSS SECTION DATA ANALYSIS
S
S
G
G
W
W
-9.00
-9.50
-10.00
-10.50
-11.00
-11.50
-12.00
-12.50
-13.00
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
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
20.00
25.00
30.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
3.50
3.00
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
Mannings N
Thorne - Zevenbergen
Jarrett


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
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


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
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: West Hawxhurst Creek						CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: Nad 1983 Zone 13S 0248998 4353250							
DATE: 10/4/11	OBSERVERS: N. Dieterich / C. Ewing						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 8	TOWNSHIP: 9 N/S	RANGE: 94 E/W	PM: 6th		
COUNTY: Mesa	WATERSHED: Buzzard Creek	WATER DIVISION: Division 5 (Lower Colorado)	DOW WATER CODE: 27981				
MAP(S): USGS: Hawxhurst Cr. ~~USFS:~~							

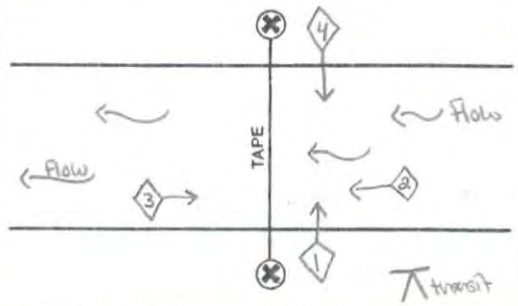
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: Large Cobble / boulder	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 4		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
Tape @ Stake LB	0.0	6.04
Tape @ Stake RB	0.0	6.09
1 WS @ Tape LB/RB	0.0	7.03 / 7.01
2 WS Upstream	18.5'	5.41
3 WS Downstream	24'	7.99
SLOPE	6.07%	

SKETCH



LEGEND: Stake, Station, 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:

No fish observed

COMMENTS

SC = 277 µS
Temp = 11.7°C
pH = 8.6

* discussion w/ Mike (roads Manager) indicated reservoir works (maintenance) was to occur in the spring/summer 2012. Reservoirs are located in the head-hgts of E. & W. Hawxhurst Cr. on USFS. (constructed in early 1900's)

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: West Hawthurst Creek | CROSS-SECTION NO: 1 | DATE: 10/4/11 | SHEET 1 OF 1

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT (RIGHT) | Gage Reading: ____ ft | TIME: 0900

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)
BM#1	—	—	5.99 +								
SG	0	—	6.09								
	0.7	0.7	7.05								
right W	1.3	0.6	7.02	0	0.6d		20	0		0	0
	2	0.7	7.04	0.02				0		0.014	0
R	2.3	0.3	6.98	0				0		0	0
	2.6		7.08	0.06				0		0.018	0
	2.9		7.15	0.13				0		0.039	0
	3.2		7.12	0.1				0.64		0.03	0.019
	3.5		7.27	0.25				0.01		0.075	0.001
	3.8		7.21	0.19				0		0.057	0
	4.1		7.22	0.2				0.01		0.06	0.001
	4.4		7.44	0.42				1.37		0.126	0.173
	4.7		7.56	0.54				1.78		0.162	0.288
	5		7.51	0.49				1.62		0.147	0.238
	5.3		7.58	0.56				1.32		0.168	0.222
	5.6		7.54	0.52				0.43		0.156	0.067
	5.9		7.49	0.47				0.54		0.141	0.076
	6.2		7.19	0.17				0.89		0.051	0.045
	6.5		7.15	0.13				0.47		0.039	0.018
	6.8		7.07	0.03				0		0.015	0
R	7.1		6.89	0.05				Rock		0	0
	7.4		7.18	0.16				0.01		0.048	0
	7.7		7.21	0.16				0		0.057	0
left W	7.8	0.1	7.22	0.19				0		0	0
	8.2	0.4	6.49	0							
	9	0.8	6.50							total =	1.15 cfs
	10	1	6.58								
	11	1	6.49								
	12	1	6.27								
	13	1	6.15								
G	13.6	0.6	6.09								
S	14	0.4	6.04								
TOTALS:											

HI = 105.99
BM#1 = 100' (arbitrary datum)

End of Measurement | Time: 0935 | Gage Reading: ____ ft | CALCULATIONS PERFORMED BY: N. Dietterich | CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: West Hawxhurst Creek							CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: Nad 1983 Zone 13S 0249023 4353295							
DATE: 7/22/14	OBSERVERS: N. Dieterich / H. Jones						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 8	TOWNSHIP: 9 N/S	RANGE: 94 E/W	PM: 6th		
COUNTY: Mesa	WATERSHED: Buzzard Cr	WATER DIVISION: Division 5 (Lower Colorado)	DOW WATER CODE:				
MAP(S)	USGS: Hawxhurst						
	USFS:						

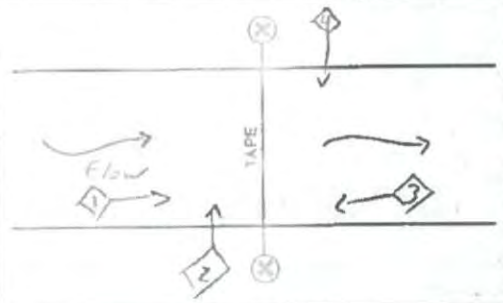
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED: 4/2014	CALIB/SPIN _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel/cobble	PHOTOGRAPHS TAKEN: (YES) NO	NUMBER OF PHOTOGRAPHS: 4		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream		
③ WS Downstream		
SLOPE	Ave = 6.2%	

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

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

COMMENTS

pH = 8.2 SC = 189.1 temp = 10

BM#1 = 5.66

BM#2 = 5.15 no turning point used

RS: 5.3[illegible]

LS: 5.37

13MA2 - 3.13 ✓

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: West Hawxhurst Cr. | CROSS-SECTION NO. 2 | DATE 7/22/14 | SHEET 1 OF 1

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT (LEFT circled) | Gage Reading: ___ ft | TIME 1130

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 (ft²)	Discharge (cfs)
S	0	0	0.6d		5.37						
	1.3	1.3			5.54						
	2	0.7			5.[illegible]						
(BF) G	2.2	0.2			5.9[illegible]						
	2.5	0.3			[illegible]						
	4	1.5			6.9						
	6	2			6.[illegible]						
End of Willows	7	1			6.33						
W	7.9	0.9		0	6.75		20	0		0	0
	8.2	0.3		.15	6.91		20	1.2		0.048	0.058
	8.5	0.3		.2	6.99		20	1.63		0.072	0.117
R	8.8	0.3		.1	6.83		20	1.9		0.024	0.046
	9.1	0.3		.35	7.11		20	.86		0.108	0.093
	9.4	0.3		.35	7.24		20	.42		0.147	0.062
	9.7	0.3		.4	7.18		20	1.21		0.129	0.156
	10.	0.3		.45	7.25		20	.76		0.15	0.114
	10.3	0.3		.1	7.25		20	1.18		0.15	0.177
	10.6	0.3		.4	7.12		20	1.95		0.111	0.216
	10.9	0.3		.45	7.16		20	.56		0.123	0.069
	11.2	0.3		.4	7.17		20	.6		0.126	0.076
	11.5	0.3		.3	7.16		20	.9		0.123	0.111
	11.8	0.3		.1	6.96		20	.52		0.063	0.033
W	12.1	0.3		0	6.72		20	0		-.009	0
	12.5	0.4			6.47						
	13.	0.5			6.19						
(BF) G	13.3	0.3			5.93						
	13.5	0.2			5.33						
S	15	1.5			5.33						

Long Profile

		Station	H_2O Surface (fs)	Water-Surf Elevation		
		0	3.56	102.1		
	CS#2	20	6.67	98.99	15.55%	
		40	7.05	98.61	1.9%	
		60	7.91	97.75	4.3%	
		80	8.82	96.84	4.5%	
		96	10.57	95.09	10.9%	
Cross section #1		126	12.26	93.4	5.6%	
		140	12.55	93.11	2.1%	
		150	13	92.66	4.5	Ave=6.2%

TOTALS:

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

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO WATER CONSERVATION BOARD

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: West Hawxhurst Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Nad 1983 Zone 13S 0249016 4353271						
DATE: 7/22/14	OBSERVERS: N. Dietevich / K. Jones					
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 8	TOWNSHIP: 9 N/(S)	RANGE: 94 E/(W)	PM: 6th	
COUNTY: Mesa	WATERSHED: Buzzard Cr.	WATER DIVISION: Division 5 (Lower Colorado)	DOW WATER CODE:			
MAP(S): (USGS): Hawxhurst						
USFS:						

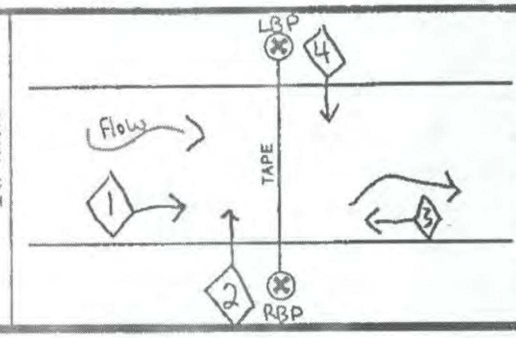
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: Marsh McBirney		
METER NUMBER:	DATE RATED: 4/14	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot · TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel / cobble		PHOTOGRAPHS TAKEN: (YES) NO	NUMBER OF PHOTOGRAPHS: 4

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	see CS #2 for data sheet for long profile
(X) Tape @ Stake RB	0.0	
(1) WS @ Tape LB/RB	0.0	
(2) WS Upstream		
(3) WS Downstream		
SLOPE	Ave = 6.2%	

SKETCH



LEGEND: Stake (X) · 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

pH = 8.2 SC = 189.1 µS@25°C Temp = 16.2°C

S1 9.17 ft
S2 ~~10.42 ft~~ 9.11 ft } level

DISCHARGE/CROSS SECTION NOTES

BM#1 = 5.66'
HI = 105.66'

STREAM NAME: West Hawxhurst Cr.	CROSS SECTION NO.	DATE 7/22/14	SHEET 1 OF 1
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (LEFT / RIGHT) (0.0 AT STAKE)	Gage Reading: ____ ft	TIME

Features (Stake (S), Grassline (G), Waterline (W), Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft) (FS)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft²)	Discharge (cfs)
S	0	0	0.6d		9.11						
	2	2			9.39						
	5	3			10.53						
	7	1			10.70						
G	8	0.1			11.4						
W	8.1	0.2		0	12.37		20	0		0	0
	8.3	0.3		.1	12.58		20	.42		0.042	0.018
	8.6	0.3		.2	12.59		20	.43		0.066	0.028
	8.9	0.3		.2	12.67		20	.95		0.09	0.086
	9.2	0.3		.25	12.65		20	.9		0.084	0.076
	9.5	0.3		.1	12.68		20	.24		0.093	0.022
	9.8	0.3		.05	12.86		20	0		0.057	0
	10.1	0.3		.25	12.61		20	0		0.072	0
	10.4	0.3		.25	12.61		20	0		0.072	0
	10.7	0.3		.2	12.59		20	.16		0.066	0.011
	11	0.3		.3	12.79		20	1.88		0.123	0.231
	11.3	0.3		.5	12.81		20	1.96		0.132	0.259
	11.6	0.3		.5	12.8		20	1.99		0.129	0.257
	11.9	0.3		.5	12.85		20	1.47		0.144	0.212
R	12.2	0.3		.1	12.4		20	.79		0.009	0.007
R	12.5	0.3		.05	12.41		20	.47		0.012	0.006
	12.8	0.3		.2	12.58		20	.50		0.063	0.032
	13.1	0.3		.1	12.44		20	.04		0.021	0.001
W	13.4	0.3		.05	12.39		20	0		0.006	0
W	13.7	0.3		0	12.39		20	0		0.006	0
	14	0.3			12.15						
	15	1			11.92						Total = 1.243
G	16.5	1.5			11.41						
	17	0.5			11.22						
S	18.4	1.4			9.12						
TOTALS:											

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