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 Turkey Creek, located in Water Division 2.

Location and Land Status. The Turkey Creek watershed originates on the east flank of Black Mountain, approximately 10 miles southwest of Colorado Springs. This reach begins at the confluence of East Fork Turkey Creek and West Fork Turkey Creek and extends downstream to the headgate of the Strobel Ditch, a distance of approximately 3.5 miles. The BLM manages approximately 0.5 miles of this reach, while 3.0 miles are in private ownership.

Biological Summary. Turkey Creek is a cold-water, high gradient stream. The first three miles of the reach flow through a narrow canyon, and then last half-mile of the reach emerges from canyon and into the rolling foothills of the Front Range. The stream is confined by bedrock in most locations. The stream generally has large-sized substrate, consisting of cobbles and small boulders. The stream has a good mix of pools, small riffles, and runs.

Fisheries surveys have revealed a self-sustaining population of brook 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 generally comprised of cottonwood, various 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 Turkey 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)
05/27/2014 #1	2.11 cfs	13.07 feet	0.93 cfs	3.72 cfs
05/27/2014 #2	2.05 cfs	16.13 feet	1.10 cfs	Out of range
		Averages:	1.01 cfs	3.72 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.

3.7 cubic feet per second is recommended during the warm weather period from

May 1 to August 31. This recommendation is driven by the average velocity criteria. This creek is steep and has limited physical habitat, so it is important to protect a flow rate that provides usable habitat in riffles when fish are completing critical life history functions during the warm weather months.

1.8 cubic feet per second is recommended during the fall period, from September 1 to November 30. This recommendation is driven by limited water availability. This flow rates significantly exceeds the average depth and wetted perimeter criteria, and provides an average velocity of approximately 0.8 feet per second.

1.00 cfs is recommended during the winter period from December 1 through March 31. 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.

3.0 cfs is recommended during the early portion of the snowmelt runoff period, from the April 1 to April 30. This flow rate comes close to meeting all three instream flow criteria, but reflects the fact that snowmelt runoff is not yet sufficient during April to meet all three instream flow criteria.

Water Availability. The BLM recommends relying upon two sources of data for water availability analysis. USGS Gage 07105945 (Rock Creek above Fort Carson Reservation, CO) measures flow from a watershed immediately to the north of Turkey Creek with very similar watershed characteristics. In addition, this gage is located on Rock Creek immediately as it exits the mountains, which provides a better estimate of mountain-influenced runoff. A basin apportionment analysis could be performed to derive flow rates for Turkey Creek. The BLM does <u>not</u> recommending reliance upon USGS Gage 07099215 (Turkey Creek near Fountain, CO). This gage is located adjacent to State Highway 115, after the creek exits the mountains and loses a very significant amount of flow to seepage. In addition, it appears that the gage may be influenced by diversion from the Strobel Ditch.

Streamstats should also be consulted. The Streamstats model produces similar estimates of baseflow as basin apportionment calculations of the Rock Creek gage.

BLM does not recommend relying upon diversion records from the Strobel Ditch. This ditch appears to divert fairly infrequently, likely because of its junior priority within the Arkansas River basin.

The BLM is not aware of any water rights within or upstream from the proposed instream flow reach:

Relationship to Land Management Plans. BLM's land use plan calls for Turkey 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 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.

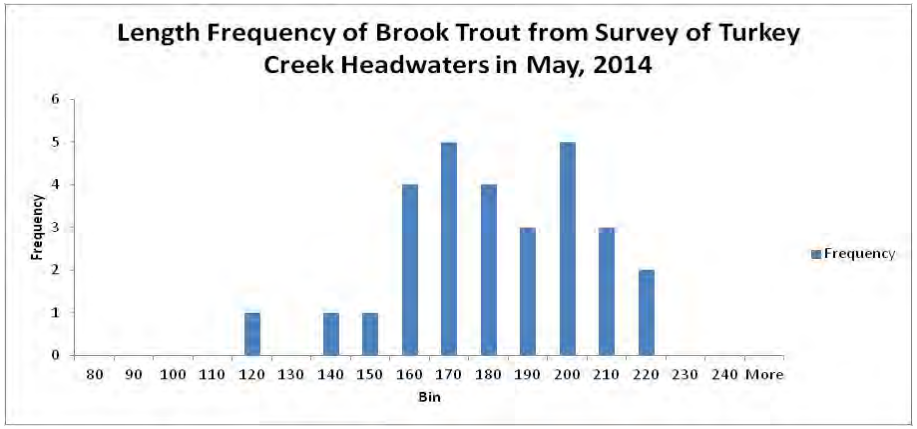
If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

Brian St. George
Deputy State Director
Resources and Fire

Cc: David Gilbert, Royal Gorge FO
Keith Berger, Royal Gorge FO

HUC12	Description	SampleDate	SiteName	Location	Protocol	TotalCatch	CommonName	TotalEffort	EffortMetric	LengthRange	CPUE
110200020701	Headwaters Turkey Cre	27-May-14	NULL	Upstream of Hwy 115 and gravel mine	TWO-PASS REMOVAL	29	BROOK TROUT	2	PASS	115 - 215	NULL
110200020702	Upper Turkey Creek	9-Nov-11	Fort Carson #50 in TA 38	Fort Carson #50 in TA 38	CPUE	97	CENTRAL STONEROLLER	2	NET	59 - 103	48.50 / NET
110200020702	Upper Turkey Creek	9-Nov-11	TA 38 North of Two Track intersect	TA 38 North of Two Track intersect	PRESENCE/ABSENCE	NULL	NULL	1	PASS	NULL	NULL
110200020704	Lower Turkey Creek	9-Nov-11	Downstream Dam Outlet Teller Reservoir	BLW Teller Reservoir Dam Outlet	PRESENCE/ABSENCE	NULL	NULL	1	PASS	NULL	NULL
110200020704	Lower Turkey Creek	9-Nov-11	AT CARRIZO SPRINGS	ABV W Carrizo Springs Ave	PRESENCE/ABSENCE	NULL	NULL	1	PASS	NULL	NULL



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

LOCATION INFORMATION

STREAM NAME:	Turkey Creek
XS LOCATION:	800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER:	0
DATE:	0-Jan-00
OBSERVERS:	0
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.022

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

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

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER: 0

DATA POINTS= 26

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	1.50	6.04			0.00		0.00	0.00	0.0%
	W	2.50	6.65	0.00	0.00	0.00		0.00	0.00	0.0%
		3.00	6.88	0.23	0.00	0.55	0.23	0.12	0.00	0.0%
		3.50	7.02	0.37	0.00	0.52	0.37	0.19	0.00	0.0%
		4.00	7.25	0.60	0.58	0.55	0.60	0.30	0.17	8.5%
		4.50	7.22	0.57	1.13	0.50	0.57	0.29	0.32	15.7%
		5.00	7.08	0.43	1.41	0.52	0.43	0.22	0.30	14.8%
		5.50	7.15	0.50	1.26	0.50	0.50	0.25	0.32	15.4%
		6.00	7.20	0.55	0.80	0.50	0.55	0.28	0.22	10.7%
		6.50	7.11	0.46	0.58	0.51	0.46	0.23	0.13	6.5%
		7.00	7.20	0.55	0.24	0.51	0.55	0.28	0.07	3.2%
		7.50	6.98	0.33	0.00	0.55	0.33	0.17	0.00	0.0%
		8.00	7.00	0.35	0.14	0.50	0.35	0.18	0.02	1.2%
		8.50	7.04	0.39	0.37	0.50	0.39	0.20	0.07	3.5%
		9.00	6.65	0.00	0.00	0.63		0.00	0.00	0.0%
		9.50	6.70	0.05	0.69	0.50	0.05	0.03	0.02	0.8%
		10.00	7.04	0.39	0.81	0.60	0.39	0.20	0.16	7.7%
		10.50	7.20	0.55	0.57	0.52	0.55	0.28	0.16	7.6%
		11.00	6.77	0.12	0.39	0.66	0.12	0.06	0.02	1.1%
		11.50	6.95	0.30	0.44	0.53	0.30	0.15	0.07	3.2%
	W	12.00	6.65	0.00	0.00	0.58		0.00	0.00	0.0%
		13.00	6.28			0.00		0.00	0.00	0.0%
		15.00	6.40			0.00		0.00	0.00	0.0%
		17.00	6.35			0.00		0.00	0.00	0.0%
1	G	17.70	6.08			0.00		0.00	0.00	0.0%
	LS	19.60	5.20			0.00		0.00	0.00	0.0%
	TOTALS ----------					10.25	0.6 (Max.)	3.37	2.05	100.0%

Manning's n = 0.1724
Hydraulic Radius= 0.32871651

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.37	3.37	0.0%
6.40	3.37	5.88	74.5%
6.42	3.37	5.67	68.2%
6.44	3.37	5.46	62.0%
6.46	3.37	5.25	55.9%
6.48	3.37	5.05	49.8%
6.50	3.37	4.84	43.7%
6.52	3.37	4.64	37.7%
6.54	3.37	4.44	31.8%
6.56	3.37	4.24	25.9%
6.58	3.37	4.05	20.0%
6.60	3.37	3.85	14.3%
6.61	3.37	3.75	11.4%
6.62	3.37	3.66	8.5%
6.63	3.37	3.56	5.7%
6.64	3.37	3.47	2.8%
6.65	3.37	3.37	0.0%
6.66	3.37	3.28	-2.8%
6.67	3.37	3.18	-5.5%
6.68	3.37	3.09	-8.3%
6.69	3.37	3.00	-10.9%
6.70	3.37	2.91	-13.5%
6.72	3.37	2.74	-18.7%
6.74	3.37	2.57	-23.8%
6.76	3.37	2.40	-28.7%
6.78	3.37	2.24	-33.7%
6.80	3.37	2.07	-38.4%
6.82	3.37	1.92	-43.1%
6.84	3.37	1.76	-47.7%
6.86	3.37	1.62	-52.1%
6.88	3.37	1.47	-56.4%
6.90	3.37	1.33	-60.5%

WATERLINE AT ZERO
AREA ERROR = 6.650

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER: 0 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	6.08	16.13	0.66	1.17	10.64	17.17	100.0%	0.62	9.89	0.93
	6.10	16.05	0.64	1.15	10.32	17.07	99.5%	0.60	9.43	0.91
	6.15	15.84	0.60	1.10	9.52	16.84	98.1%	0.57	8.32	0.87
	6.20	15.63	0.56	1.05	8.74	16.60	96.7%	0.53	7.28	0.83
	6.25	15.41	0.52	1.00	7.96	16.37	95.3%	0.49	6.29	0.79
	6.30	14.82	0.49	0.95	7.20	15.74	91.7%	0.46	5.46	0.76
	6.35	13.64	0.48	0.90	6.49	14.53	84.6%	0.45	4.84	0.75
	6.40	10.59	0.56	0.85	5.88	11.45	66.7%	0.51	4.82	0.82
	6.45	10.37	0.52	0.80	5.36	11.21	65.3%	0.48	4.18	0.78
	6.50	10.15	0.48	0.75	4.84	10.97	63.9%	0.44	3.59	0.74
	6.55	9.93	0.44	0.70	4.34	10.73	62.5%	0.40	3.04	0.70
	6.60	9.72	0.40	0.65	3.85	10.49	61.1%	0.37	2.52	0.66
WL	6.65	9.50	0.35	0.60	3.37	10.25	59.7%	0.33	2.05	0.61
	6.70	8.74	0.33	0.55	2.91	9.45	55.1%	0.31	1.70	0.58
	6.75	8.41	0.30	0.50	2.48	9.06	52.8%	0.27	1.34	0.54
	6.80	7.97	0.26	0.45	2.07	8.54	49.8%	0.24	1.03	0.50
	6.85	7.44	0.23	0.40	1.69	7.93	46.2%	0.21	0.77	0.46
	6.90	6.89	0.19	0.35	1.33	7.29	42.5%	0.18	0.55	0.41
	6.95	6.29	0.16	0.30	1.00	6.62	38.5%	0.15	0.36	0.36
	7.00	5.37	0.13	0.25	0.70	5.63	32.8%	0.12	0.22	0.32
	7.05	4.42	0.10	0.20	0.46	4.62	26.9%	0.10	0.13	0.27
	7.10	3.77	0.07	0.15	0.25	3.91	22.8%	0.06	0.05	0.21
	7.15	2.35	0.04	0.10	0.10	2.43	14.2%	0.04	0.01	0.15
	7.20	0.68	0.03	0.05	0.02	0.69	4.0%	0.03	0.00	0.12

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.05	cfs
CALCULATED FLOW (Qc)=	2.05	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	6.65	ft
CALCULATED WATERLINE (WLc)=	6.65	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.60	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.61	ft/sec
MANNING'S N=	0.172	
SLOPE=	0.022	ft/ft
.4 * Qm =	0.8	cfs
2.5 * Qm=	5.1	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

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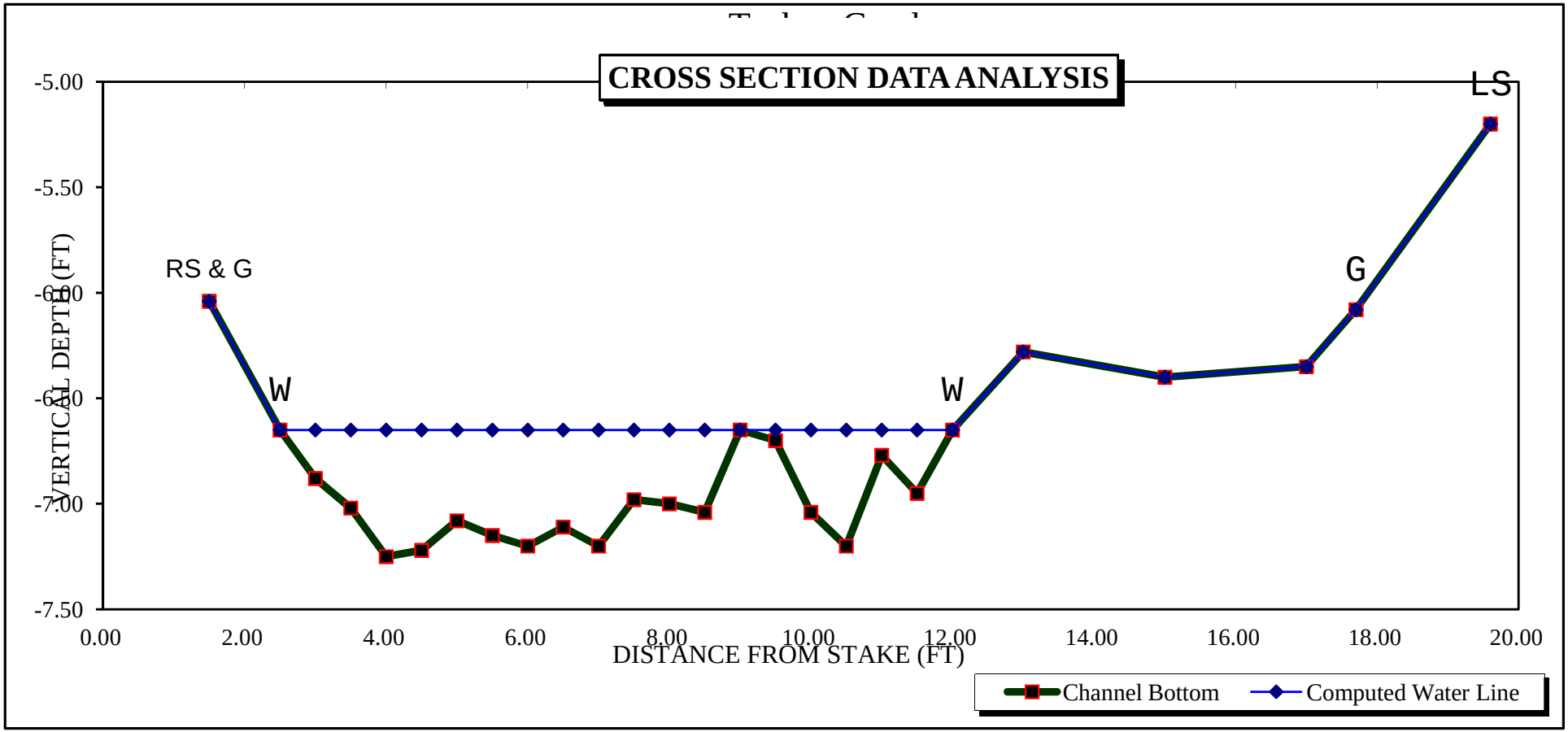
RECOMMENDATION BY: ……………………………………………… AGENCY…………………………………………… DATE:………………………

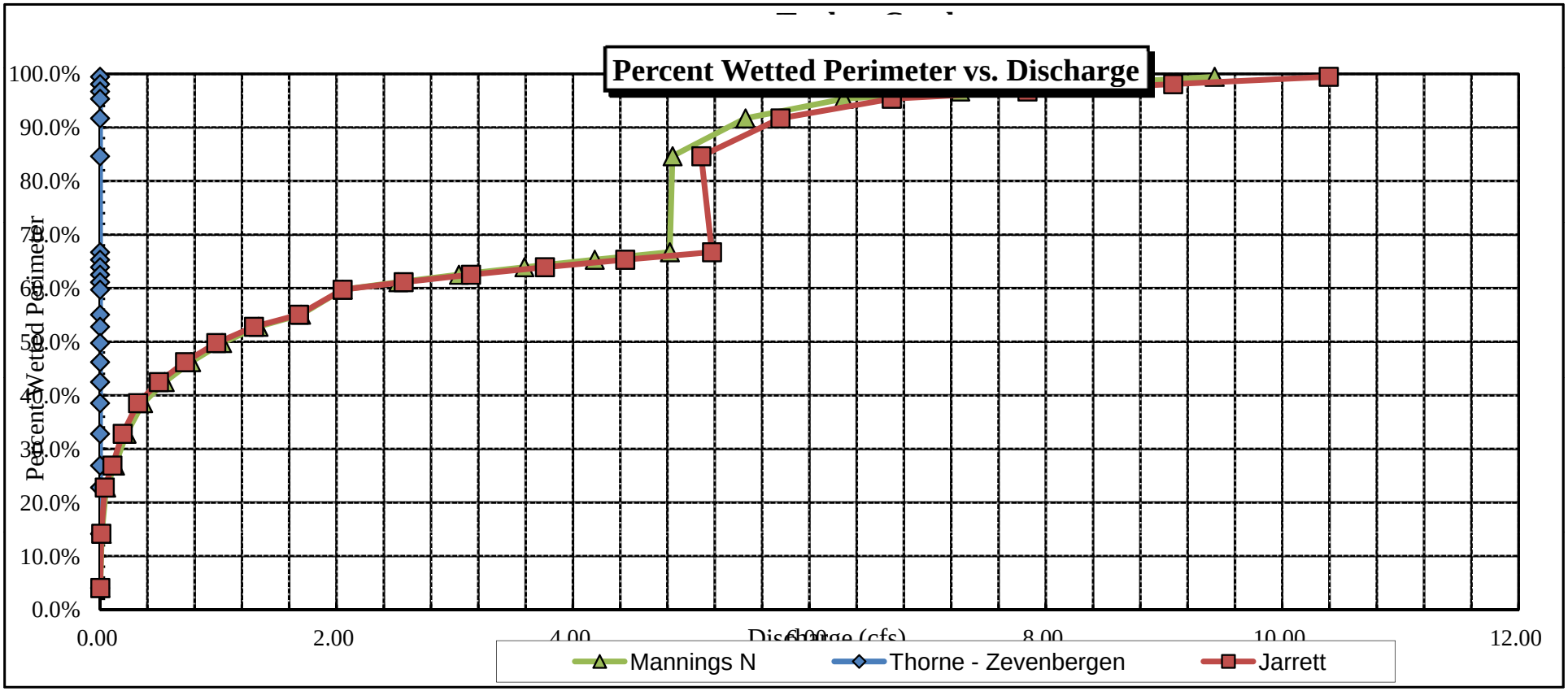
CWCB REVIEW BY: …………………………………………………………………………………………… DATE:………………………

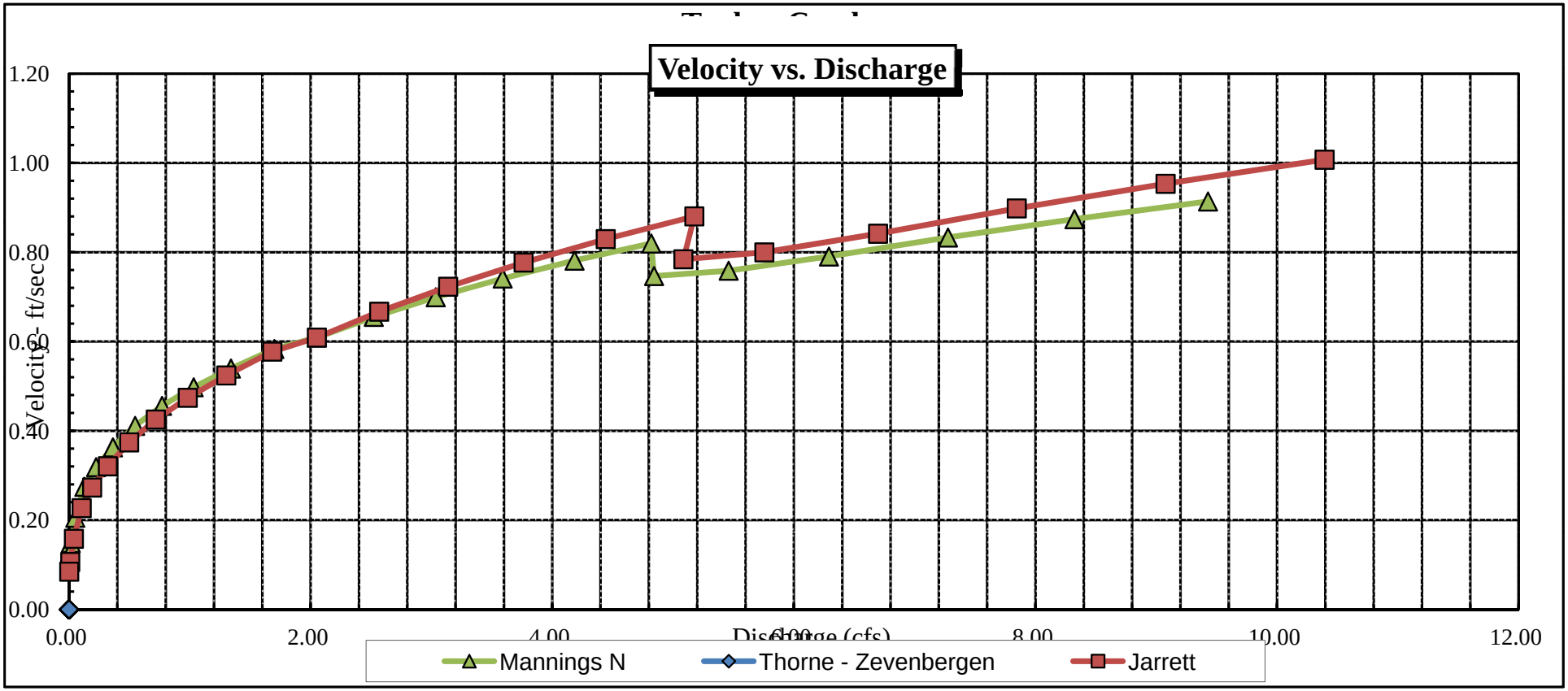
STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr conf with E Fk & W Fk
XS NUMBER: 0 Jarrett Variable Manning's n Correction Applied

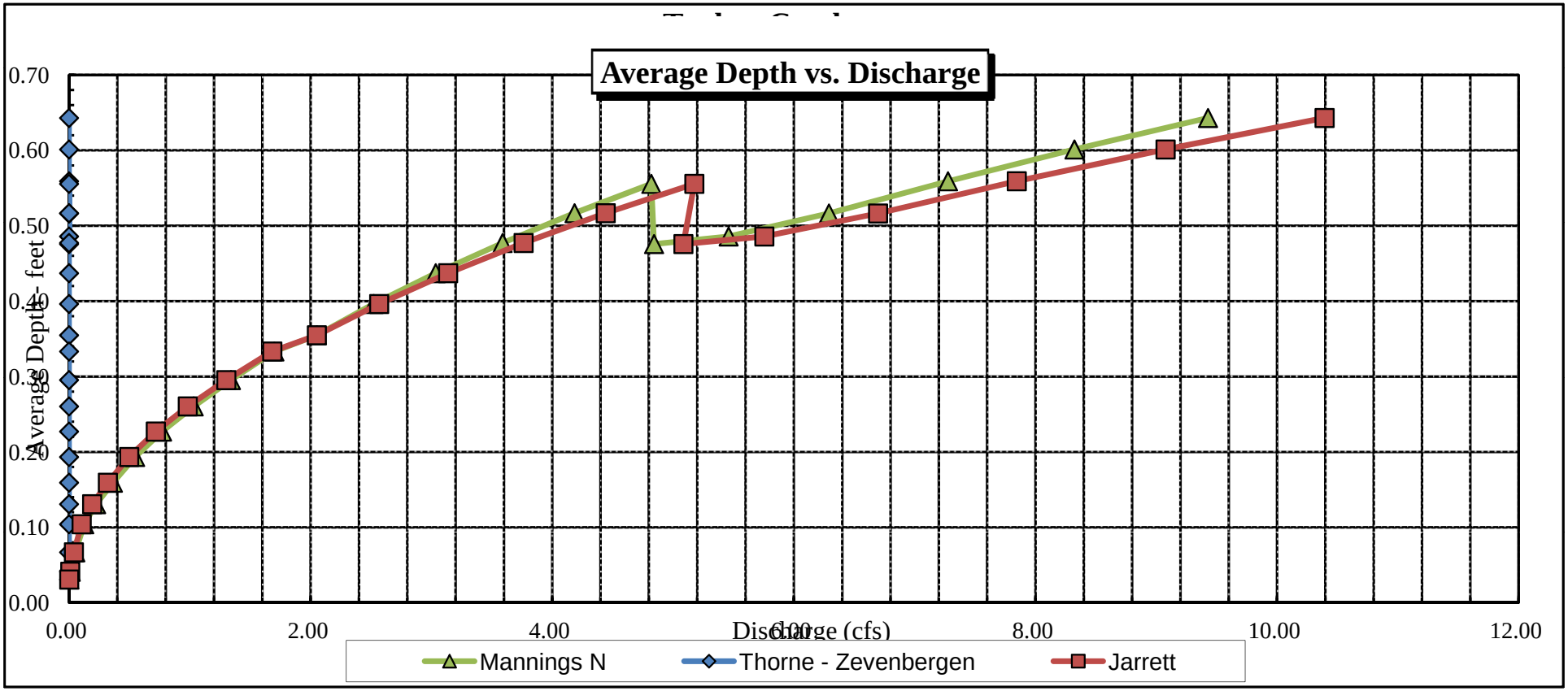
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

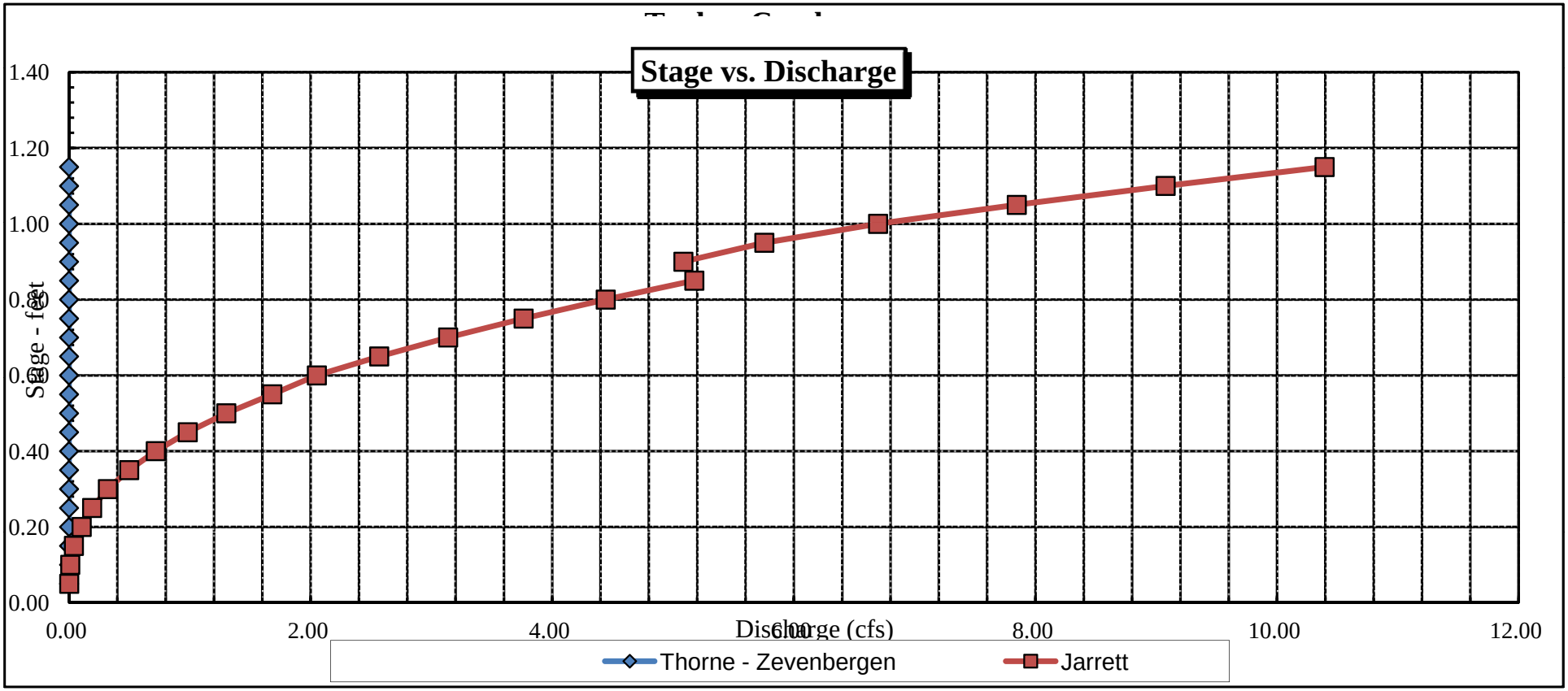
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.08	16.13	0.66	1.17	10.64	17.17	100.0%	0.62	10.94	1.03
	6.10	16.05	0.64	1.15	10.32	17.07	99.5%	0.60	10.39	1.01
	6.15	15.84	0.60	1.10	9.52	16.84	98.1%	0.57	9.08	0.95
	6.20	15.63	0.56	1.05	8.74	16.60	96.7%	0.53	7.84	0.90
	6.25	15.41	0.52	1.00	7.96	16.37	95.3%	0.49	6.70	0.84
	6.30	14.82	0.49	0.95	7.20	15.74	91.7%	0.46	5.76	0.80
	6.35	13.64	0.48	0.90	6.49	14.53	84.6%	0.45	5.09	0.78
	6.40	10.59	0.56	0.85	5.88	11.45	66.7%	0.51	5.18	0.88
	6.45	10.37	0.52	0.80	5.36	11.21	65.3%	0.48	4.44	0.83
	6.50	10.15	0.48	0.75	4.84	10.97	63.9%	0.44	3.76	0.78
	6.55	9.93	0.44	0.70	4.34	10.73	62.5%	0.40	3.14	0.72
	6.60	9.72	0.40	0.65	3.85	10.49	61.1%	0.37	2.57	0.67
WL	6.65	9.50	0.35	0.60	3.37	10.25	59.7%	0.33	2.05	0.61
	6.70	8.74	0.33	0.55	2.91	9.45	55.1%	0.31	1.68	0.58
	6.75	8.41	0.30	0.50	2.48	9.06	52.8%	0.27	1.30	0.52
	6.80	7.97	0.26	0.45	2.07	8.54	49.8%	0.24	0.98	0.47
	6.85	7.44	0.23	0.40	1.69	7.93	46.2%	0.21	0.72	0.43
	6.90	6.89	0.19	0.35	1.33	7.29	42.5%	0.18	0.50	0.37
	6.95	6.29	0.16	0.30	1.00	6.62	38.5%	0.15	0.32	0.32
	7.00	5.37	0.13	0.25	0.70	5.63	32.8%	0.12	0.19	0.27
	7.05	4.42	0.10	0.20	0.46	4.62	26.9%	0.10	0.10	0.23
	7.10	3.77	0.07	0.15	0.25	3.91	22.8%	0.06	0.04	0.16
	7.15	2.35	0.04	0.10	0.10	2.43	14.2%	0.04	0.01	0.11
	7.20	0.68	0.03	0.05	0.02	0.69	4.0%	0.03	0.00	0.08


CROSS SECTION DATA ANALYSIS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
VERTICAL DEPTH (FT)
RS & G
W
W
G
LS
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
2.00
4.00
8.00
10.00
12.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Velocity - ft/sec
0.00
2.00
4.00
8.00
10.00
12.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
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
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
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:	Turkey Creek
XS LOCATION:	800 ft. dwnst fr confl of E Fk & W Fk
XS NUMBER:	1
DATE:	27-May-14
OBSERVERS:	R. Smith, D. Gilbert
1/4 SEC:	SW
SECTION:	19
TWP:	16S
RANGE:	67W
PM:	Sixth
COUNTY:	El Paso
WATERSHED:	Arkansas
DIVISION:	2
DOW CODE:	33592
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:	0.022

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

ASSIGNED TO: ….....…….....DATE.....

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr confl of E Fk & W Fk
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	5.32			0.00		0.00	0.00	0.0%
1	G	1.50	6.28			0.00		0.00	0.00	0.0%
		2.60	7.00			0.00		0.00	0.00	0.0%
	W	3.90	7.45	0.00	0.00	0.00		0.00	0.00	0.0%
		4.80	7.65	0.20	0.00	0.92	0.20	0.16	0.00	0.0%
		5.50	7.72	0.27	1.81	0.70	0.27	0.16	0.29	13.9%
		6.00	7.72	0.27	1.45	0.50	0.27	0.14	0.20	9.3%
		6.50	7.79	0.34	0.85	0.50	0.34	0.17	0.14	6.8%
		7.00	7.80	0.35	1.07	0.50	0.35	0.18	0.19	8.9%
		7.50	7.93	0.48	1.17	0.52	0.48	0.24	0.28	13.3%
		8.00	8.00	0.55	0.11	0.50	0.55	0.28	0.03	1.4%
		8.50	7.86	0.41	0.21	0.52	0.41	0.21	0.04	2.0%
		9.00	7.90	0.45	1.31	0.50	0.45	0.23	0.29	13.9%
		9.50	7.83	0.38	0.86	0.50	0.38	0.19	0.16	7.7%
		10.00	7.83	0.38	0.83	0.50	0.38	0.19	0.16	7.5%
		10.50	7.83	0.38	1.34	0.50	0.38	0.19	0.25	12.0%
		11.00	7.60	0.15	0.77	0.55	0.15	0.08	0.06	2.7%
		11.50	7.74	0.29	0.06	0.52	0.29	0.17	0.01	0.5%
	W	12.20	7.45	0.00	0.00	0.76		0.00	0.00	0.0%
		13.00	7.11			0.00		0.00	0.00	0.0%
		13.50	6.90			0.00		0.00	0.00	0.0%
		14.00	6.70			0.00		0.00	0.00	0.0%
1	G	14.60	6.30			0.00		0.00	0.00	0.0%
	LS	16.00	5.62			0.00		0.00	0.00	0.0%
	TOTALS ----------					8.50	0.55 (Max.)	2.57	2.11	100.0%

Manning's n = 0.1204
Hydraulic Radius= 0.30170796

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr confl of E Fk & W Fk
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.57	2.57	0.0%
7.20	2.57	4.80	87.2%
7.22	2.57	4.61	79.8%
7.24	2.57	4.42	72.4%
7.26	2.57	4.24	65.1%
7.28	2.57	4.05	57.9%
7.30	2.57	3.87	50.8%
7.32	2.57	3.69	43.8%
7.34	2.57	3.51	36.8%
7.36	2.57	3.33	29.9%
7.38	2.57	3.16	23.1%
7.40	2.57	2.99	16.4%
7.41	2.57	2.90	13.1%
7.42	2.57	2.82	9.8%
7.43	2.57	2.73	6.5%
7.44	2.57	2.65	3.2%
7.45	2.57	2.57	0.0%
7.46	2.57	2.48	-3.2%
7.47	2.57	2.40	-6.4%
7.48	2.57	2.32	-9.6%
7.49	2.57	2.24	-12.7%
7.50	2.57	2.16	-15.8%
7.52	2.57	2.00	-22.0%
7.54	2.57	1.85	-28.0%
7.56	2.57	1.69	-34.0%
7.58	2.57	1.55	-39.8%
7.60	2.57	1.40	-45.5%
7.62	2.57	1.26	-51.0%
7.64	2.57	1.12	-56.4%
7.66	2.57	0.99	-61.6%
7.68	2.57	0.86	-66.5%
7.70	2.57	0.74	-71.1%

WATERLINE AT ZERO
AREA ERROR = 7.450

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr confl of E Fk & W Fk
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	6.30	13.07	1.16	1.70	15.19	13.83	100.0%	1.10	29.62	1.95
	6.45	12.62	1.05	1.55	13.27	13.29	96.1%	1.00	24.27	1.83
	6.50	12.46	1.01	1.50	12.64	13.10	94.8%	0.96	22.60	1.79
	6.55	12.31	0.98	1.45	12.02	12.92	93.4%	0.93	20.98	1.74
	6.60	12.16	0.94	1.40	11.41	12.74	92.1%	0.90	19.41	1.70
	6.65	12.01	0.90	1.35	10.81	12.56	90.8%	0.86	17.90	1.66
	6.70	11.86	0.86	1.30	10.21	12.38	89.5%	0.82	16.44	1.61
	6.75	11.66	0.83	1.25	9.62	12.15	87.9%	0.79	15.08	1.57
	6.80	11.46	0.79	1.20	9.04	11.93	86.2%	0.76	13.77	1.52
	6.85	11.25	0.75	1.15	8.48	11.70	84.6%	0.72	12.52	1.48
	6.90	11.05	0.72	1.10	7.92	11.47	83.0%	0.69	11.32	1.43
	6.95	10.86	0.68	1.05	7.37	11.25	81.4%	0.65	10.18	1.38
	7.00	10.66	0.64	1.00	6.83	11.03	79.8%	0.62	9.09	1.33
	7.05	10.40	0.61	0.95	6.31	10.75	77.7%	0.59	8.09	1.28
	7.10	10.13	0.57	0.90	5.79	10.47	75.7%	0.55	7.15	1.23
	7.15	9.87	0.54	0.85	5.29	10.19	73.7%	0.52	6.26	1.18
	7.20	9.61	0.50	0.80	4.80	9.91	71.6%	0.48	5.43	1.13
	7.25	9.35	0.46	0.75	4.33	9.63	69.6%	0.45	4.66	1.07
	7.30	9.09	0.43	0.70	3.87	9.35	67.6%	0.41	3.94	1.02
	7.35	8.82	0.39	0.65	3.42	9.07	65.6%	0.38	3.27	0.96
	7.40	8.56	0.35	0.60	2.99	8.79	63.5%	0.34	2.66	0.89
WL	7.45	8.30	0.31	0.55	2.57	8.50	61.5%	0.30	2.11	0.82
	7.50	7.95	0.27	0.50	2.16	8.14	58.9%	0.27	1.63	0.76
	7.55	7.61	0.23	0.45	1.77	7.78	56.3%	0.23	1.21	0.68
	7.60	7.26	0.19	0.40	1.40	7.42	53.7%	0.19	0.84	0.60
	7.65	6.63	0.16	0.35	1.05	6.76	48.8%	0.16	0.56	0.53
	7.70	5.72	0.13	0.30	0.74	5.82	42.1%	0.13	0.34	0.46
	7.75	4.46	0.11	0.25	0.49	4.53	32.7%	0.11	0.21	0.42
	7.80	3.57	0.08	0.20	0.28	3.62	26.2%	0.08	0.10	0.34
	7.85	2.16	0.06	0.15	0.13	2.20	15.9%	0.06	0.04	0.28
	7.90	0.97	0.05	0.10	0.05	0.99	7.2%	0.05	0.01	0.26
	7.95	0.54	0.03	0.05	0.01	0.55	3.9%	0.02	0.00	0.15
	8.00	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr confl of E Fk & W Fk
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.11	cfs
CALCULATED FLOW (Qc)=	2.11	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	7.45	ft
CALCULATED WATERLINE (WLc)=	7.45	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.82	ft/sec
MANNING'S N=	0.120	
SLOPE=	0.022	ft/ft
.4 * Qm =	0.8	cfs
2.5 * Qm=	5.3	cfs

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

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

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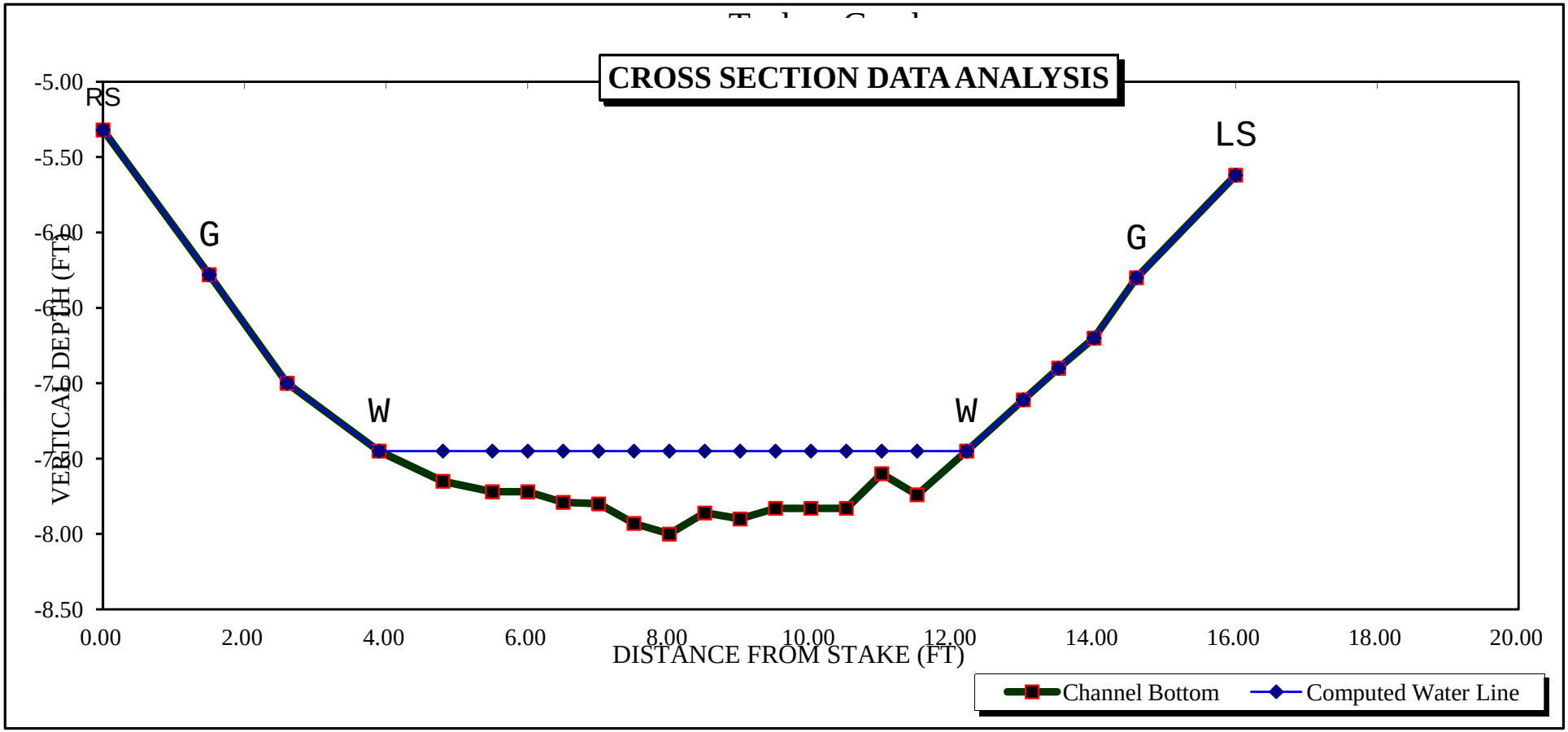
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......…....…...…….…...... DATE:......…...….......……………

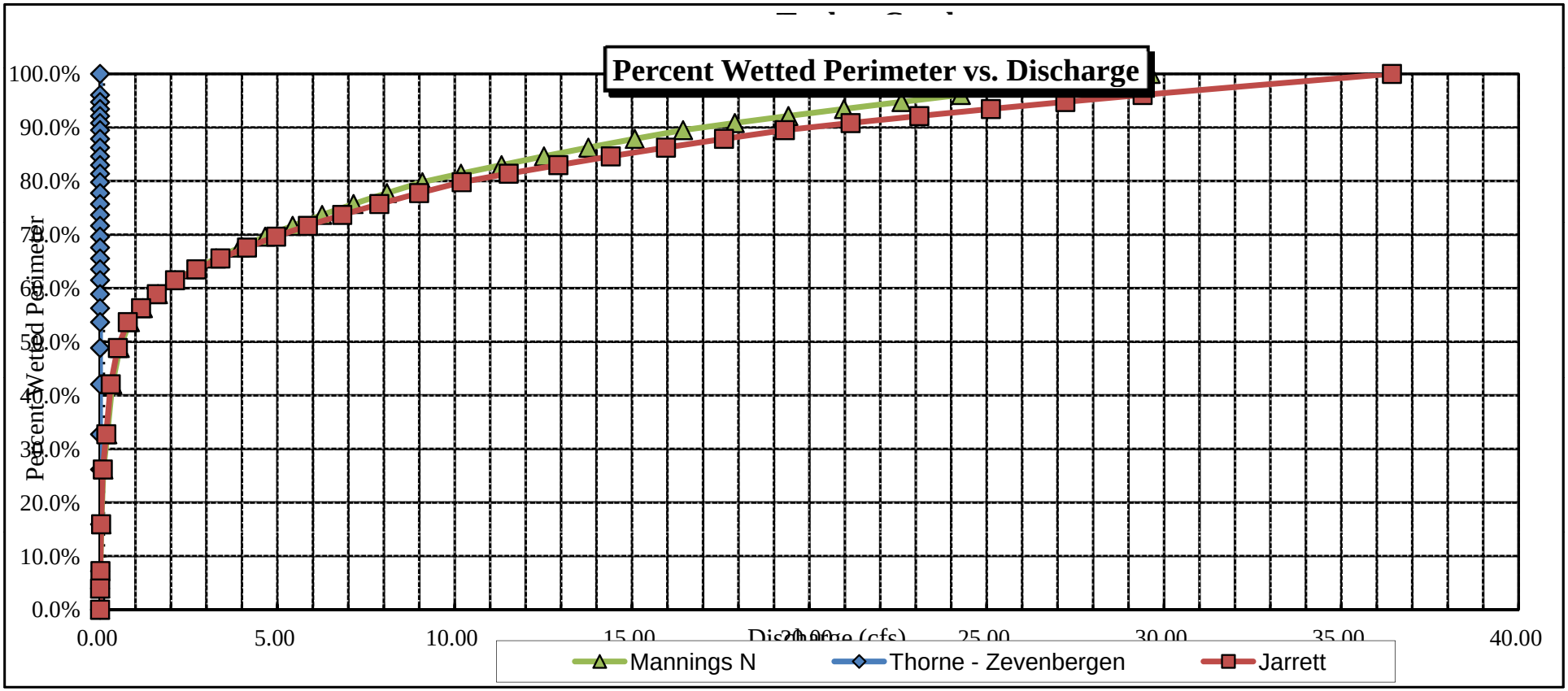
CWCB REVIEW BY: ..…………………………....………………………………………………...…............. DATE:.................…………….....

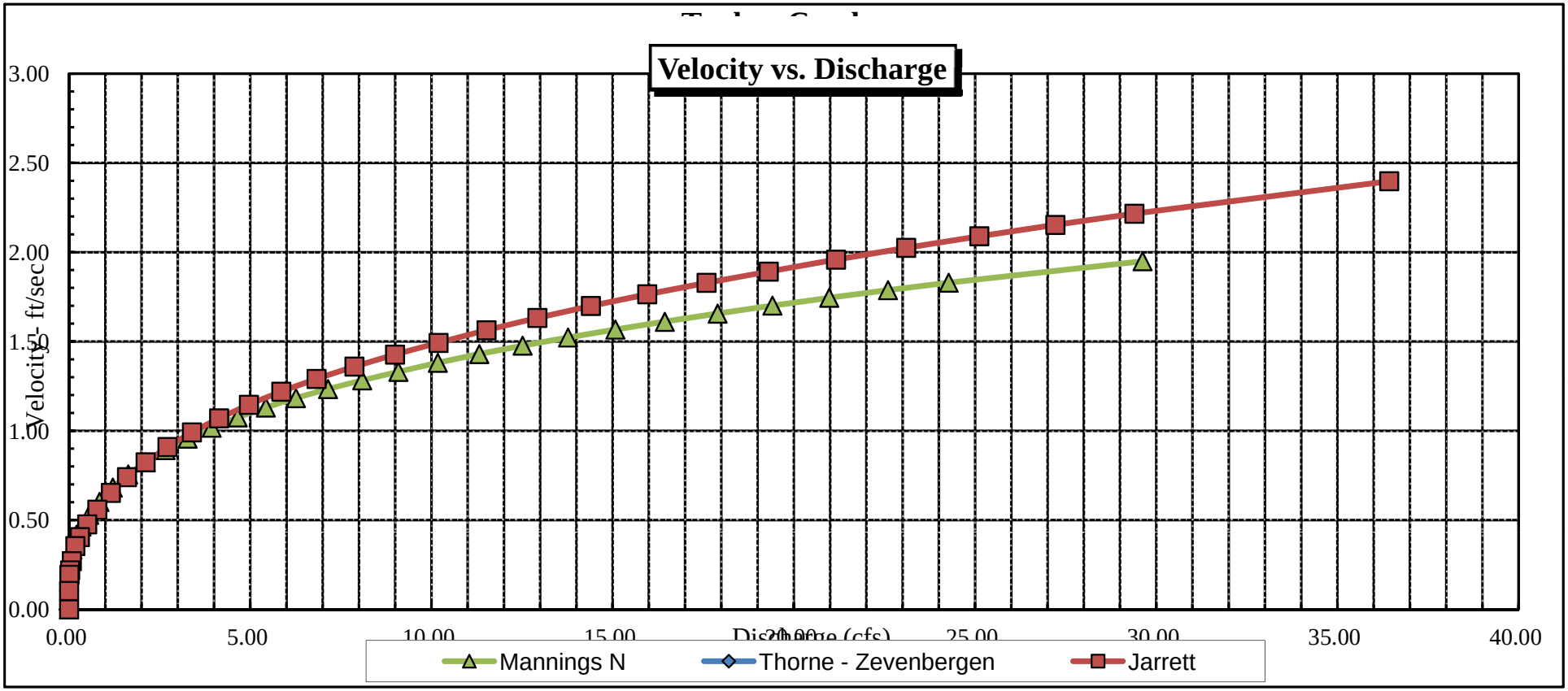
STREAM NAME: Turkey Creek
XS LOCATION: 800 ft. dwnst fr confl of E Fk & W Fk
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

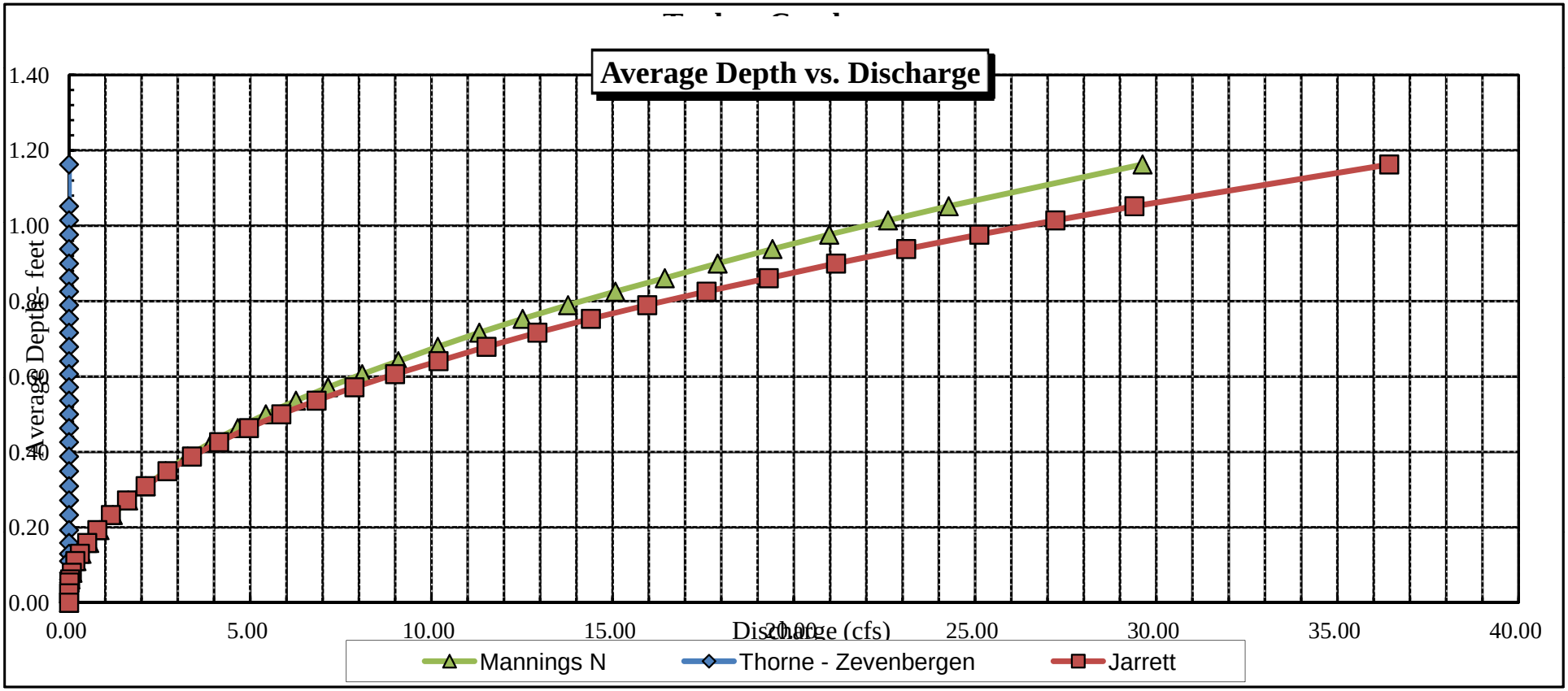
STAGING TABLE
GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

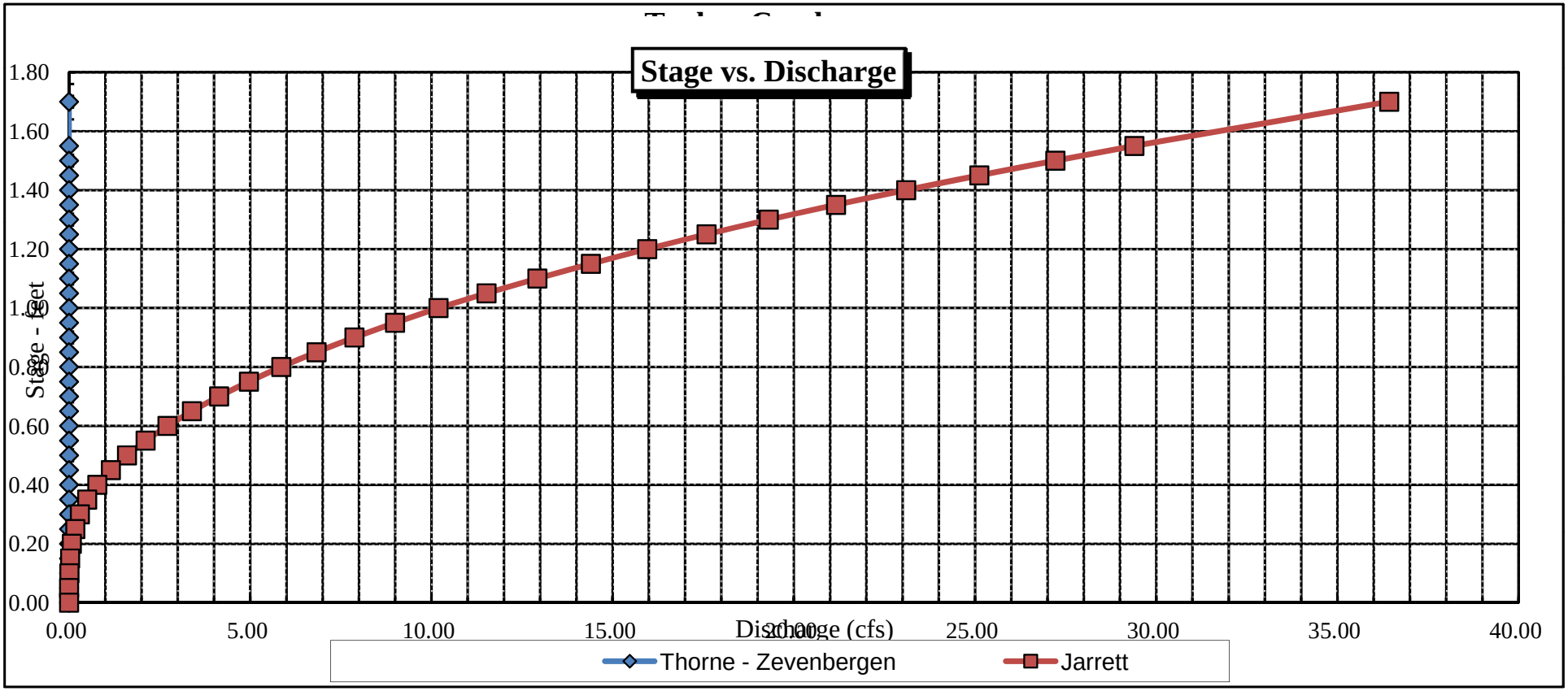
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.30	13.07	1.16	1.70	15.19	13.83	100.0%	1.10	36.43	2.40
	6.45	12.62	1.05	1.55	13.27	13.29	96.1%	1.00	29.40	2.22
	6.50	12.46	1.01	1.50	12.64	13.10	94.8%	0.96	27.22	2.15
	6.55	12.31	0.98	1.45	12.02	12.92	93.4%	0.93	25.12	2.09
	6.60	12.16	0.94	1.40	11.41	12.74	92.1%	0.90	23.10	2.02
	6.65	12.01	0.90	1.35	10.81	12.56	90.8%	0.86	21.16	1.96
	6.70	11.86	0.86	1.30	10.21	12.38	89.5%	0.82	19.31	1.89
	6.75	11.66	0.83	1.25	9.62	12.15	87.9%	0.79	17.59	1.83
	6.80	11.46	0.79	1.20	9.04	11.93	86.2%	0.76	15.96	1.76
	6.85	11.25	0.75	1.15	8.48	11.70	84.6%	0.72	14.40	1.70
	6.90	11.05	0.72	1.10	7.92	11.47	83.0%	0.69	12.92	1.63
	6.95	10.86	0.68	1.05	7.37	11.25	81.4%	0.65	11.52	1.56
	7.00	10.66	0.64	1.00	6.83	11.03	79.8%	0.62	10.20	1.49
	7.05	10.40	0.61	0.95	6.31	10.75	77.7%	0.59	9.00	1.43
	7.10	10.13	0.57	0.90	5.79	10.47	75.7%	0.55	7.87	1.36
	7.15	9.87	0.54	0.85	5.29	10.19	73.7%	0.52	6.83	1.29
	7.20	9.61	0.50	0.80	4.80	9.91	71.6%	0.48	5.86	1.22
	7.25	9.35	0.46	0.75	4.33	9.63	69.6%	0.45	4.96	1.15
	7.30	9.09	0.43	0.70	3.87	9.35	67.6%	0.41	4.14	1.07
	7.35	8.82	0.39	0.65	3.42	9.07	65.6%	0.38	3.39	0.99
	7.40	8.56	0.35	0.60	2.99	8.79	63.5%	0.34	2.72	0.91
WL	7.45	8.30	0.31	0.55	2.57	8.50	61.5%	0.30	2.11	0.82
	7.50	7.95	0.27	0.50	2.16	8.14	58.9%	0.27	1.60	0.74
	7.55	7.61	0.23	0.45	1.77	7.78	56.3%	0.23	1.15	0.65
	7.60	7.26	0.19	0.40	1.40	7.42	53.7%	0.19	0.78	0.56
	7.65	6.63	0.16	0.35	1.05	6.76	48.8%	0.16	0.50	0.48
	7.70	5.72	0.13	0.30	0.74	5.82	42.1%	0.13	0.30	0.40
	7.75	4.46	0.11	0.25	0.49	4.53	32.7%	0.11	0.17	0.35
	7.80	3.57	0.08	0.20	0.28	3.62	26.2%	0.08	0.08	0.27
	7.85	2.16	0.06	0.15	0.13	2.20	15.9%	0.06	0.03	0.22
	7.90	0.97	0.05	0.10	0.05	0.99	7.2%	0.05	0.01	0.19
	7.95	0.54	0.03	0.05	0.01	0.55	3.9%	0.02	0.00	0.10
	8.00	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


CROSS SECTION DATA ANALYSIS
RS
G
W
W
G
LS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
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)
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
35.00
40.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
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
35.00
40.00
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
Discharge (cfs)
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
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: Turkey Creek					CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: 800 ft. downstream from confluence of East Fork + West Fork						
DATE: 5-27-14	OBSERVERS: R. Smith, D Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 19	TOWNSHIP: 16 N/S	RANGE: 67 E/W	PM: Sixth	
COUNTY: El Paso	WATERSHED: Arkansas R.	WATER DIVISION: 2	DOW WATER CODE: 33592			
MAP(S): USGS:						
USFS:						

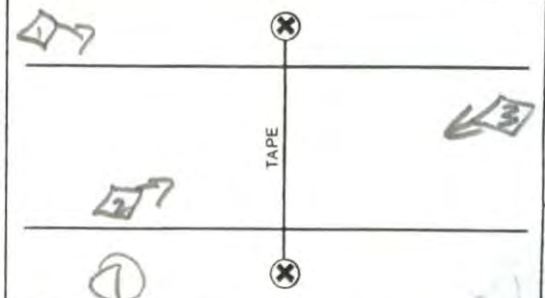
SUPPLEMENTAL DATA

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: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: sand to 2-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	6.65 / 6.65
② WS Upstream	5.0	6.34
③ WS Downstream	70.5	8.03
SLOPE	1.69 / 75.5 = 0.022	

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

pH = 7.6
Cond = 122
Temp = 13°C
Salinity = 0.1

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Turkey Creek | CROSS-SECTION NO.: | DATE: 5-22-14 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 2:50 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)
G+LS	1.5		6.04								
W	2.5		6.65	0							
	3.0		6.88	.23			→	0.0			
	3.5		7.02	.37				0.0			
	4.0		7.25	.60				0.58			
	4.5		7.22	.57				1.13			
	5.0		7.08	.43				1.41			
	5.5		7.15	.50				1.26			
	6.0		7.20	.55				0.80			
	6.5		7.11	.46				0.58			
	7.0		7.20	.55				0.24			
	7.5		6.98	.33				0.0			
	8.0		7.00	.35				0.14			
	8.5		7.04	.39				0.37			
	9.0		6.65	0				0.0			
	9.5		6.70	.05				0.69			
	10.0		7.04	.39				0.81			
	10.5		7.20	.55				0.57			
	11.0		6.77	.12				0.39			
	11.5		6.95	.30				0.44			
W	12.0		6.65	0							
	13.0		6.28								
	15.0		6.40								
	17.0		6.35								
G	17.7		6.00								
LS	19.6		5.20								
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: Turkey Creek					CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: 800 ft. downstream from confluence of East Fk + West. Fk						
DATE: 5-27-14	OBSERVERS: R. Smith, D. Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 19	TOWNSHIP: 16 N/S	RANGE: 67 E/W	PM: Sixth	
COUNTY: El Paso	WATERSHED: Arkansas	WATER DIVISION: 2	DOW WATER CODE: 33592			
MAP(S): USGS:	GPS Zone 13 505818					
USFS:	4277032					

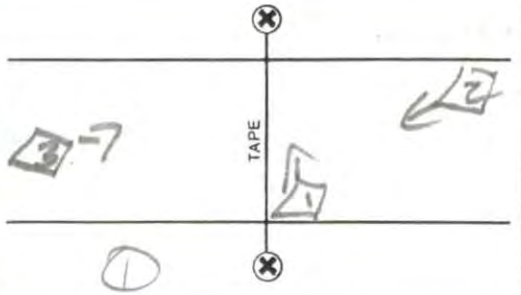
SUPPLEMENTAL DATA

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: sand to 2-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	7.45/7.45
② WS Upstream	40.0'	6.34
③ WS Downstream	35.5'	8.03
SLOPE	1.69 / 75.5' = 0.022	

SKETCH



AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly, damselfly

COMMENTS

Significant

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Turkey Creek	CROSS-SECTION NO.: 1	DATE: 5-27-14	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 2:05 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)
RS	0.0		5.32								
G	1.5		6.28								
	2.6		7.00								
W	3.9		7.45	0				0			
	4.8		7.65	.20				0			
	5.5		7.72	.27				1.81			
	6.0		7.72	.27				1.45			
	6.5		7.79	.34				0.85			
	7.0		7.80	.35				1.07			
	7.5		7.93	.48				1.17			
	8.0		8.00	.55				0.11			
	8.5		7.86	.41				0.21			
	9.0		7.90	.45				1.31			
	9.5		7.83	.38				0.86			
	10.0		7.83	.38				0.83			
	10.5		7.83	.38				1.34			
	11.0		7.60	.15				0.77			
	11.5		7.74	.29				0.06			
W	12.2		7.45	0				0			
	13.0		7.11								
	13.5		6.90								
	14.0		6.70								
G	14.6		6.30								
LS	16.0		5.62								
TOTALS:											

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