



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210
www.co.blm.gov



In Reply Refer To:
7250 (CO-930)

DEC 22 2014

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 Terror Creek, located in Water Division 4.

Location and Land Status. Terror Creek originates approximately nine miles north of Paonia on the south slopes of the Grand Mesa. The creek flows into the North Fork of the Gunnison River near Paonia. This recommendation covers two stream reaches on Terror Creek. The first reach starts at the confluence of the East Fork and West Fork and extends downstream to the headgate of the Terror Creek Ditch. This stream reach covers a distance of approximately 1.5 miles. The BLM manages all of the lands along this stream reach. The second reach starts at the headgate of the Terror Creek Ditch and extends to the headgate of the Fire Mountain Canal. This stream reach covers a distance of approximately 1.5 miles. The BLM manages approximately 95 percent of this stream reach, while the remainder is within private ownership.

Biological Summary. Terror Creek is a cold-water, high gradient stream. It flows through a narrow canyon with a floor approximately one-eighth mile in width. The stream is generally constrained by bedrock, especially in locations where the streams comes close to the canyon walls. The stream generally has large-sized substrate, ranging from four-inch cobbles to boulders up to two feet in diameter. The stream has a high percentage of pool habitat, but sufficient riffle and side channel habitat exists to support salmonid fish reproduction. Fisheries surveys have revealed self-sustaining populations of speckled dace and native cutthroat trout. The BLM plans to collect fin samples from the cutthroat trout population to determine the genetic quality of the population.

The riparian community in this part of Terror Creek is generally comprised of willow species, alder, blue spruce, narrowleaf cottonwood. In general, the riparian community is in very good condition, provides adequate shading and cover for fish habitat, and provides stream stability during flood events.

R2Cross Analysis. The BLM collected the following R2Cross data from Terror 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)
09/27/2007 #1	6.13 cfs	28.3 feet	4.68 cfs	5.15 cfs
09/27/2007 #2	5.73 cfs	29.8 feet	4.08 cfs	Out of range
10/21/2008 #1	2.15 cfs	22.0 feet	3.76 cfs	4.46
10/21/2008 #2	1.82 cfs	22.8 feet	3.21 cfs	Out of range
Averages:			3.93 cfs	4.80 cfs

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

First Reach – Confluence of East Fork and West Fork Terror Creek to Headgate of Terror Creek Ditch

4.8 cubic feet per second is recommended for the snowmelt runoff and summer period from April 1 through September 30. This recommendation is driven by the wetted perimeter and velocity criteria. Wetting at least 50 percent of the channel will provide important physical habitat during a time of year when the fish population is completing key life cycle functions.

1.5 cubic feet per second is recommended during the fall and winter period between October 1 and March 31. This recommendation is driven by limited water availability during the fall and winter. This flow rate generally provides between 0.15 and 0.20 feet depth, 40 to 50 percent wetted perimeter, and an average 0.9 feet per second velocity. This flow rate should prevent icing in pools and allow fish to successfully overwinter.

Second Reach – Terror Creek Ditch headgate to Fire Mountain Canal headgate

4.2 cubic feet per second is recommended for the snowmelt runoff period from April 1 through May 31. This recommendation is driven by limited water availability, but comes close to meeting the wetted perimeter and velocity criteria. Wetting at least 50 percent of the channel will provide important physical habitat during a time of year when the fish population moves into this reach and completes key life cycle functions. This flow rate will also assist in recharging stream-side aquifers. Storage in and discharge from these aquifers will assist in maintaining the riparian community during the June to March 31 period, when flows are very low because of diversions.

The BLM does not wish to make an instream flow recommendation for the period between June 1 and March 31. Because of diversions from senior water rights, there is insufficient water available in this reach to meet any of the instream flow criteria.

If flows do become available because of changes in management of diversions, the BLM recommends that the Colorado Water Conservation Board (CWCB) reconsider this stream for an appropriation during the June 1 to March 31 period.

Water Availability. The BLM recommends relying upon multiple data sources to confirm water availability. The first information source is diversion records from the Terror Ditch and Fawcett Ditch. Not only do these ditches have continuous diversion records from 1970 to the present, Terror Ditch also has some diversion records for winter months. The second information sources are the U.S. Geological Survey (USGS) gage stations. USGS Gage Station 09132985 (East Fork Terror Creek below Cottonwood Stomp near Bowie, CO) has records from 2001 to the present. The value of this gage data is limited by lack of data during the winter because of icing issues, and by the fact that it measures only a portion of the watershed that contributes to flows in the subject reach. However, this gage data could possibly be combined with data from a gage operated by Bowie Resources on West Fork Terror Creek. Finally, the USGS Gage 09132995 (Terror Creek at Mouth Near Bowie, CO) provides data from 2001 to the present. This gage is heavily affected by the operation of Fawcett Ditch, Terror Ditch, and the Fire Mountain Canal. However, it can generally be used to confirm the magnitude of snowmelt runoff flows, and the fact that the entire creek experiences flows during winter, even though Terror Ditch diverts during the winter season.

The BLM is aware of the following decreed water rights for surface diversion within the proposed instream flow reach:

Terror Ditch – 13.5 cfs
 Fawcett Ditch – 1.49 cfs
 Holybee Ditch – 0.4 cfs

Upstream from the proposed reach, the Overland Ditch, owned by Overland Ditch and Reservoir Company, diverts from multiple small tributaries in the headwaters of the Terror Creek watershed. The water rights for the ditch allow the company to divert up to a total of 75 cfs from the Hubbard, Terror, Roadmap, Lower Cow Creek, and Leroux Creek drainages.

The BLM is also aware of 85 cfs of undeveloped conditional water rights in upstream locations associated with the Grand Mesa Canal. These rights appear to be owned by the Grand Mesa Water Conservancy District and North Fork Water Conservancy District.

Relationship to Land Management Plans. The BLM land use plan for this area calls for actions to maintain and enhance riparian and fisheries habitat. In general, any proposed new land use, such as right-of-way corridors or mineral development, must be implemented with no surface occupancy to avoid impacts to the creek. Any proposed land uses along this creek are also carefully reviewed and mitigated to prevent impacts to native cutthroat trout, which appear on the BLM's sensitive species list. Establishing an instream flow water right would assist in meeting these objectives.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with the BLM's draft recommendation in February 2014.

We thank both CPW and the CWCB 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,

Acting



Brian St. George
Deputy State Director
Resources and Fire Management

cc: Jedd Sondergard, Uncompahgre FO
Barbara Sharrow, Uncompahgre FO
Lori Armstrong, Southwest District Office

Uncompahgre Field Office Stream Surveys

August 2007

Terror Creek - Water Code #43593

Terror Creek, located northeast of Paonia, Colorado on BLM lands managed by the Uncompahgre Field Office was sampled on August 22, 2007. Terror Creek is tributary to North Fork Gunnison River. Presence/absence sampling was done in support of the Colorado BLM in-stream flow program. Sampling was conducted via backpack electro-shocker and approximately 150 feet of stream was sampled. Personnel present were Tom Fresques, Dennis Murphy, and Malia Boyum.

Fish weights and lengths cannot be reported because data sheets were misplaced after the initial effort to identify fish species and fish numbers were completed.



Fish



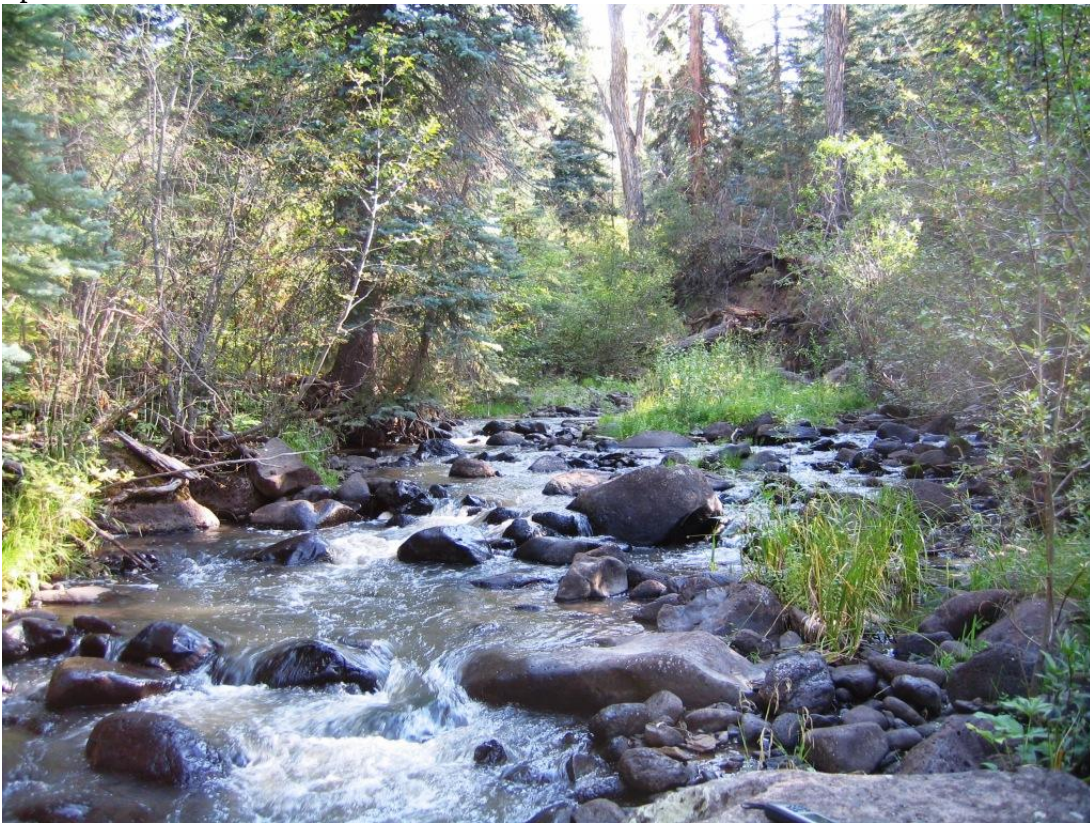
Colorado River cutthroat trout - adult



Colorado River cutthroat trout – juvenile



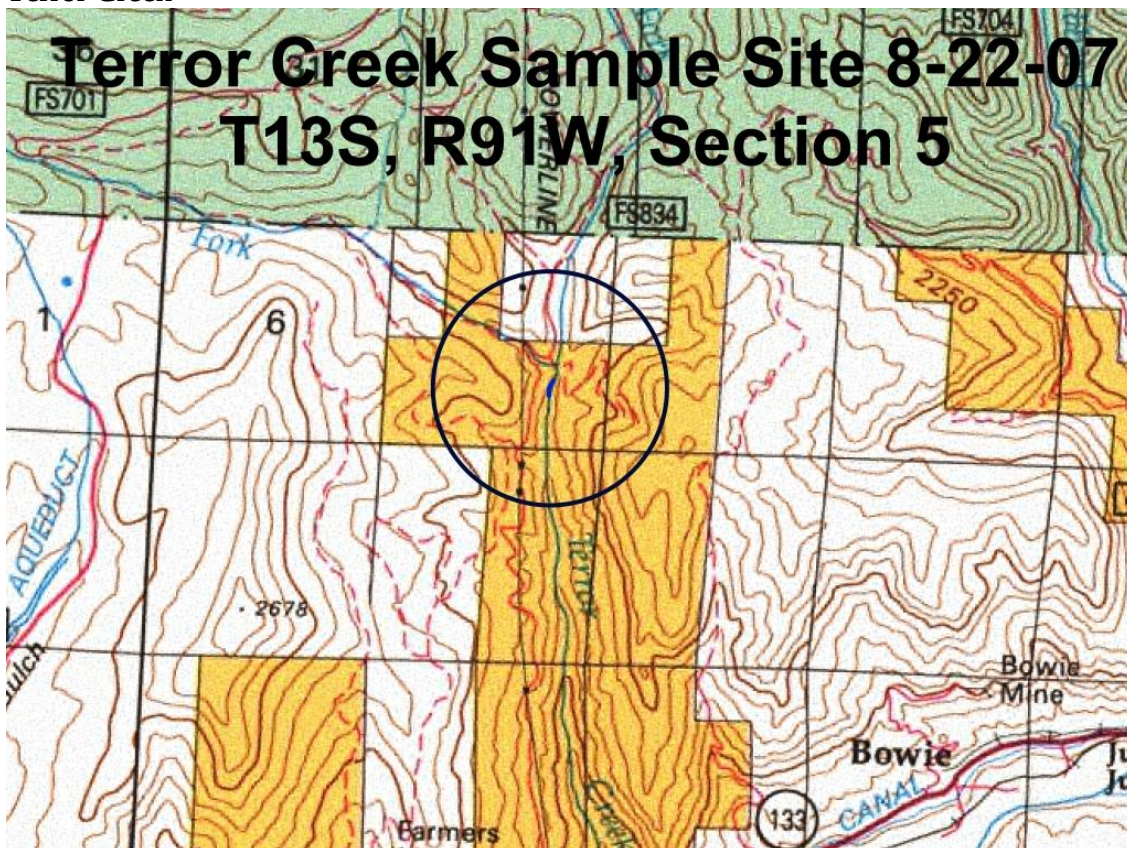
Speckled Dace



Terror Creek



Terror Creek



Map of Sample Site

STREAM SURVEY FISH SAMPLING FORM

WATER_ Terror Creek _____ H2O CODE_ 43593 _DATE_ 8-22-07

GEAR_ Backpack Electroshocker EFFORT_ 150 ft. _____ STATION #_ 1 _ PASS 1

CREW Fresques, Murphy, Boyum DRAINAGE N. F. Gunnison River LOCATION
Just below confluence of West and East Fork Terror Creek

Pass	species	length	weight		species	length	weight	Pass
1	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	CRCT							
	SPD							
	SPD							
	SPD							
	SPD							

GPS Location:

Notes: Stream Width_ 18-22 _ft. Sample Reach_ 150 _ft.

Conductivity:

Electroshocker settings

Notes: Stream was running approximately 5-7 cfs. Riparian habitat looked vigorous and good pools were present. Water was slightly off color. Good aquatic insect assemblage with stone, caddis, and mayflies noted. These cutthroat are likely pure given the pure population residing upstream in W. Fork Terror Creek. Fish appeared healthy. May want to collect fin clips from the mainstem of Terror Creek to determine genetic status and identify cutthroat upper and lower distribution limits. An instream flow recommendation on this creek would be valuable in maintaining this fishery.

*Note: Fish lengths and weights were taken but data sheets were misplaced.

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

LOCATION INFORMATION

STREAM NAME: Terror Creek
XS LOCATION: 450' downstream from W. Fk.
XS NUMBER: 2

DATE: 21-Oct-08
OBSERVERS: R. Smith, D. Murphy

1/4 SEC: SE
SECTION: 5
TWP: 13S
RANGE: 91W
PM: Sixth

COUNTY: Delta
WATERSHED: N. Fk. Gunnison
DIVISION: 4
DOW CODE: 43593

USGS MAP: Bowie 7.5'
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: 0.01

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Terror Creek
 XS LOCATION: 450' downstream from W. Fk.
 XS NUMBER: 2

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 RS & G	5.60	4.26		
W	6.20	5.49		
	6.50	5.55	0.05	0.00
	7.00	5.55	0.05	0.00
	8.00	5.55	0.05	0.00
	8.50	5.65	0.15	0.11
	8.75	5.80	0.30	1.21
	9.00	5.80	0.35	2.63
	9.25	5.65	0.15	2.56
	9.50	5.65	0.15	2.44
	10.00	5.65	0.15	2.29
	10.25	5.70	0.20	2.26
	10.50	5.70	0.20	2.50
	10.75	5.70	0.20	2.17
	11.00	5.70	0.20	2.03
	11.25	5.75	0.25	1.94
	11.50	5.55	0.05	0.00
	11.75	5.70	0.20	1.80
	12.00	5.70	0.20	1.56
	12.50	5.85	0.35	1.37
	13.00	5.80	0.30	0.67
	13.50	5.80	0.30	0.07
	14.00	5.75	0.25	0.02
	14.50	5.55	0.05	0.00
W	14.80	5.50		
1 LS & G	28.70	4.23		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.31	0.05	0.02	0.00	0.0%
0.50	0.05	0.04	0.00	0.0%
1.00	0.05	0.04	0.00	0.0%
0.51	0.15	0.06	0.01	0.3%
0.29	0.30	0.08	0.09	5.0%
0.25	0.35	0.09	0.23	12.7%
0.29	0.15	0.04	0.10	5.3%
0.25	0.15	0.06	0.14	7.5%
0.50	0.15	0.06	0.13	7.1%
0.25	0.20	0.05	0.11	6.2%
0.25	0.20	0.05	0.13	6.9%
0.25	0.20	0.05	0.11	6.0%
0.25	0.20	0.05	0.10	5.6%
0.25	0.25	0.06	0.12	6.7%
0.32	0.05	0.01	0.00	0.0%
0.29	0.20	0.05	0.09	4.9%
0.25	0.20	0.08	0.12	6.4%
0.52	0.35	0.18	0.24	13.2%
0.50	0.30	0.15	0.10	5.5%
0.50	0.30	0.15	0.01	0.6%
0.50	0.25	0.13	0.00	0.1%
0.54	0.05	0.02	0.00	0.0%
0.30		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

8.89 0.35 1.48 1.82 100.0%
 (Max.)

Manning's n = 0.0367
 Hydraulic Radius= 0.16689723

STREAM NAME: Terror Creek
 XS LOCATION: 450' downstream from W. Fk.
 XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.48	1.51	2.0%
5.25	1.48	4.03	171.8%
5.27	1.48	3.81	156.5%
5.29	1.48	3.58	141.4%
5.31	1.48	3.36	126.7%
5.33	1.48	3.15	112.2%
5.35	1.48	2.94	98.1%
5.37	1.48	2.73	84.3%
5.39	1.48	2.53	70.8%
5.41	1.48	2.34	57.6%
5.43	1.48	2.15	44.7%
5.45	1.48	1.96	32.1%
5.46	1.48	1.87	25.9%
5.47	1.48	1.78	19.8%
5.48	1.48	1.69	13.8%
5.49	1.48	1.60	7.8%
5.50	1.48	1.51	2.0%
5.51	1.48	1.43	-3.8%
5.52	1.48	1.34	-9.5%
5.53	1.48	1.26	-15.1%
5.54	1.48	1.18	-20.6%
5.55	1.48	1.10	-26.1%
5.57	1.48	0.96	-35.3%
5.59	1.48	0.84	-43.7%
5.61	1.48	0.71	-51.8%
5.63	1.48	0.60	-59.7%
5.65	1.48	0.49	-67.3%
5.67	1.48	0.39	-73.8%
5.69	1.48	0.30	-79.6%
5.71	1.48	0.23	-84.8%
5.73	1.48	0.17	-88.6%
5.75	1.48	0.12	-91.9%

WATERLINE AT ZERO

AREA ERROR = 5.498

STREAM NAME: Terror Creek
 XS LOCATION: 450' downstream from W. Fk.
 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	4.26	22.77	0.92	1.59	20.92	23.89	100.0%	0.88	77.42	3.70
	4.50	20.05	0.79	1.35	15.81	21.00	87.9%	0.75	52.92	3.35
	4.55	19.47	0.76	1.30	14.83	20.40	85.4%	0.73	48.46	3.27
	4.60	18.90	0.73	1.25	13.87	19.79	82.9%	0.70	44.23	3.19
	4.65	18.33	0.71	1.20	12.93	19.19	80.3%	0.67	40.21	3.11
	4.70	17.76	0.68	1.15	12.03	18.58	77.8%	0.65	36.42	3.03
	4.75	17.19	0.65	1.10	11.16	17.98	75.3%	0.62	32.84	2.94
	4.80	16.62	0.62	1.05	10.31	17.37	72.7%	0.59	29.46	2.86
	4.85	16.04	0.59	1.00	9.50	16.77	70.2%	0.57	26.29	2.77
	4.90	15.47	0.56	0.95	8.71	16.16	67.7%	0.54	23.32	2.68
	4.95	14.90	0.53	0.90	7.95	15.55	65.1%	0.51	20.55	2.58
	5.00	14.33	0.50	0.85	7.22	14.95	62.6%	0.48	17.97	2.49
	5.05	13.76	0.47	0.80	6.52	14.34	60.1%	0.45	15.57	2.39
	5.10	13.19	0.44	0.75	5.84	13.74	57.5%	0.43	13.36	2.29
	5.15	12.61	0.41	0.70	5.20	13.13	55.0%	0.40	11.33	2.18
	5.20	12.04	0.38	0.65	4.58	12.53	52.5%	0.37	9.47	2.07
	5.25	11.47	0.35	0.60	3.99	11.92	49.9%	0.33	7.79	1.95
	5.30	10.90	0.32	0.55	3.43	11.32	47.4%	0.30	6.27	1.83
	5.35	10.33	0.28	0.50	2.90	10.71	44.9%	0.27	4.92	1.69
	5.40	9.76	0.25	0.45	2.40	10.11	42.3%	0.24	3.73	1.55
	5.45	9.18	0.21	0.40	1.93	9.50	39.8%	0.20	2.69	1.40
WL	5.50	8.58	0.17	0.35	1.48	8.86	37.1%	0.17	1.82	1.23
	5.55	8.02	0.13	0.30	1.07	8.30	34.7%	0.13	1.10	1.03
	5.60	6.00	0.13	0.25	0.75	6.23	26.1%	0.12	0.75	0.99
	5.65	5.47	0.09	0.20	0.47	5.66	23.7%	0.08	0.36	0.77
	5.70	4.04	0.06	0.15	0.25	4.16	17.4%	0.06	0.15	0.61
	5.75	2.27	0.05	0.10	0.11	2.32	9.7%	0.05	0.06	0.54
	5.80	1.44	0.01	0.05	0.02	1.45	6.1%	0.01	0.00	0.22
	5.85	0.02	0.00	0.00	0.00	0.02	0.1%	0.00	0.00	0.03

STREAM NAME: Terror Creek
XS LOCATION: 450' downstream from W. Fk.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)= 1.82 cfs
CALCULATED FLOW (Qc)= 1.82 cfs
(Qm-Qc)/Qm * 100 = -0.2 %

MEASURED WATERLINE (WLm)= 5.50 ft
CALCULATED WATERLINE (WLc)= 5.50 ft
(WLm-WLc)/WLm * 100 = -0.1 %

MAX MEASURED DEPTH (Dm)= 0.35 ft
MAX CALCULATED DEPTH (Dc)= 0.35 ft
(Dm-Dc)/Dm * 100 = -0.5 %

MEAN VELOCITY= 1.23 ft/sec
MANNING'S N= 0.037
SLOPE= 0.01 ft/ft

.4 * Qm = 0.7 cfs
2.5 * Qm= 4.5 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

RECOMMENDATION BY: AGENCY..... DATE:.....
CWCB REVIEW BY: DATE:.....

STREAM NAME: Terror Creek
 XS LOCATION: 450' downstream from W. Fk.
 XS NUMBER: 2

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

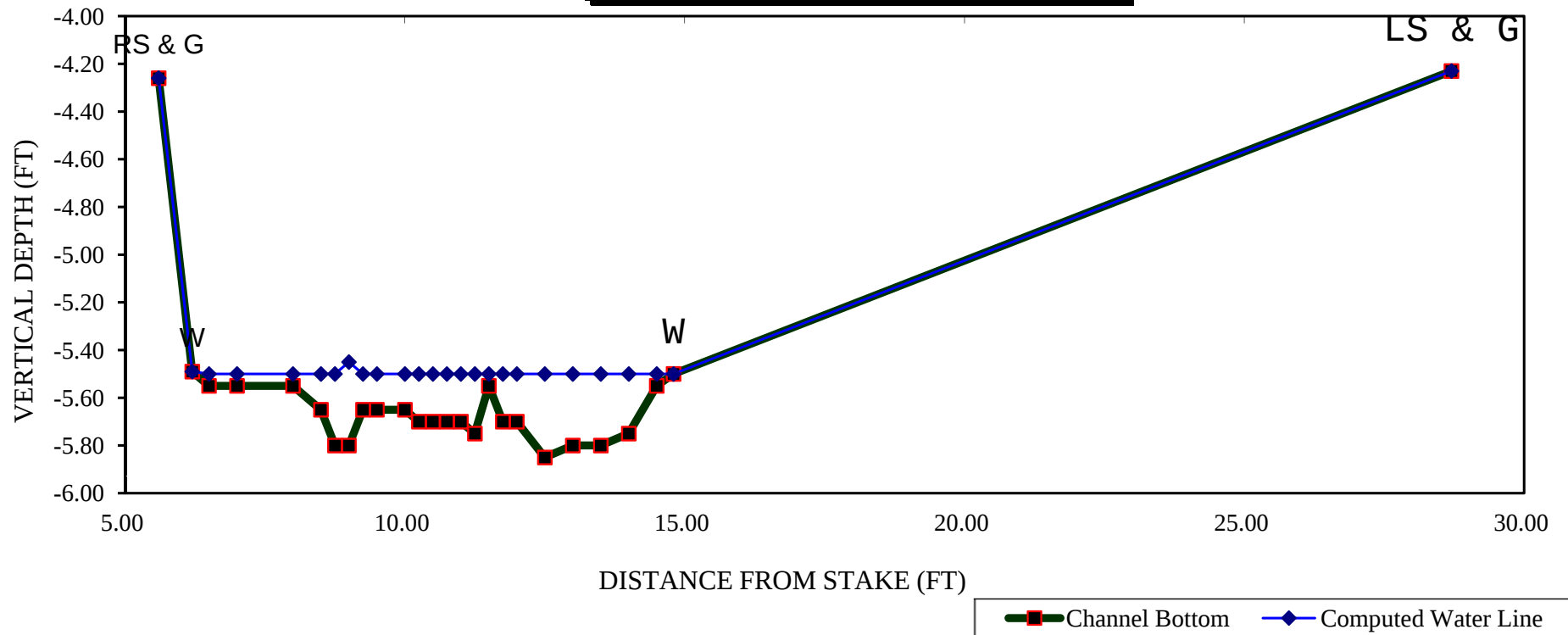
STAGING TABLE

WL = Waterline corrected for variations in field measured water surface elevations and sag

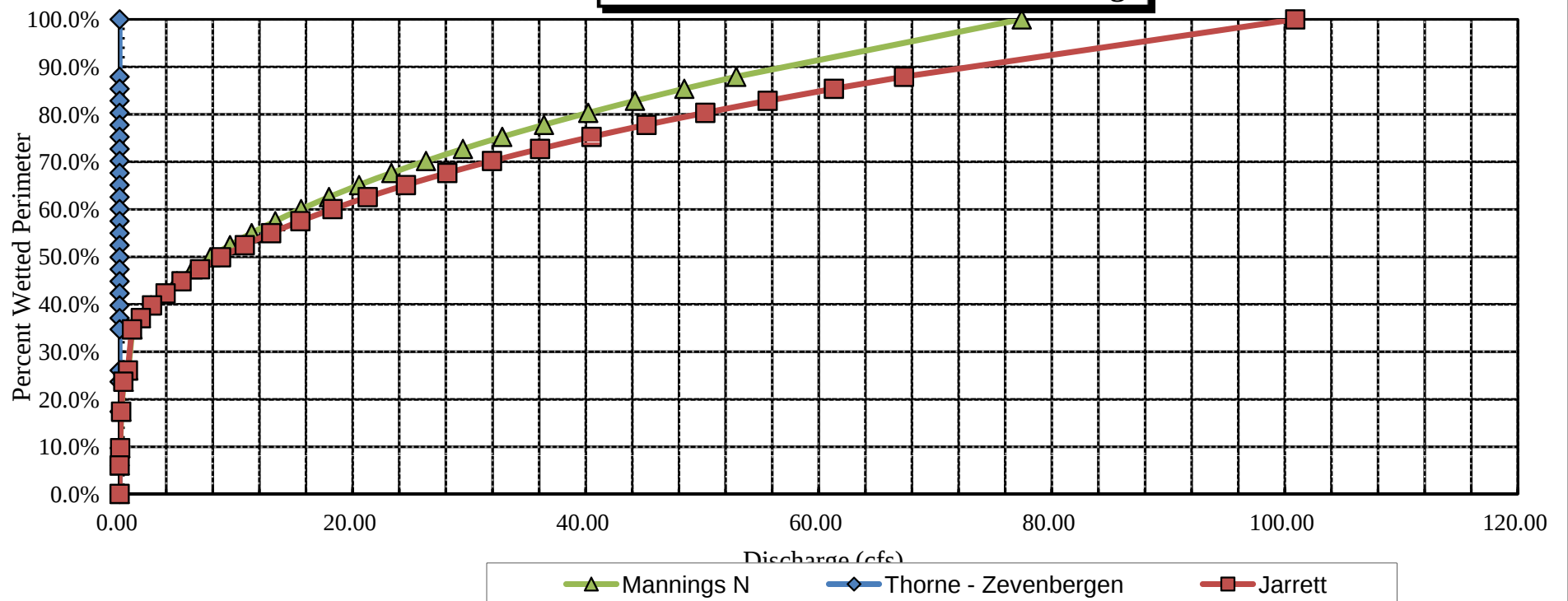
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.26	22.77	0.92	1.59	20.92	23.89	100.0%	0.88	100.89	4.82
	4.50	20.05	0.79	1.35	15.81	21.00	87.9%	0.75	67.32	4.26
	4.55	19.47	0.76	1.30	14.83	20.40	85.4%	0.73	61.30	4.13
	4.60	18.90	0.73	1.25	13.87	19.79	82.9%	0.70	55.61	4.01
	4.65	18.33	0.71	1.20	12.93	19.19	80.3%	0.67	50.26	3.89
	4.70	17.76	0.68	1.15	12.03	18.58	77.8%	0.65	45.22	3.76
	4.75	17.19	0.65	1.10	11.16	17.98	75.3%	0.62	40.50	3.63
	4.80	16.62	0.62	1.05	10.31	17.37	72.7%	0.59	36.08	3.50
	4.85	16.04	0.59	1.00	9.50	16.77	70.2%	0.57	31.96	3.36
	4.90	15.47	0.56	0.95	8.71	16.16	67.7%	0.54	28.12	3.23
	4.95	14.90	0.53	0.90	7.95	15.55	65.1%	0.51	24.57	3.09
	5.00	14.33	0.50	0.85	7.22	14.95	62.6%	0.48	21.29	2.95
	5.05	13.76	0.47	0.80	6.52	14.34	60.1%	0.45	18.27	2.80
	5.10	13.19	0.44	0.75	5.84	13.74	57.5%	0.43	15.51	2.65
	5.15	12.61	0.41	0.70	5.20	13.13	55.0%	0.40	13.00	2.50
	5.20	12.04	0.38	0.65	4.58	12.53	52.5%	0.37	10.74	2.34
	5.25	11.47	0.35	0.60	3.99	11.92	49.9%	0.33	8.70	2.18
	5.30	10.90	0.32	0.55	3.43	11.32	47.4%	0.30	6.90	2.01
	5.35	10.33	0.28	0.50	2.90	10.71	44.9%	0.27	5.31	1.83
	5.40	9.76	0.25	0.45	2.40	10.11	42.3%	0.24	3.94	1.64
	5.45	9.18	0.21	0.40	1.93	9.50	39.8%	0.20	2.78	1.44
WL	5.50	8.58	0.17	0.35	1.48	8.86	37.1%	0.17	1.82	1.23
	5.55	8.02	0.13	0.30	1.07	8.30	34.7%	0.13	1.06	0.99
	5.60	6.00	0.13	0.25	0.75	6.23	26.1%	0.12	0.71	0.94
	5.65	5.47	0.09	0.20	0.47	5.66	23.7%	0.08	0.32	0.68
	5.70	4.04	0.06	0.15	0.25	4.16	17.4%	0.06	0.13	0.52
	5.75	2.27	0.05	0.10	0.11	2.32	9.7%	0.05	0.05	0.44
	5.80	1.44	0.01	0.05	0.02	1.45	6.1%	0.01	0.00	0.15
	5.85	0.02	0.00	0.00	0.00	0.02	0.1%	0.00	0.00	0.01

Terror Creek

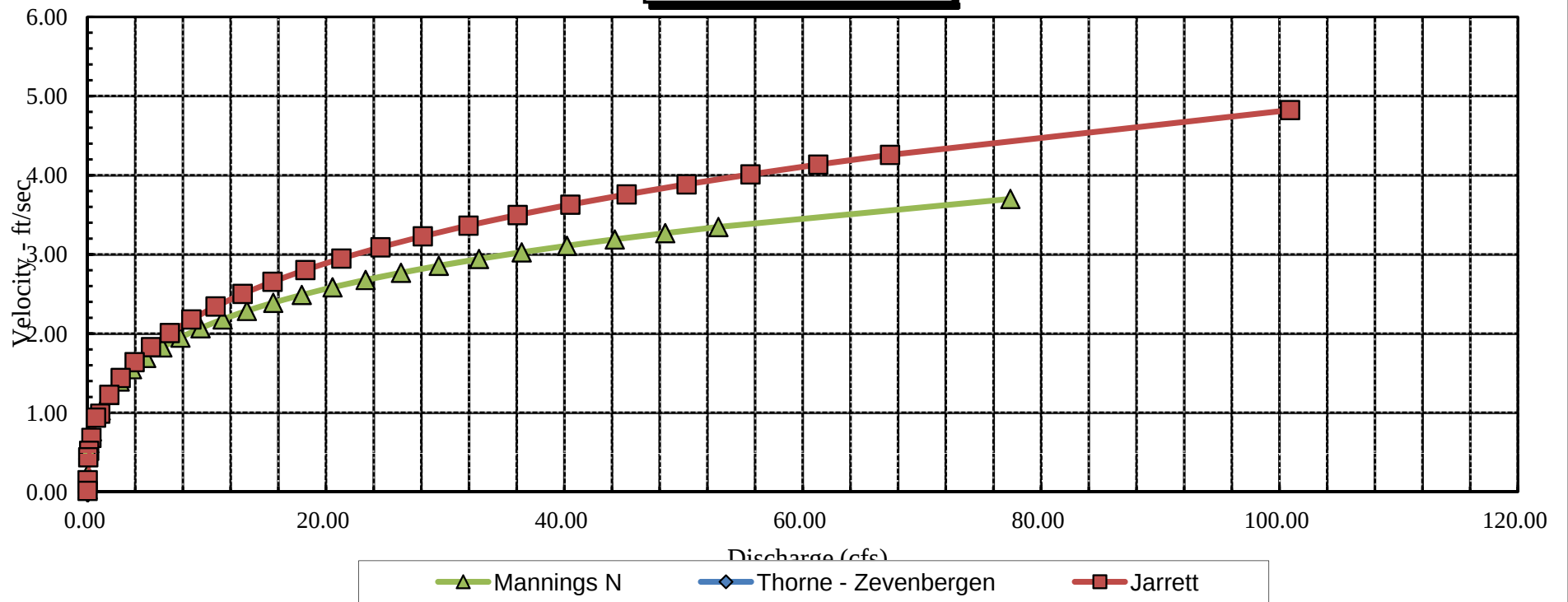
CROSS SECTION DATA ANALYSIS



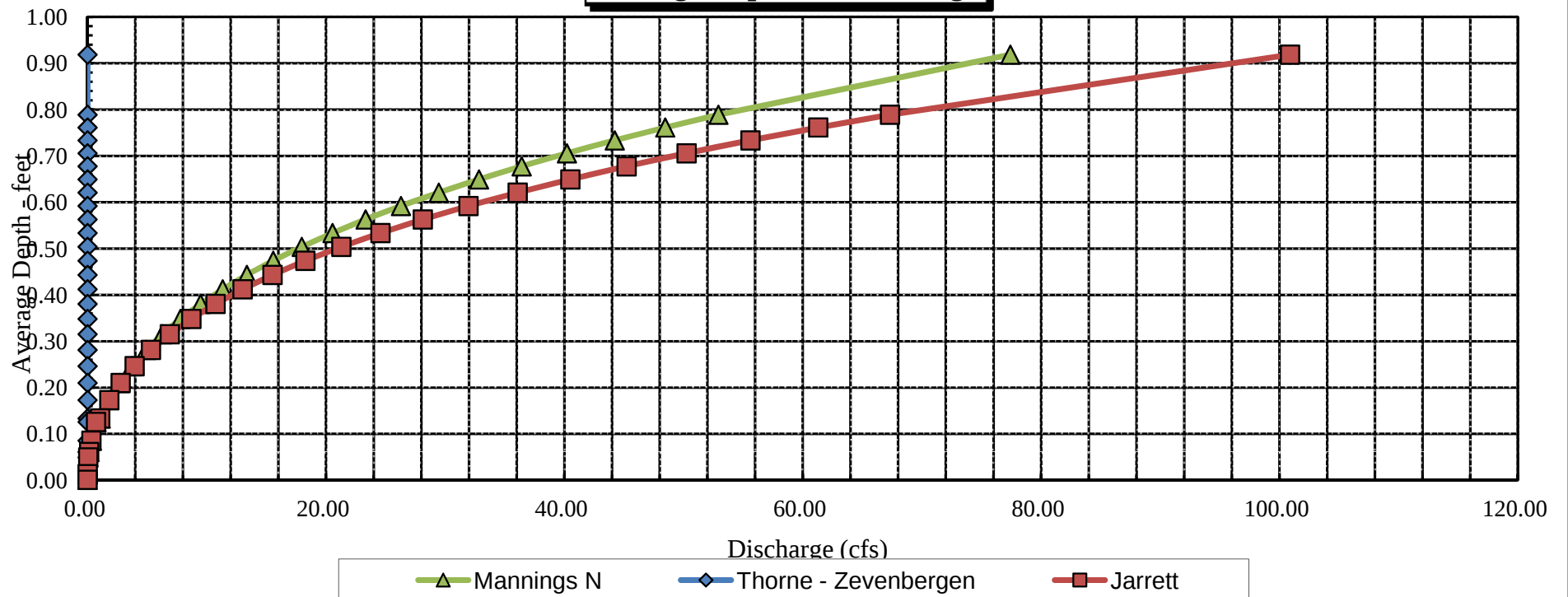
Terror Creek
Percent Wetted Perimeter vs. Discharge



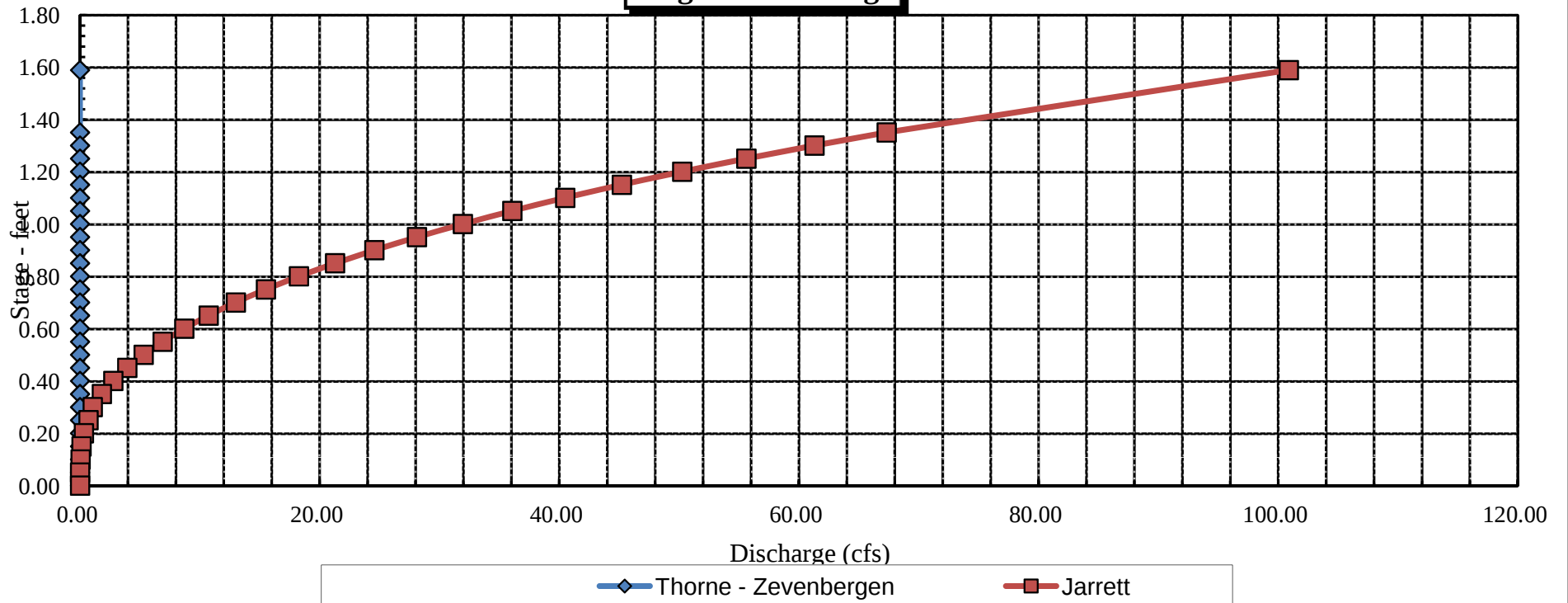
Terror Creek
Velocity vs. Discharge



Terror Creek
Average Depth vs. Discharge



Terror Creek
Stage vs. Discharge



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

LOCATION INFORMATION

STREAM NAME: Terror Creek
XS LOCATION: Approx. 650' downstream fr. W. Fk.
XS NUMBER: 1

DATE: 21-Oct-08
OBSERVERS: R. Smith, D. Murphy

1/4 SEC: SE
SECTION: 5
TWP: 13S
RANGE: 91W
PM: Sixth

COUNTY: Delta
WATERSHED: N. Fk. Gunnison
DIVISION: 4
DOW CODE: 43593

USGS MAP: Bowie 7.5'
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: 0.021

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Terror Creek
 XS LOCATION: Approx. 650' downstream fr. W. Fk.
 XS NUMBER: 1

DATA POINTS= 23

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 RS & G	10.00	3.54		
W	13.00	4.75		
	13.50	4.95	0.20	0.00
	14.00	5.05	0.30	0.70
	14.50	5.15	0.40	0.61
	15.00	5.05	0.30	1.84
	15.50	4.80	0.05	0.00
	16.00	4.80	0.05	0.00
	16.50	5.05	0.35	2.23
	17.00	5.15	0.40	2.46
	17.50	4.90	0.10	2.40
	18.00	5.00	0.20	1.62
	18.50	4.90	0.10	1.87
	19.00	5.10	0.30	1.92
	19.50	4.90	0.10	1.64
	20.00	4.85	0.05	0.00
	20.50	4.85	0.05	0.65
W	21.00	4.80		
	21.70	4.85		
	22.30	4.75		
	24.50	4.62		
	29.00	4.18		
1 LS & G	32.00	3.55		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.54	0.20	0.10	0.00	0.0%
0.51	0.30	0.15	0.11	4.9%
0.51	0.40	0.20	0.12	5.7%
0.51	0.30	0.15	0.28	12.9%
0.56	0.05	0.03	0.00	0.0%
0.50	0.05	0.03	0.00	0.0%
0.56	0.35	0.18	0.39	18.2%
0.51	0.40	0.20	0.49	22.9%
0.56	0.10	0.05	0.12	5.6%
0.51	0.20	0.10	0.16	7.5%
0.51	0.10	0.05	0.09	4.4%
0.54	0.30	0.15	0.29	13.4%
0.54	0.10	0.05	0.08	3.8%
0.50	0.05	0.03	0.00	0.0%
0.50	0.05	0.03	0.02	0.8%
0.50		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

8.36	0.4	1.48	2.15	100.0%
(Max.)				

Manning's n = 0.0465
 Hydraulic Radius= 0.17649875

STREAM NAME: Terror Creek
 XS LOCATION: Approx. 650' downstream fr. W. Fk.
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.48	1.49	1.0%
4.53	1.48	4.27	189.7%
4.55	1.48	4.02	172.2%
4.57	1.48	3.76	155.1%
4.59	1.48	3.51	138.3%
4.61	1.48	3.27	121.8%
4.63	1.48	3.03	105.7%
4.65	1.48	2.80	90.1%
4.67	1.48	2.58	75.0%
4.69	1.48	2.37	60.4%
4.71	1.48	2.16	46.3%
4.73	1.48	1.96	32.8%
4.74	1.48	1.86	26.2%
4.75	1.48	1.77	19.8%
4.76	1.48	1.67	13.5%
4.77	1.48	1.58	7.2%
4.78	1.48	1.49	1.0%
4.79	1.48	1.40	-5.1%
4.80	1.48	1.31	-11.2%
4.81	1.48	1.22	-17.0%
4.82	1.48	1.14	-22.4%
4.83	1.48	1.07	-27.6%
4.85	1.48	0.93	-37.2%
4.87	1.48	0.80	-45.5%
4.89	1.48	0.69	-53.2%
4.91	1.48	0.58	-60.4%
4.93	1.48	0.49	-67.0%
4.95	1.48	0.40	-72.9%
4.97	1.48	0.32	-78.2%
4.99	1.48	0.25	-82.9%
5.01	1.48	0.20	-86.8%
5.03	1.48	0.15	-90.2%

WATERLINE AT ZERO

AREA ERROR = 4.777

STREAM NAME: Terror Creek
 XS LOCATION: Approx. 650' downstream fr. 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	3.55	21.98	1.00	1.60	21.93	22.67	100.0%	0.97	99.26	4.53
	3.78	20.33	0.84	1.37	17.14	20.96	92.5%	0.82	69.33	4.05
	3.83	19.97	0.81	1.32	16.13	20.58	90.8%	0.78	63.43	3.93
	3.88	19.61	0.77	1.27	15.14	20.20	89.1%	0.75	57.79	3.82
	3.93	19.25	0.74	1.22	14.17	19.83	87.5%	0.71	52.39	3.70
	3.98	18.89	0.70	1.17	13.21	19.45	85.8%	0.68	47.25	3.58
	4.03	18.52	0.66	1.12	12.28	19.07	84.1%	0.64	42.36	3.45
	4.08	18.16	0.63	1.07	11.36	18.70	82.5%	0.61	37.72	3.32
	4.13	17.80	0.59	1.02	10.46	18.32	80.8%	0.57	33.33	3.18
	4.18	17.44	0.55	0.97	9.58	17.94	79.2%	0.53	29.18	3.05
	4.23	16.82	0.52	0.92	8.73	17.31	76.4%	0.50	25.57	2.93
	4.28	16.18	0.49	0.87	7.90	16.66	73.5%	0.47	22.22	2.81
	4.33	15.55	0.46	0.82	7.11	16.02	70.7%	0.44	19.13	2.69
	4.38	14.91	0.43	0.77	6.35	15.37	67.8%	0.41	16.28	2.57
	4.43	14.28	0.39	0.72	5.62	14.72	65.0%	0.38	13.67	2.43
	4.48	13.64	0.36	0.67	4.92	14.07	62.1%	0.35	11.29	2.30
	4.53	13.01	0.33	0.62	4.25	13.43	59.2%	0.32	9.14	2.15
	4.58	12.37	0.29	0.57	3.62	12.78	56.4%	0.28	7.21	1.99
	4.63	11.69	0.26	0.52	3.01	12.09	53.3%	0.25	5.53	1.83
	4.68	10.72	0.23	0.47	2.45	11.11	49.0%	0.22	4.15	1.69
	4.73	9.75	0.20	0.42	1.94	10.12	44.7%	0.19	2.99	1.54
WL	4.78	9.07	0.16	0.37	1.47	9.43	41.6%	0.16	1.98	1.34
	4.83	7.40	0.14	0.32	1.06	7.73	34.1%	0.14	1.29	1.23
	4.88	5.61	0.13	0.27	0.74	5.90	26.0%	0.12	0.85	1.16
	4.93	4.60	0.10	0.22	0.48	4.83	21.3%	0.10	0.48	0.99
	4.98	3.36	0.08	0.17	0.28	3.52	15.5%	0.08	0.24	0.86
	5.03	2.32	0.06	0.12	0.14	2.42	10.7%	0.06	0.10	0.69
	5.08	1.36	0.03	0.07	0.05	1.41	6.2%	0.03	0.02	0.48
	5.13	0.40	0.01	0.02	0.00	0.41	1.8%	0.01	0.00	0.23

STREAM NAME: Terror Creek
XS LOCATION: Approx. 650' downstream fr. W. Fk.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)= 2.15 cfs
CALCULATED FLOW (Qc)= 1.98 cfs
(Qm-Qc)/Qm * 100 = 7.8 %

MEASURED WATERLINE (WLm)= 4.78 ft
CALCULATED WATERLINE (WLc)= 4.78 ft
(WLm-WLc)/WLm * 100 = 0.0 %

MAX MEASURED DEPTH (Dm)= 0.40 ft
MAX CALCULATED DEPTH (Dc)= 0.37 ft
(Dm-Dc)/Dm * 100 = 6.7 %

MEAN VELOCITY= 1.34 ft/sec
MANNING'S N= 0.047
SLOPE= 0.021 ft/ft

.4 * Qm = 0.9 cfs
2.5 * Qm= 5.4 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

RECOMMENDATION BY: AGENCY..... DATE:.....
CWCB REVIEW BY: DATE:.....

STREAM NAME: Terror Creek
 XS LOCATION: Approx. 650' downstream fr. W. Fk.
 XS NUMBER: 1
 Jarrett Variable Manning's n Correction Applied

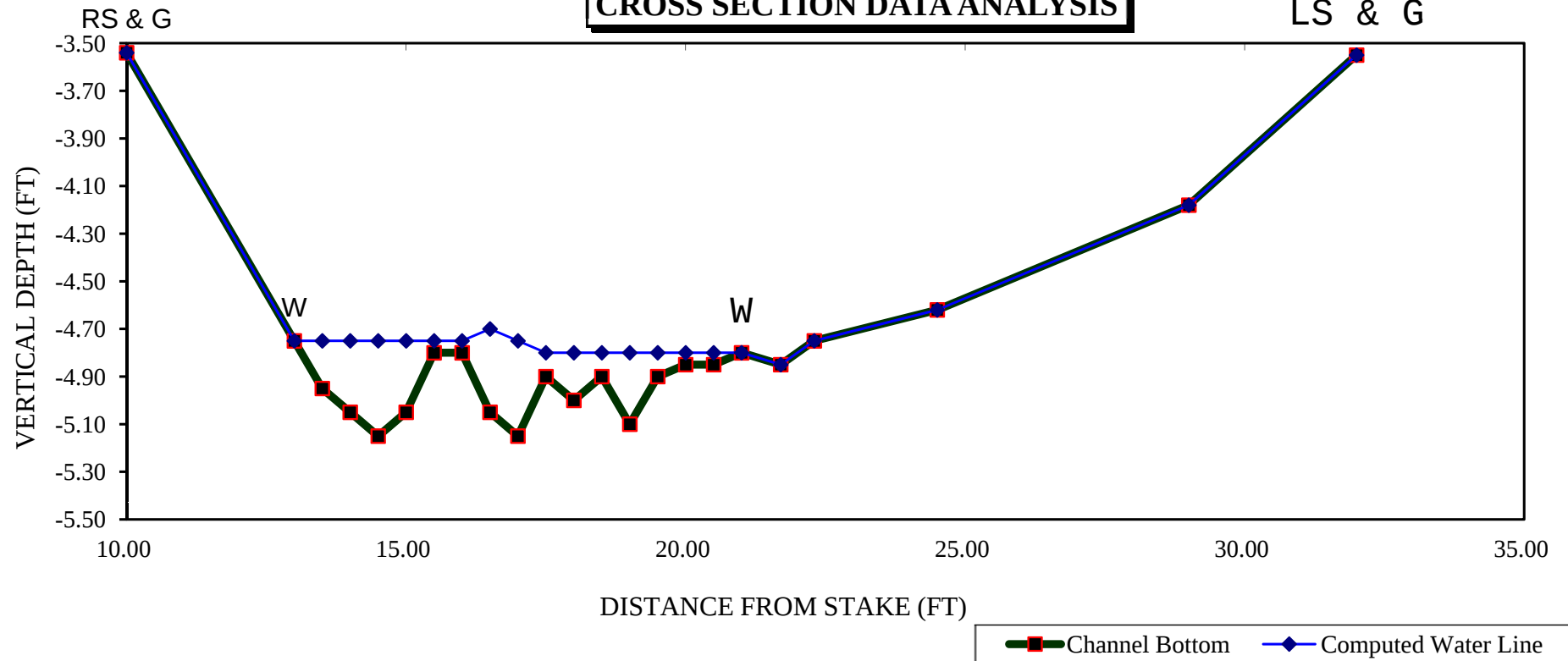
GL = lowest Grassline elevation corrected for sag

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

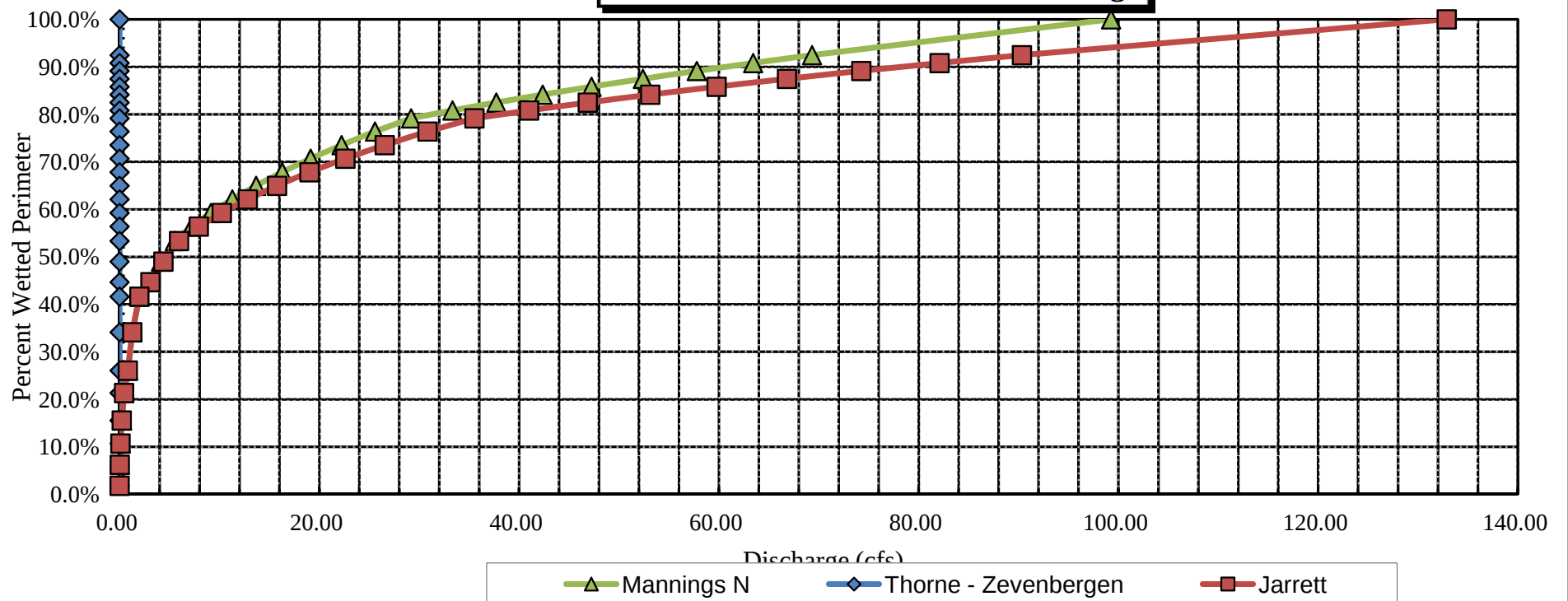
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.55	21.98	1.00	1.60	21.93	22.67	100.0%	0.97	132.88	6.06
	3.78	20.33	0.84	1.37	17.14	20.96	92.5%	0.82	90.34	5.27
	3.83	19.97	0.81	1.32	16.13	20.58	90.8%	0.78	82.09	5.09
	3.88	19.61	0.77	1.27	15.14	20.20	89.1%	0.75	74.25	4.90
	3.93	19.25	0.74	1.22	14.17	19.83	87.5%	0.71	66.81	4.72
	3.98	18.89	0.70	1.17	13.21	19.45	85.8%	0.68	59.77	4.52
	4.03	18.52	0.66	1.12	12.28	19.07	84.1%	0.64	53.12	4.33
	4.08	18.16	0.63	1.07	11.36	18.70	82.5%	0.61	46.87	4.12
	4.13	17.80	0.59	1.02	10.46	18.32	80.8%	0.57	41.00	3.92
	4.18	17.44	0.55	0.97	9.58	17.94	79.2%	0.53	35.52	3.71
	4.23	16.82	0.52	0.92	8.73	17.31	76.4%	0.50	30.83	3.53
	4.28	16.18	0.49	0.87	7.90	16.66	73.5%	0.47	26.54	3.36
	4.33	15.55	0.46	0.82	7.11	16.02	70.7%	0.44	22.60	3.18
	4.38	14.91	0.43	0.77	6.35	15.37	67.8%	0.41	19.01	3.00
	4.43	14.28	0.39	0.72	5.62	14.72	65.0%	0.38	15.76	2.81
	4.48	13.64	0.36	0.67	4.92	14.07	62.1%	0.35	12.84	2.61
	4.53	13.01	0.33	0.62	4.25	13.43	59.2%	0.32	10.23	2.41
	4.58	12.37	0.29	0.57	3.62	12.78	56.4%	0.28	7.93	2.19
	4.63	11.69	0.26	0.52	3.01	12.09	53.3%	0.25	5.95	1.98
	4.68	10.72	0.23	0.47	2.45	11.11	49.0%	0.22	4.39	1.79
	4.73	9.75	0.20	0.42	1.94	10.12	44.7%	0.19	3.09	1.59
WL	4.78	9.07	0.16	0.37	1.47	9.43	41.6%	0.16	1.98	1.34
	4.83	7.40	0.14	0.32	1.06	7.73	34.1%	0.14	1.27	1.20
	4.88	5.61	0.13	0.27	0.74	5.90	26.0%	0.12	0.82	1.11
	4.93	4.60	0.10	0.22	0.48	4.83	21.3%	0.10	0.44	0.92
	4.98	3.36	0.08	0.17	0.28	3.52	15.5%	0.08	0.21	0.77
	5.03	2.32	0.06	0.12	0.14	2.42	10.7%	0.06	0.08	0.59
	5.08	1.36	0.03	0.07	0.05	1.41	6.2%	0.03	0.02	0.37
	5.13	0.40	0.01	0.02	0.00	0.41	1.8%	0.01	0.00	0.15

Terror Creek

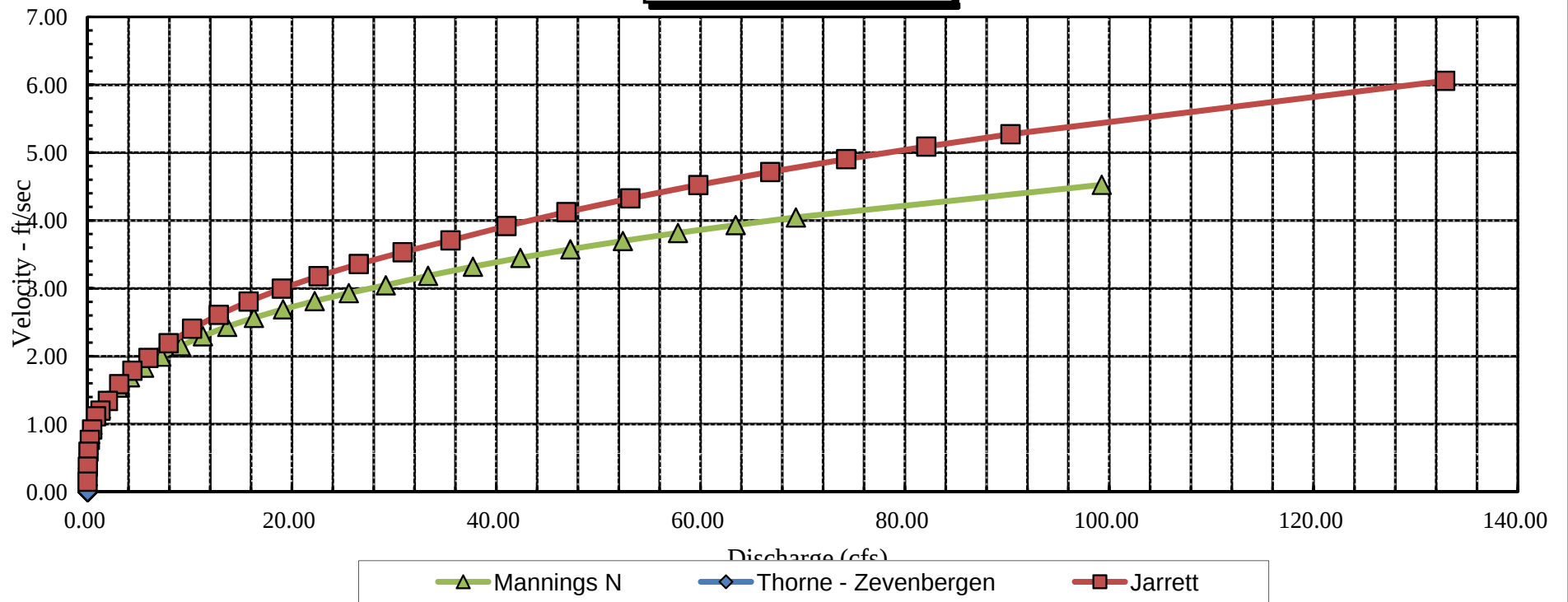
CROSS SECTION DATA ANALYSIS



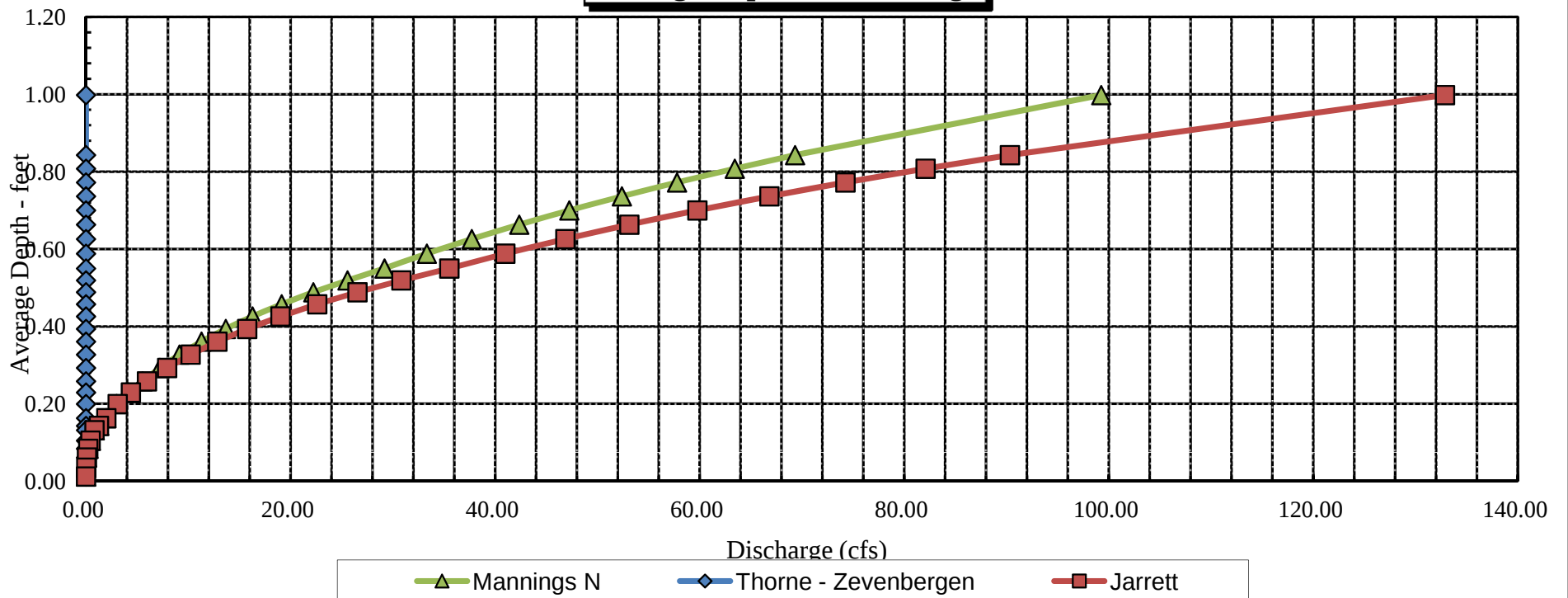
Terror Creek
Percent Wetted Perimeter vs. Discharge



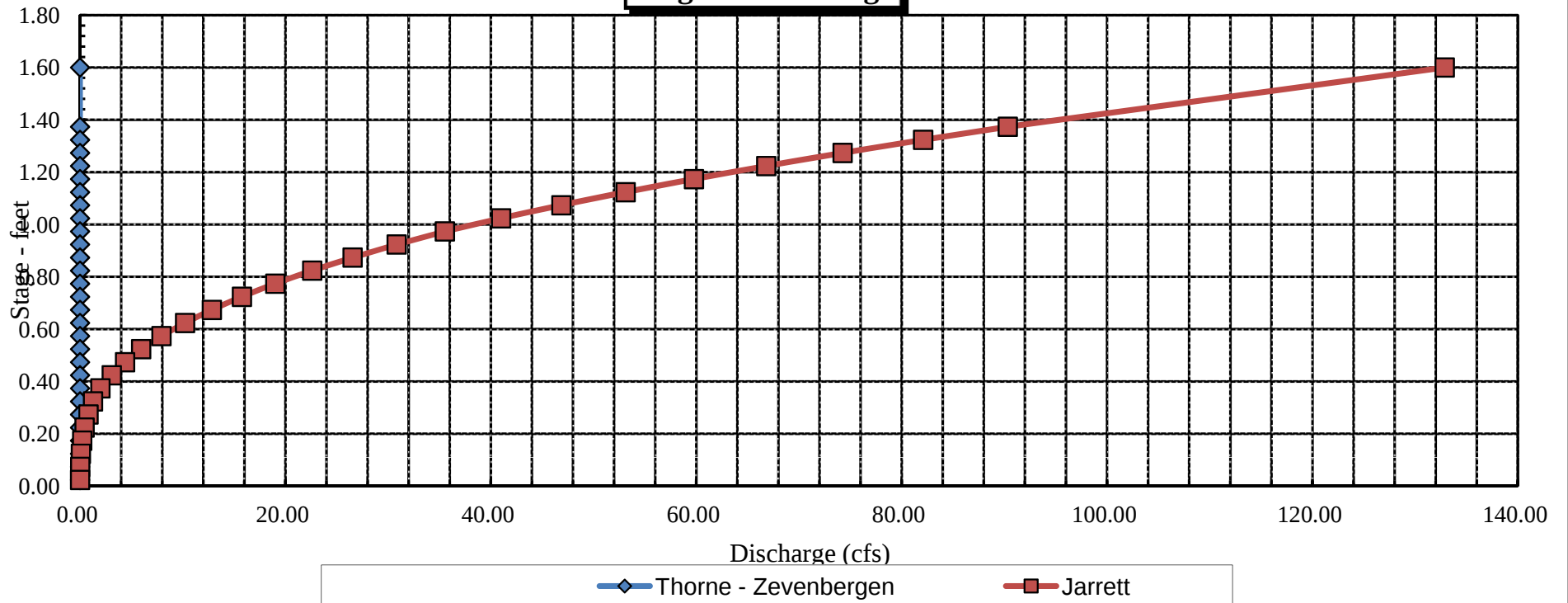
Terror Creek
Velocity vs. Discharge



Terror Creek
Average Depth vs. Discharge



Terror Creek Stage vs. Discharge



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

LOCATION INFORMATION

STREAM NAME: Terror Creek
XS LOCATION: 1000 ft. ds from conf. w/ W. Frk.
XS NUMBER: 2

DATE: 27-Sep-07
OBSERVERS: R. Smith, M. Eberle

1/4 SEC: SE
SECTION: 5
TWP: 13N
RANGE: 91W
PM: Sixth

COUNTY: Delta
WATERSHED: Gunnison
DIVISION: 4
DOW CODE: 43593

USGS MAP: Bowie 7.5'
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: 0.035

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Terror Creek
 XS LOCATION: 1000 ft. ds from conf. w/ W. Frk.
 XS NUMBER: 2

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE		VERT	WATER		WETTED	WATER	AREA	Q	% Q	
	DIST	DEPTH	DEPTH	VEL	PERIM.	DEPTH	(Am)	(Qm)	CELL	
1	LS & GL	3.10	5.20		0.00		0.00	0.00	0.0%	
		3.80	5.59		0.00		0.00	0.00	0.0%	
	W	4.00	6.22		0.00		0.00	0.00	0.0%	
		5.00	6.50	0.30	0.02	1.04	0.30	0.30	0.01	0.1%
		6.00	6.70	0.50	0.08	1.02	0.50	0.50	0.04	0.7%
		7.00	6.90	0.70	1.20	1.02	0.70	0.70	0.84	14.7%
		8.00	6.50	0.30	0.73	1.08	0.30	0.33	0.24	4.2%
		9.20	6.95	0.75	1.21	1.28	0.75	0.75	0.91	15.8%
	R	10.00	6.80	0.60	0.47	0.81	0.60	0.84	0.39	6.9%
		12.00	6.25	0.00	0.00	2.07		0.00	0.00	0.0%
		13.50	6.50	0.30	0.17	1.52	0.30	0.45	0.08	1.3%
		15.00	6.50	0.30	1.00	1.50	0.30	0.44	0.44	7.6%
	R	16.40	6.40	0.20	0.80	1.40	0.20	0.28	0.22	3.9%
		17.80	6.40	0.20	0.67	1.40	0.20	0.26	0.17	3.0%
		19.00	6.10	0.00	0.00	1.24		0.00	0.00	0.0%
		21.00	6.40	0.25	1.61	2.02	0.25	0.38	0.60	10.5%
		22.00	6.45	0.30	1.60	1.00	0.30	0.45	0.72	12.6%
		24.00	6.90	0.75	0.06	2.05	0.75	1.13	0.07	1.2%
		25.00	7.05	0.90	0.62	1.01	0.90	0.90	0.56	9.7%
		26.00	6.55	0.40	0.15	1.12	0.40	0.40	0.06	1.0%
		27.00	6.55	0.40	0.18	1.00	0.40	0.40	0.07	1.3%
		28.00	6.45	0.30	1.00	1.00	0.30	0.30	0.30	5.2%
		29.00	6.35	0.20	0.05	1.00	0.20	0.20	0.01	0.2%
		W	30.00	6.12		1.03		0.00	0.00	0.0%
		G	33.00	5.15		0.00		0.00	0.00	0.0%
		RS	34.00	4.01		0.00		0.00	0.00	0.0%

TOTALS -----

26.63	0.9	9.00	5.73	100.0%
(Max.)				

Manning's n = 0.2117
 Hydraulic Radius= 0.33784027

STREAM NAME: Terror Creek
 XS LOCATION: 1000 ft. ds from conf. w/ W. Frk.
 XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.00	7.28	-19.1%
6.00	9.00	13.65	51.7%
6.02	9.00	13.12	45.9%
6.04	9.00	12.59	40.0%
6.06	9.00	12.07	34.2%
6.08	9.00	11.54	28.3%
6.10	9.00	11.02	22.5%
6.12	9.00	10.50	16.7%
6.14	9.00	9.99	11.0%
6.16	9.00	9.48	5.4%
6.18	9.00	8.98	-0.2%
6.20	9.00	8.48	-5.7%
6.21	9.00	8.24	-8.4%
6.22	9.00	8.00	-11.1%
6.23	9.00	7.75	-13.8%
6.24	9.00	7.51	-16.5%
6.25	9.00	7.28	-19.1%
6.26	9.00	7.04	-21.7%
6.27	9.00	6.81	-24.3%
6.28	9.00	6.58	-26.9%
6.29	9.00	6.35	-29.4%
6.30	9.00	6.12	-31.9%
6.32	9.00	5.68	-36.8%
6.34	9.00	5.25	-41.6%
6.36	9.00	4.84	-46.2%
6.38	9.00	4.43	-50.7%
6.40	9.00	4.04	-55.1%
6.42	9.00	3.70	-58.9%
6.44	9.00	3.37	-62.5%
6.46	9.00	3.07	-65.8%
6.48	9.00	2.79	-69.0%
6.50	9.00	2.53	-71.9%

WATERLINE AT ZERO

AREA ERROR = 6.179

STREAM NAME: Terror Creek
 XS LOCATION: 1000 ft. ds from conf. w/ W. Frk.
 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	5.20	29.75	1.21	1.85	36.00	31.08	100.0%	1.16	52.16	1.45
	5.23	29.60	1.19	1.82	35.13	30.92	99.5%	1.14	50.24	1.43
	5.28	29.36	1.15	1.77	33.66	30.66	98.6%	1.10	47.04	1.40
	5.33	29.11	1.11	1.72	32.20	30.39	97.8%	1.06	43.94	1.36
	5.38	28.87	1.07	1.67	30.75	30.13	96.9%	1.02	40.93	1.33
	5.43	28.62	1.02	1.62	29.31	29.86	96.1%	0.98	38.02	1.30
	5.48	28.38	0.98	1.57	27.88	29.60	95.2%	0.94	35.20	1.26
	5.53	28.14	0.94	1.52	26.47	29.33	94.4%	0.90	32.47	1.23
	5.58	27.89	0.90	1.47	25.07	29.06	93.5%	0.86	29.84	1.19
	5.63	27.70	0.85	1.42	23.68	28.84	92.8%	0.82	27.27	1.15
	5.68	27.53	0.81	1.37	22.30	28.62	92.1%	0.78	24.80	1.11
	5.73	27.36	0.76	1.32	20.93	28.41	91.4%	0.74	22.42	1.07
	5.78	27.19	0.72	1.27	19.56	28.19	90.7%	0.69	20.14	1.03
	5.83	27.02	0.67	1.22	18.21	27.98	90.0%	0.65	17.96	0.99
	5.88	26.85	0.63	1.17	16.86	27.76	89.3%	0.61	15.88	0.94
	5.93	26.68	0.58	1.12	15.52	27.55	88.6%	0.56	13.91	0.90
	5.98	26.51	0.54	1.07	14.19	27.33	88.0%	0.52	12.04	0.85
	6.03	26.34	0.49	1.02	12.87	27.12	87.3%	0.47	10.29	0.80
	6.08	26.17	0.44	0.97	11.56	26.90	86.6%	0.43	8.64	0.75
	6.13	25.67	0.40	0.92	10.26	26.36	84.8%	0.39	7.18	0.70
WL	6.18	24.91	0.36	0.87	8.99	25.54	82.2%	0.35	5.89	0.65
	6.23	24.11	0.32	0.82	7.77	24.70	79.5%	0.31	4.72	0.61
	6.28	22.90	0.29	0.77	6.59	23.46	75.5%	0.28	3.71	0.56
	6.33	21.49	0.26	0.72	5.48	22.01	70.8%	0.25	2.85	0.52
	6.38	19.91	0.22	0.67	4.44	20.40	65.6%	0.22	2.11	0.48
	6.43	16.13	0.22	0.62	3.54	16.60	53.4%	0.21	1.66	0.47
	6.48	13.73	0.20	0.57	2.80	14.17	45.6%	0.20	1.25	0.45
	6.53	10.54	0.21	0.52	2.20	10.94	35.2%	0.20	0.99	0.45
	6.58	8.36	0.21	0.47	1.74	8.72	28.1%	0.20	0.78	0.45
	6.63	7.35	0.18	0.42	1.35	7.66	24.7%	0.18	0.55	0.41
	6.68	6.34	0.16	0.37	1.00	6.60	21.2%	0.15	0.38	0.37
	6.73	5.32	0.13	0.32	0.71	5.54	17.8%	0.13	0.24	0.33
	6.78	4.31	0.11	0.27	0.47	4.48	14.4%	0.11	0.14	0.29
	6.83	3.25	0.09	0.22	0.28	3.37	10.9%	0.08	0.07	0.25
	6.88	2.15	0.07	0.17	0.15	2.23	7.2%	0.07	0.03	0.21
	6.93	1.21	0.05	0.12	0.06	1.25	4.0%	0.05	0.01	0.18
	6.98	0.61	0.04	0.07	0.02	0.63	2.0%	0.03	0.00	0.14
	7.03	0.18	0.01	0.02	0.00	0.19	0.6%	0.01	0.00	0.06

STREAM NAME: Terror Creek
XS LOCATION: 1000 ft. ds from conf. w/ W. Frk.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.73 cfs
CALCULATED FLOW (Qc)=	5.89 cfs
(Qm-Qc)/Qm * 100 =	-2.8 %

MEASURED WATERLINE (W _{Lm})=	6.25 ft
CALCULATED WATERLINE (W _{Lc})=	6.18 ft
(W _{Lm} -W _{Lc})/W _{Lm} * 100 =	1.1 %

MAX MEASURED DEPTH (Dm)=	0.90 ft
MAX CALCULATED DEPTH (Dc)=	0.87 ft
(Dm-Dc)/Dm * 100	3.3 %

MEAN VELOCITY=	0.65 ft/sec
MANNING'S N=	0.212
SLOPE=	0.035 ft/ft

.4 * Qm = 2.3 cfs
2.5 * Qm = 14.3 cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)

PERIOD

RATIONALE FOR RECOMMENDATION:

=====

[illegible]

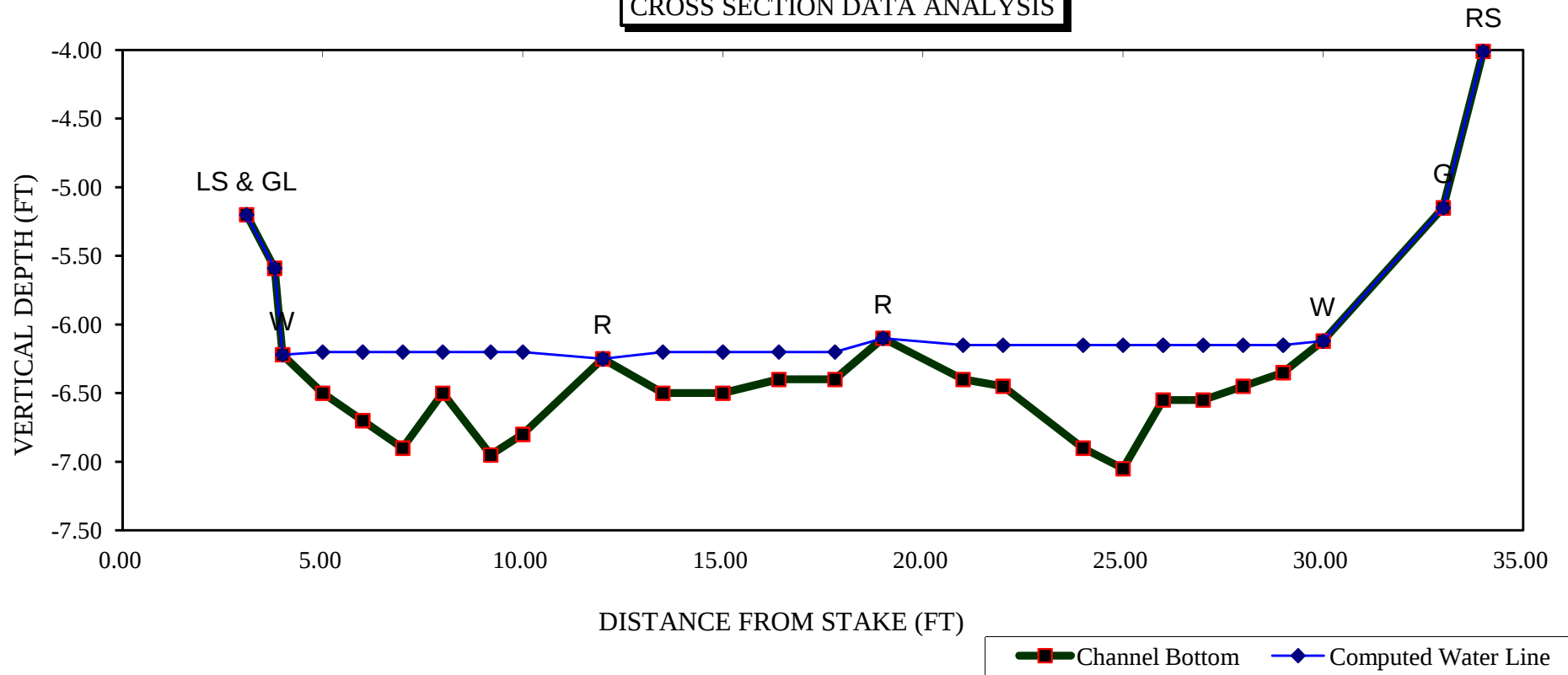
RECOMMENDATION BY: AGENCY..... DATE:.....

CWCB REVIEW BY: DATE:

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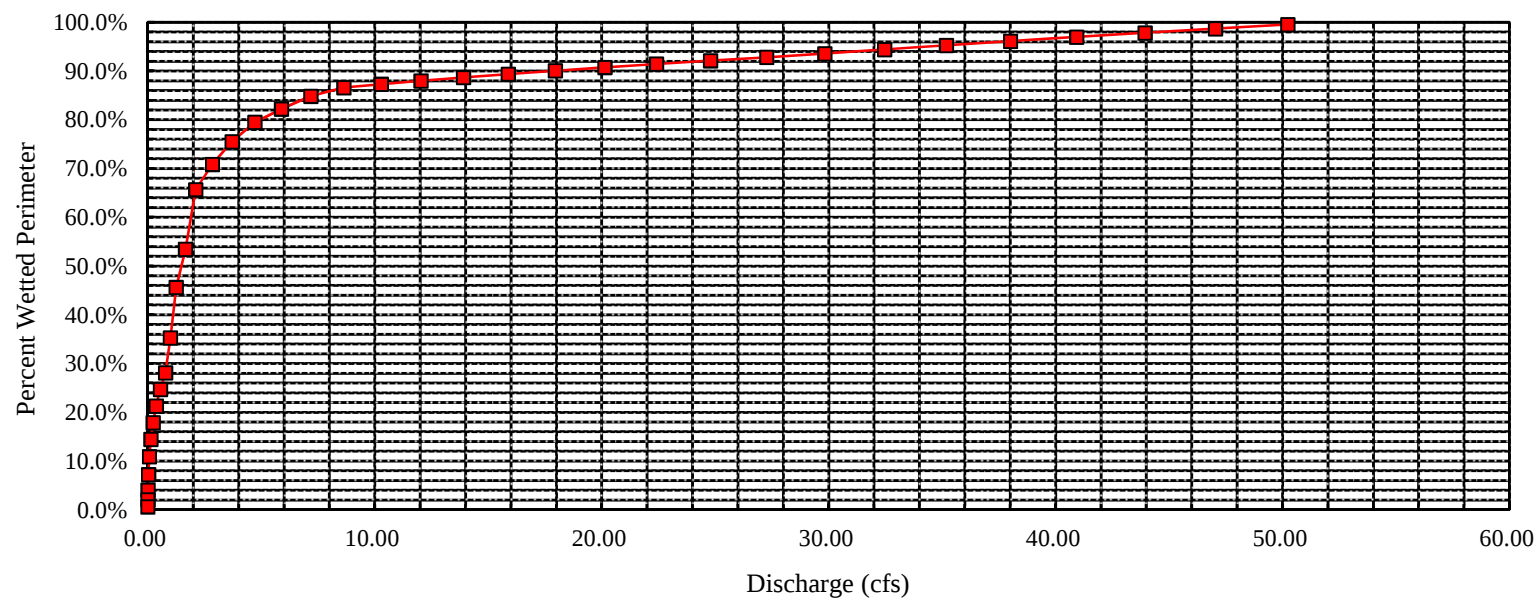
Terror Creek

CROSS SECTION DATA ANALYSIS



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Percent Wetted Perimeter vs. Discharge



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

LOCATION INFORMATION

STREAM NAME: Terror Creek
XS LOCATION: 700' DS from confluence w/ W. Fk.
XS NUMBER: 1

DATE: 27-Sep-07
OBSERVERS: R. Smith, M. Eberle

1/4 SEC: SE
SECTION: 5
TWP: 13S
RANGE: 91W
PM: Sixth

COUNTY: Delta
WATERSHED: Gunnison
DIVISION: 4
DOW CODE: 43593

USGS MAP: Bowie 7.5'
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: 0.0278

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Terror Creek
 XS LOCATION: 700' DS from confluence w/ W. Fk.
 XS NUMBER: 1

DATA POINTS= 22

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 RS & GL	0.00	4.78		
	5.00	5.42		
W	6.60	6.00		
	7.00	6.30	0.30	0.00
	8.00	6.60	0.60	0.24
	9.00	6.30	0.30	0.36
	10.00	6.40	0.40	0.00
	11.00	6.30	0.30	0.21
	12.00	6.30	0.30	0.74
	13.50	6.15	0.15	0.91
	14.50	6.30	0.30	0.59
	15.40	6.20	0.20	1.15
	17.00	5.90	0.00	0.00
	18.00	6.50	0.50	0.96
	20.00	6.70	0.70	3.09
	21.00	5.95	0.00	0.00
	22.00	6.40	0.40	0.42
	23.00	6.30	0.30	1.85
	24.00	6.40	0.40	0.46
W	25.40	5.96		
1 GL	28.60	4.64		
LS	29.00	4.52		

TOTALS -----

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.50	0.30	0.21	0.00	0.0%
1.04	0.60	0.60	0.14	2.4%
1.04	0.30	0.30	0.11	1.8%
1.00	0.40	0.40	0.00	0.0%
1.00	0.30	0.30	0.06	1.0%
1.00	0.30	0.38	0.28	4.5%
1.51	0.15	0.19	0.17	2.8%
1.01	0.30	0.29	0.17	2.7%
0.91	0.20	0.25	0.29	4.7%
1.63		0.00	0.00	0.0%
1.17	0.50	0.75	0.72	11.8%
2.01	0.70	1.05	3.24	53.0%
1.25		0.00	0.00	0.0%
1.10	0.40	0.40	0.17	2.7%
1.00	0.30	0.30	0.56	9.1%
1.00	0.40	0.48	0.22	3.6%
1.47		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

19.65 0.7 5.89 6.13 100.0%
 (Max.)

Manning's n = 0.1066
 Hydraulic Radius= 0.29961273

STREAM NAME: Terror Creek
 XS LOCATION: 700' DS from confluence w/ W. Fk.
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	5.89	6.08	3.3%
5.73	5.89	10.92	85.5%
5.75	5.89	10.52	78.7%
5.77	5.89	10.12	71.9%
5.79	5.89	9.72	65.2%
5.81	5.89	9.33	58.4%
5.83	5.89	8.94	51.8%
5.85	5.89	8.55	45.1%
5.87	5.89	8.16	38.5%
5.89	5.89	7.77	32.0%
5.91	5.89	7.39	25.5%
5.93	5.89	7.01	19.0%
5.94	5.89	6.82	15.8%
5.95	5.89	6.63	12.6%
5.96	5.89	6.45	9.5%
5.97	5.89	6.26	6.4%
5.98	5.89	6.08	3.3%
5.99	5.89	5.90	0.2%
6.00	5.89	5.72	-2.8%
6.01	5.89	5.54	-5.8%
6.02	5.89	5.37	-8.8%
6.03	5.89	5.19	-11.8%
6.05	5.89	4.85	-17.6%
6.07	5.89	4.51	-23.3%
6.09	5.89	4.18	-29.0%
6.11	5.89	3.86	-34.5%
6.13	5.89	3.54	-39.9%
6.15	5.89	3.22	-45.3%
6.17	5.89	2.92	-50.4%
6.19	5.89	2.63	-55.4%
6.21	5.89	2.35	-60.1%
6.23	5.89	2.08	-64.6%

WATERLINE AT ZERO

AREA ERROR = 5.991

STREAM NAME: Terror Creek
 XS LOCATION: 700' DS from confluence w/ 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	4.78	28.26	1.18	1.92	33.39	29.49	100.0%	1.13	84.32	2.53
	4.99	26.10	1.06	1.71	27.66	27.28	92.5%	1.01	64.91	2.35
	5.04	25.59	1.03	1.66	26.37	26.75	90.7%	0.99	60.72	2.30
	5.09	25.08	1.00	1.61	25.10	26.23	88.9%	0.96	56.68	2.26
	5.14	24.57	0.97	1.56	23.86	25.70	87.2%	0.93	52.79	2.21
	5.19	24.06	0.94	1.51	22.65	25.18	85.4%	0.90	49.06	2.17
	5.24	23.54	0.91	1.46	21.46	24.65	83.6%	0.87	45.47	2.12
	5.29	23.03	0.88	1.41	20.29	24.13	81.8%	0.84	42.03	2.07
	5.34	22.52	0.85	1.36	19.15	23.60	80.0%	0.81	38.74	2.02
	5.39	22.01	0.82	1.31	18.04	23.08	78.3%	0.78	35.59	1.97
	5.44	21.60	0.78	1.26	16.95	22.65	76.8%	0.75	32.48	1.92
	5.49	21.34	0.74	1.21	15.88	22.38	75.9%	0.71	29.36	1.85
	5.54	21.08	0.70	1.16	14.82	22.10	74.9%	0.67	26.39	1.78
	5.59	20.82	0.66	1.11	13.77	21.82	74.0%	0.63	23.55	1.71
	5.64	20.57	0.62	1.06	12.74	21.54	73.1%	0.59	20.85	1.64
	5.69	20.31	0.58	1.01	11.71	21.26	72.1%	0.55	18.30	1.56
	5.74	20.05	0.53	0.96	10.71	20.99	71.2%	0.51	15.88	1.48
	5.79	19.79	0.49	0.91	9.71	20.71	70.2%	0.47	13.62	1.40
	5.84	19.53	0.45	0.86	8.73	20.43	69.3%	0.43	11.50	1.32
	5.89	19.27	0.40	0.81	7.76	20.15	68.3%	0.38	9.54	1.23
	5.94	18.73	0.36	0.76	6.81	19.57	66.4%	0.35	7.82	1.15
WL	5.99	17.95	0.33	0.71	5.89	18.74	63.6%	0.31	6.32	1.07
	6.04	17.18	0.29	0.66	5.01	17.90	60.7%	0.28	4.98	0.99
	6.09	16.43	0.25	0.61	4.17	17.08	57.9%	0.24	3.78	0.91
	6.14	15.67	0.21	0.56	3.37	16.26	55.1%	0.21	2.74	0.81
	6.19	14.24	0.18	0.51	2.62	14.75	50.0%	0.18	1.92	0.73
	6.24	12.51	0.16	0.46	1.95	12.94	43.9%	0.15	1.28	0.66
	6.29	10.74	0.13	0.41	1.37	11.09	37.6%	0.12	0.79	0.58
	6.34	7.16	0.13	0.36	0.93	7.45	25.3%	0.12	0.54	0.58
	6.39	4.41	0.15	0.31	0.64	4.62	15.7%	0.14	0.40	0.62
	6.44	3.51	0.13	0.26	0.45	3.67	12.4%	0.12	0.26	0.57
	6.49	3.02	0.10	0.21	0.29	3.14	10.6%	0.09	0.14	0.47
	6.54	2.20	0.07	0.16	0.16	2.28	7.7%	0.07	0.06	0.39
	6.59	1.30	0.05	0.11	0.07	1.35	4.6%	0.05	0.02	0.32
	6.64	0.67	0.03	0.06	0.02	0.69	2.4%	0.03	0.00	0.22
	6.69	0.11	0.00	0.01	0.00	0.11	0.4%	0.00	0.00	0.06

STREAM NAME: Terror Creek
XS LOCATION: 700' DS from confluence w/ W. Fk.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	6.13 cfs
CALCULATED FLOW (Qc)=	6.32 cfs
(Qm-Qc)/Qm * 100 =	-3.2 %
MEASURED WATERLINE (WLm)=	5.98 ft
CALCULATED WATERLINE (WLc)=	5.99 ft
(WLm-WLc)/WLm * 100 =	-0.2 %
MAX MEASURED DEPTH (Dm)=	0.70 ft
MAX CALCULATED DEPTH (Dc)=	0.71 ft
(Dm-Dc)/Dm * 100	-1.3 %
MEAN VELOCITY=	1.07 ft/sec
MANNING'S N=	0.107
SLOPE=	0.0278 ft/ft
.4 * Qm =	2.5 cfs
2.5 * Qm=	15.3 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

[illegible]

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

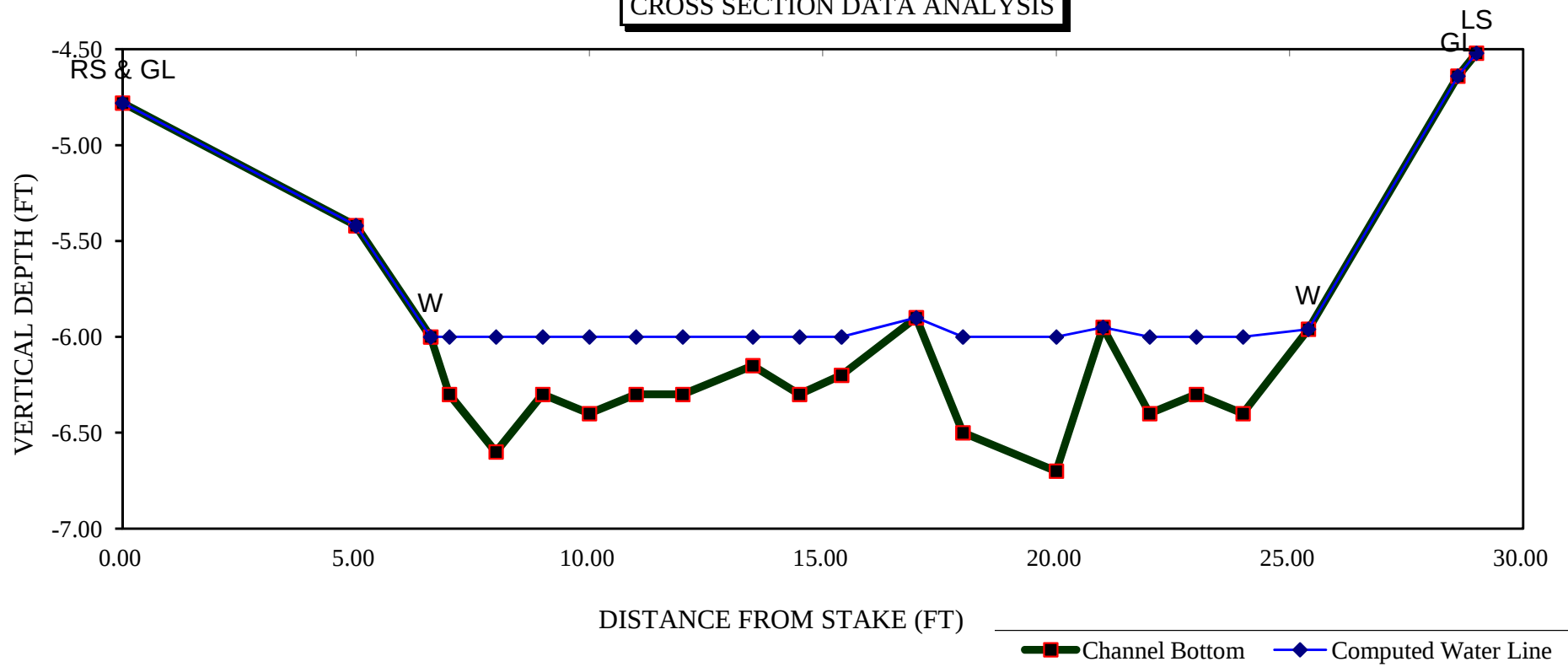
CWCB REVIEW BY: DATE:

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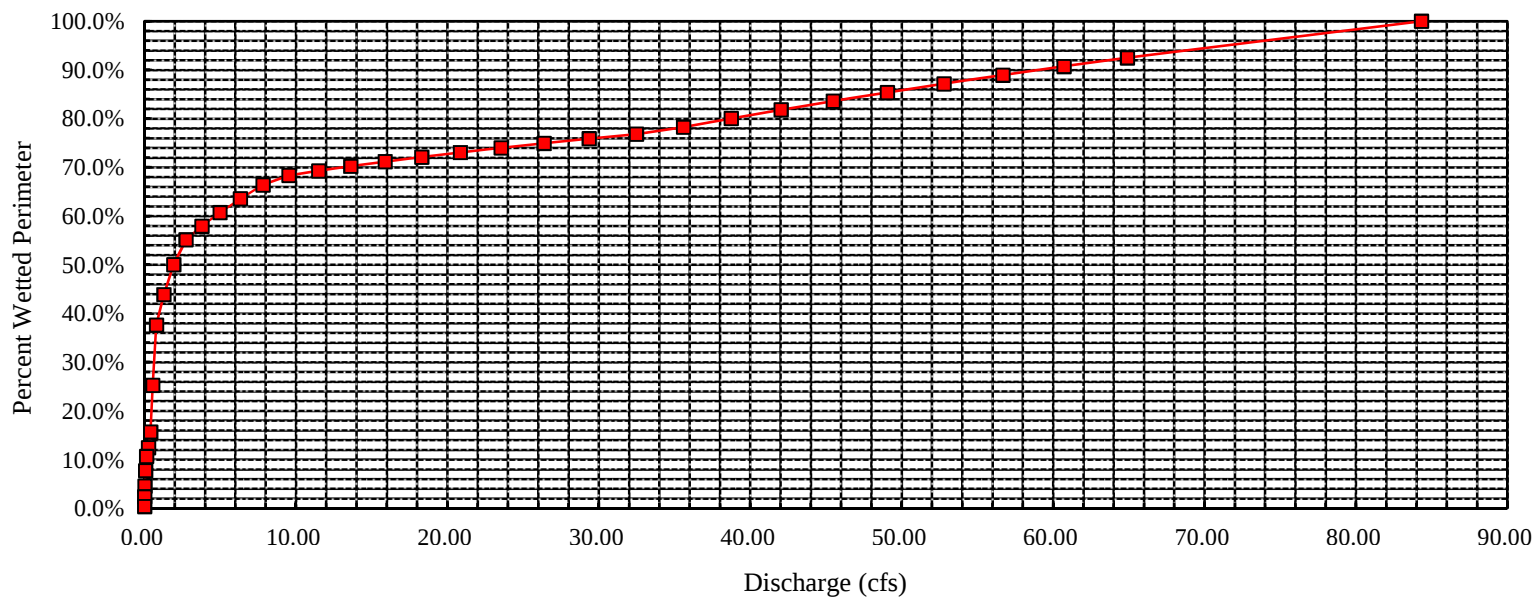
Terror Creek

CROSS SECTION DATA ANALYSIS



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Percent Wetted Perimeter vs. Discharge





COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>Terror Creek</u>		CROSS-SECTION NO.: <u>1</u>	
CROSS-SECTION LOCATION: <u>700 ft. downstream from confluence w/ West Fork</u>			
DATE: <u>9-27-07</u>	OBSERVERS: <u>R. Smith, M. Fierle</u>		
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>5</u>	TOWNSHIP: <u>13 N</u> RANGE: <u>9 E</u> PM: <u>6:42</u>
COUNTY: <u>Delta</u>	WATERSHED: <u>Gunnison</u>	WATER DIVISION: <u>4</u>	DOW WATER CODE: <u>43593</u>
MAP(S):	USGS: <u>Bowie 7.5'</u>	GPS: <u>213 276905</u>	USFS: <u>4313845</u>

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION:	YES / NO	METER TYPE: <u>Marsh-McBirney</u>
METER NUMBER:	DATE RATED:	CALIB/SPIN: <u>sec</u> TAPE WEIGHT: <u>surveyed</u> lbs/foot TAPE TENSION: <u>surveyed</u> lbs
CHANNEL BED MATERIAL SIZE RANGE: <u>4" cobbles to 2-foot boulders</u>		PHOTOGRAPHS TAKEN: <u>YES/NO</u> NUMBER OF PHOTOGRAPHS: <u>3</u>

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	<u>surveyed</u>
⊗ Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB	0.0	
② WS Upstream	<u>14.0</u>	<u>5.70</u>
③ WS Downstream	<u>14.0</u>	<u>6.48</u>
SLOPE	<u>0.78 / 28.0 = 0.0278</u>	

SKETCH

LEGEND:

Stake ⊗

Station ①

Photo ◇

Direction of Flow →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: <u>YES/NO</u>	DISTANCE ELECTROFISHED: <u>ft</u>	FISH CAUGHT: <u>YES/NO</u>	WATER CHEMISTRY SAMPLED: <u>YES/NO</u>															
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	
<u>see attached</u>																		
AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:																		
<u>mayfly, caddisfly</u>																		

COMMENTS

<u>TDS = 100</u>
<u>Temp = 48°F</u>
<u>pH = 8.2</u>

DISCHARGE/CROSS SECTION NOTES

[illegible]



FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER
CONSERVATION BOARD

LOCATION INFORMATION

STREAM NAME: <u>Terror Creek</u>		CROSS-SECTION NO.: <u>2</u>	
CROSS-SECTION LOCATION: <u>1,000 ft. downstream from confluence</u> <u>w/ West Fork</u>			
DATE: <u>9-27-07</u>	OBSERVERS: <u>R. Smith, M. Ebene</u>		
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>5</u>	TOWNSHIP: <u>13 N 10</u>
			RANGE: <u>7 E 10</u> PM: <u>6th</u>
COUNTY: <u>Delta</u>	WATERSHED: <u>Gunnison</u>	WATER DIVISION: <u>4</u>	DOW WATER CODE: <u>43593</u>
MAP(S):	USGS: <u>Bowie 7.5'</u>		
	USFS:		

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO	METER TYPE: <u>Marsh-McBirney</u>
METER NUMBER:	DATE RATED:
CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot
TAPE TENSION: _____ lbs	NUMBER OF PHOTOGRAPHS: <u>3</u>
CHANNEL BED MATERIAL SIZE RANGE: <u>1 inch cobble to 3-foot boulder</u>	
PHOTOGRAPHS TAKEN: ☒ YES ☐ NO	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	<u>surveyed</u>
⊗ Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB	0.0	<u>6.22 / 6.12</u>
② WS Upstream	<u>17.0</u>	<u>5.61</u>
③ WS Downstream	<u>17.0</u>	<u>6.80</u>
SLOPE	<u>1.21 / 34.0 = .035</u>	

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	
<u>see attached survey</u>																		
AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:																		
<u>mayfly, caddisfly</u>																		

COMMENTS

<u>TDS = 100</u>	<u>Very difficult to find riffles</u>
<u>Ph = 8.2</u>	
<u>Temp = 48°</u>	

DISCHARGE/CROSS SECTION NOTES

[illegible]



FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



**COLORADO WATER
CONSERVATION BOARD**

LOCATION INFORMATION

STREAM NAME:		Terror Creek				CROSS-SECTION NO.:		1													
CROSS-SECTION LOCATION:		Approx. 650 downstream from cont. W/ West Fork																			
DATE:		10-21-08		OBSERVERS:		R. Smith, D. Murphy															
LEGAL DESCRIPTION:		1/4 SECTION:		SE		SECTION:		5		TOWNSHIP:		13 N (S)		RANGE:		91 E (W)		PM:		6th	
COUNTY:		Delta		WATERSHED:		N Ft. Gunnison		WATER DIVISION:		4		DOW WATER CODE:		43593							
MAP(S):		USGS:		Bowie 7.5'		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
CHANNEL BED MATERIAL SIZE RANGE: 6" to 18"		PHOTOGRAPHS TAKEN: YES/NO	TAPE TENSION: surveyed lbs

CHANNEL PROFILE DATA

STATION		DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗	Tape @ Stake LB	0.0	Surveyed
⊗	Tape @ Stake RB	0.0	
①	WS @ Tape LB/RB	0.0	4.80 / 4.75
②	WS Upstream	4.0	4.68
③	WS Downstream	4.0	4.85
SLOPE		0.17 / 8.0 = 0.021	

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

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

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

mayfly, caddisfly

COMMENTS

PH = 8.6
Temp = 50°C
TDS = 160

High silt load, with some algae.

DISCHARGE/CROSS SECTION NOTES

[illegible]



FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>Terror Creek</u>		CROSS-SECTION NO.: <u>2</u>	
CROSS-SECTION LOCATION: <u>450 ft. downstream from confluence with West Fk. Terror Creek</u>			
DATE: <u>10-21-08</u>	OBSERVERS: <u>R. Smith, D. Murphy</u>		
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>5</u>	TOWNSHIP: <u>13 N(S)</u>
		RANGE: <u>91 E(W)</u>	PM: <u>6th</u>
COUNTY: <u>Delta</u>	WATERSHED: <u>N. Fk. Gunnison</u>	WATER DIVISION: <u>4</u>	DOW WATER CODE: <u>43593</u>
MAP(S):	USGS: <u>Gowie 7.5'</u>		
	USFS:		

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO		METER TYPE: <u>M-M</u>	
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: <u>su weighed</u> _____ lbs/foot
CHANNEL BED MATERIAL SIZE RANGE: <u>4" - 8"</u>	PHOTOGRAPHS TAKEN ☒ YES ☐ NO	NUMBER OF PHOTOGRAPHS: <u>3</u>	

CHANNEL PROFILE DATA

STATION		DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗	Tape @ Stake LB	0.0	5.95
⊗	Tape @ Stake RB	0.0	5.95
①	WS @ Tape LB/RB	0.0	5.49 / 5.50
②	WS Upstream	11.0	5.55
③	WS Downstream	4.0	5.40
SLOPE	0.15 / 5.0 = .01		

S K E E T

6.2

1

2

3

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:

mayfly, caddisfly (abundant)

COMMENTS

TDS = 160
Ph = 8.6
Temp = 50°C

DISCHARGE/CROSS SECTION NOTES

[illegible]