United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7093
www.blm.gov/co

TAKE PRIDE IN AMERICA

In Reply Refer To:
7250 (CO-932)

DEC 30 2008

RECEIVED
JAN 05 2009
Colorado Water Conservation Board

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 enlargement on Schafer Gulch, located in Water Division 4. The existing instream flow water right on this creek is 1.0 cubic feet per second, year round, from the headwaters to the confluence with Henson Creek, a distance of 1.7 miles. The existing instream flow water right was established in 1984.

Location and Land Status: Schafer Gulch is tributary to Henson Creek approximately two miles east of Engineer Pass. The creek is located within Hinsdale County, approximately 13 miles west of Lake City. This recommendation covers the entire stream reach, beginning at the headwaters and extending downstream to the confluence with Henson Creek. Most of the land along the 1.7 mile reach is owned and managed by the BLM. The exception is one patented mining claim that straddles approximately one-half mile of the creek near the confluence with Henson Creek.

Biological Summary: Overall, Schafer Gulch is a high gradient stream with large substrate size. There are extensive willow communities and large beaver ponds near the confluence with Henson Creek. The middle part of the stream provides a step-pool environment in which small pools and very short riffles are separated by small waterfalls. In this section, the creek flows through a spruce-fir riparian community. The upper part of the creek has lower gradients, and is located in a high-altitude hanging valley. The upper part of the reach supports extensive willow habitat. The creek supports a healthy and diverse aquatic insect community, including caddisfly, stonefly, and mayfly. Fishery surveys indicate that the creek supports a self-sustaining population of brook trout.

R2Cross Analysis: BLM's data analysis, coordinated with the Division of Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

- A 1.3 cubic feet per second (cfs) enlargement is recommended during the high temperature period from April 15 through September 15, bringing the total instream flow up to 2.3 cubic feet per second during this time period.

Justification for Instream Flow Enlargement: BLM was prompted to re-examine the instream flow on Schafer Gulch because of BLM water quality management objectives in the Henson Creek and Lake Fork watersheds. Both of these stream systems are affected by historic mining activities, and BLM began initiating projects to treat and minimize acid mine runoff and heavy metals contamination. Within these watersheds, streams that are presently able to support fish are extraordinarily valuable for the habitat they provide and for their ability to dilute runoff originating in more contaminated parts of the watershed. Finally, this creek is located along the very heavily used Alpine Loop backcountry byway. Users of the byway seek opportunities to fish and camp along the uncontaminated streams within these watersheds.

BLM's cross-section analysis revealed that the current instream flow rate is not fully protective for several reasons. First, in locations where the stream widens out and is capable of providing significant riffle and physical habitat, the current 1.0 cfs water right provides only 21 percent of wetted perimeter. This means that a very high percentage of the usable habitat would not be watered in a stream where usable habitat is at a premium. In narrower riffles, the current 1.0 cfs right provides much more wetted perimeter, but the velocities are still below the rates preferred by salmonids. BLM's conclusion is that it is prudent to protect a higher flow rate that is capable of making more of the limited physical habitat available for the fish population.

BLM also believes that Schafer Gulch is capable of providing nursery habitat and a source for fish repopulation in Henson Creek. Presently, downstream portions of Henson Creek provide marginal fish habitat, depending on hydrologic conditions. As water quality issues above the confluence with Schafer are addressed, Schafer Gulch can provide important habitat for repopulating this portion of Henson Creek. BLM also notes that lower Schafer Gulch supports extensive beaver activity, which is limited to streams in the watershed that have good water quality.

Water Availability: For water availability analysis, BLM recommends using a combination of methods. First, BLM recommends developing a synthetic hydrograph using the equations provided in *Estimation of Natural Streamflow Characteristics in Western Colorado, USGS Water Resources Investigation Report 85-4086, 1985.* This method incorporates data about basin size and elevation. This synthetic hydrograph should then be reconciled against historic gage data, using a basin apportionment approach. The most relevant historic gage is USGS gage 09124000 (Henson Creek at Lake City, CO). When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter, and may have underestimated winter flows as a result.

BLM is not aware of any decreed or historic stream diversion in this stream reach.

Conclusion: BLM believes that there is strong justification for an additional instream flow appropriation on this highly accessible and pristine creek. Our initial water availability analysis indicates there is sufficient water to support the appropriation without material injury to existing water rights. Accordingly, we urge the board to make an initial appropriation at its regular board meeting in January 2009.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section to support this recommendation were provided with the draft recommendation in February 2008. We thank the Colorado Water Conservation Board for its cooperation in this effort.

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

Sincerely,

for Linda Anañia
Deputy State Director, Resources and Fire

cc:
Kenny McDaniel, Gunnison FO
Art Hayes, Gunnison FO
Tom Fresques, Glenwood Springs FO

DRAFT INSTREAM FLOW RECOMMENDATION – SCHAFER GULCH, WD 4

Feb. 13, 2008

Ms. Linda Bassi
Colorado Water Conservation Board
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Denver, Colorado 80203

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R2Cross Analysis. BLM's data analysis, coordinated with the Division of Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

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the Henson Creek and Lake Fork watersheds. Both of these stream systems are affected by historic mining activities, and BLM has begun to initiate projects to treat and minimize acid mine runoff and heavy metals contamination. Within these watersheds, streams that are presently able to support fish are extraordinarily valuable for the habitat they provide and for their ability to dilute runoff originating in more contaminated parts of the watershed. Finally, this creek is located along the very heavily used Alpine Loop backcountry byway. Users of the byway seek opportunities to fish and camp along the uncontaminated streams within these watersheds.

BLM's cross section analysis revealed that the current instream flow rate is not fully protective for several reasons. First, in locations where the stream widens out and is capable of providing significant riffle and physical habitat, the current 1.0 cfs water right provides only 21% wetted perimeter. This means that a very high percentage of the usable habitat would not be watered in a stream where usable habitat is at a premium. In narrower rifles, the current 1.0 cfs right provides much more wetted perimeter, but the velocities are still below the rates preferred by salmonids. BLM's conclusion is that it is prudent to protect a higher flow rate that is capable of making more of the limited physical habitat available for the fish population.

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

Sincerely,

Linda Anania
Deputy State Director
Resources and Fire

4 Enclosures

cc: Kenny McDaniel, Gunnison FO
Art Hayes, Gunnison FO
Tom Fresques, Glenwood Springs FO

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Schaefer Gulch						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 800 ft. upstream from confluence w/ N. Ft. Henson						
DATE: 10-10-07	OBSERVERS: R Smith, J. Roach					
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 20	TOWNSHIP: 43 (N)/S	RANGE: 6 E/(W)	PM: NM	
COUNTY: Hinsdale	WATERSHED: Lake Fork	WATER DIVISION:	DOW WATER CODE: 42228			
MAP(S): USGS: Handies Peak 7.5'		Z 13 GPS 276378				
USFS:		4205426				

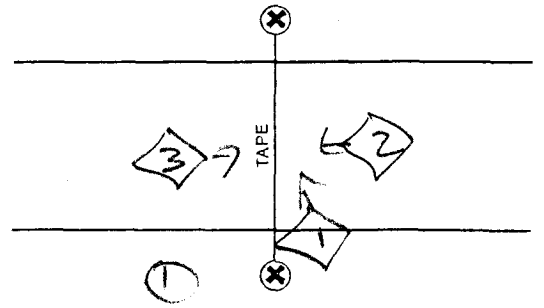
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: Marsh-McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 2" cobbles to 1-foot boulders	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	4.64 / 4.63 (14.3 / 13.2)
(2) WS Upstream	17.0	4.04
(3) WS Downstream	21.0	5.66
SLOPE	1.62/38.0 =	

SKETCH



LEGEND:
- Stake (X)
- Station (1)
- Photo (1)
- Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

TDS = 110
Ph = 8.0
Temp = 7°C

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Schaefer Gulch	CROSS-SECTION NO.: 1	DATE: 10-10-07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 2:35 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.8		3.02								
G	3.4		4.22								
	3.9		4.46								
W	4.3		4.64								
	4.7		4.70	0.05				Ø			
	5.1		4.95	0.30				Ø			
	5.5		4.80	0.15				Ø			
	5.9		4.85	0.20				.01			
	6.3		4.85	0.20				Ø			
	6.7		4.95	0.30				.18			
	7.1		4.95	0.30				1.23			
	7.5		5.10	0.45				1.07			
	7.9		5.05	0.40				1.83			
	8.3		4.95	0.30				2.70			
	8.7		4.95	0.30				2.43			
	9.1		4.80	0.15				1.47			
	9.5		4.85	0.20				1.85			
	9.9		4.85	0.20				1.50			
	10.3		4.95	0.30				1.17			
	10.7		4.90	0.25				0.77			
	11.1		4.90	0.25				1.80			
	11.5		4.95	0.30				1.98			
	11.9		4.90	0.25				1.80			
	12.3		4.90	0.25				1.33			
	12.7		4.70	0.05				0.67			
W	13.2		4.63								
G	13.5		4.22								
RS	15.2		3.20								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Schaefer Gulch						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: 600 ft. upstream from confluence w/ N. Ft. Henson							
DATE: 10-10-07	OBSERVERS: R. Smith, J. Roach						
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 20	TOWNSHIP: 43 (N)S	RANGE: 6E(W)	PM: NM		
COUNTY: Hinsdale	WATERSHED: Lake Fork	WATER DIVISION: 4	DOW WATER CODE: 42228				
MAP(S): USGS: Handies Peak 7.5'							
USFS:							

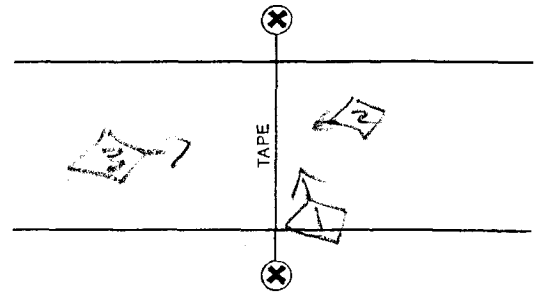
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: Marsh-McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 4" cobble to 1-foot boulder	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	6.34 / 6.30 (4.8 / 14.2)
(2) WS Upstream	22.0	5.70
(3) WS Downstream	11.0	6.58
SLOPE	0.88 / 33.0 = .026	

SKETCH



LEGEND:
- Stake (X)
- Station (1)
- Photo (1)
- Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

Ph: 8.0
Temp = 7° C
TDS = 110

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

LOCATION INFORMATION

STREAM NAME:	Schafer Gulch
XS LOCATION:	800 ft. u/s from conf.w/ N. Fk. Henson Ck
XS NUMBER:	1
DATE:	10-Oct-09
OBSERVERS:	R. Smith, J. Roach
1/4 SEC:	NE
SECTION:	20
TWP:	43N
RANGE:	6W
PM:	NM
COUNTY:	Hinsdale
WATERSHED:	Lake Fork Gunnison
DIVISION:	4
DOW CODE:	42228
USGS MAP:	Handies Peak 7.5'
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:	0.042

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

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

STREAM NAME: Schafer Gulch
XS LOCATION: 800 ft. u/s from conf.w/ N. Fk. Henson Ck
XS NUMBER: 1

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.80	3.02	0.00		0.00		0.00	0.00	0.0%
1	G	3.40	4.22	0.00		0.00		0.00	0.00	0.0%
		3.90	4.46	0.00		0.00		0.00	0.00	0.0%
	W	4.30	4.64	0.00		0.00		0.00	0.00	0.0%
		4.70	4.70	0.05	0.00	0.40	0.05	0.02	0.00	0.0%
		5.10	4.95	0.30	0.00	0.47	0.30	0.12	0.00	0.0%
		5.50	4.80	0.15	0.00	0.43	0.15	0.06	0.00	0.0%
		5.90	4.85	0.20	0.01	0.40	0.20	0.08	0.00	0.0%
		6.30	4.85	0.20	0.00	0.40	0.20	0.08	0.00	0.0%
		6.70	4.95	0.30	0.18	0.41	0.30	0.12	0.02	0.8%
		7.10	4.95	0.30	1.23	0.40	0.30	0.12	0.15	5.7%
		7.50	5.10	0.45	1.07	0.43	0.45	0.18	0.19	7.4%
		7.90	5.05	0.40	1.83	0.40	0.40	0.16	0.29	11.3%
		8.30	4.95	0.30	2.70	0.41	0.30	0.12	0.32	12.5%
		8.70	4.95	0.30	2.43	0.40	0.30	0.12	0.29	11.3%
		9.10	4.80	0.15	1.47	0.43	0.15	0.06	0.09	3.4%
		9.50	4.85	0.20	1.85	0.40	0.20	0.08	0.15	5.7%
		9.90	4.85	0.20	1.50	0.40	0.20	0.08	0.12	4.6%
		10.30	4.95	0.30	1.17	0.41	0.30	0.12	0.14	5.4%
		10.70	4.90	0.25	0.77	0.40	0.25	0.10	0.08	3.0%
		11.10	4.90	0.25	1.80	0.40	0.25	0.10	0.18	6.9%
		11.50	4.95	0.30	1.98	0.40	0.30	0.12	0.24	9.2%
		11.90	4.90	0.25	1.80	0.40	0.25	0.10	0.18	6.9%
		12.30	4.90	0.25	1.33	0.40	0.25	0.10	0.13	5.1%
		12.70	4.70	0.05	0.67	0.45	0.05	0.02	0.02	0.6%
	W	13.20	4.63			0.50		0.00	0.00	0.0%
1	G	13.50	4.22			0.00		0.00	0.00	0.0%
	RS	15.20	3.20			0.00		0.00	0.00	0.0%
	TOTALS ----------					9.17	0.45	2.06	2.59	100.0%
							(Max.)			

Manning's n = 0.0897
Hydraulic Radius= 0.225029293

STREAM NAME: Schafer Gulch
XS LOCATION: 800 ft. u/s from conf.w/ N. Fk. Henson Ck
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.06	2.19	6.1%
4.39	2.06	4.51	118.6%
4.41	2.06	4.32	109.2%
4.43	2.06	4.12	100.0%
4.45	2.06	3.93	90.8%
4.47	2.06	3.75	81.6%
4.49	2.06	3.56	72.5%
4.51	2.06	3.37	63.5%
4.53	2.06	3.19	54.5%
4.55	2.06	3.00	45.6%
4.57	2.06	2.82	36.7%
4.59	2.06	2.64	27.9%
4.60	2.06	2.55	23.5%
4.61	2.06	2.46	19.2%
4.62	2.06	2.37	14.8%
4.63	2.06	2.28	10.5%
4.64	2.06	2.19	6.1%
4.65	2.06	2.10	1.9%
4.66	2.06	2.01	-2.4%
4.67	2.06	1.93	-6.5%
4.68	2.06	1.84	-10.6%
4.69	2.06	1.76	-14.6%
4.71	2.06	1.60	-22.4%
4.73	2.06	1.44	-30.1%
4.75	2.06	1.28	-37.8%
4.77	2.06	1.13	-45.3%
4.79	2.06	0.97	-52.8%
4.81	2.06	0.82	-60.2%
4.83	2.06	0.67	-67.3%
4.85	2.06	0.54	-73.8%
4.87	2.06	0.43	-79.4%
4.89	2.06	0.32	-84.4%

WATERLINE AT ZERO
AREA ERROR = 4.649

STREAM NAME: Schafer Gulch
XS LOCATION: 800 ft. u/s from conf.w/ N. Fk. Henson 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	4.22	10.10	0.61	0.88	6.14	10.67	100.0%	0.58	14.41	2.35
	4.25	10.02	0.58	0.85	5.84	10.56	99.0%	0.55	13.36	2.29
	4.30	9.88	0.54	0.80	5.34	10.38	97.4%	0.51	11.65	2.18
	4.35	9.74	0.50	0.75	4.85	10.21	95.7%	0.48	10.03	2.07
	4.40	9.59	0.46	0.70	4.37	10.03	94.0%	0.44	8.52	1.95
	4.45	9.45	0.41	0.65	3.89	9.85	92.4%	0.40	7.12	1.83
	4.50	9.31	0.37	0.60	3.42	9.67	90.7%	0.35	5.82	1.70
	4.55	9.16	0.32	0.55	2.96	9.49	88.9%	0.31	4.63	1.56
	4.60	9.01	0.28	0.50	2.51	9.30	87.2%	0.27	3.55	1.42
WL	4.65	8.70	0.24	0.45	2.06	8.96	84.0%	0.23	2.63	1.27
	4.70	8.00	0.21	0.40	1.64	8.26	77.4%	0.20	1.90	1.16
	4.75	7.82	0.16	0.35	1.25	8.05	75.5%	0.16	1.22	0.98
	4.80	7.65	0.11	0.30	0.86	7.86	73.7%	0.11	0.67	0.78
	4.85	5.60	0.09	0.25	0.51	5.76	54.0%	0.09	0.35	0.68
	4.90	3.97	0.06	0.20	0.25	4.07	38.1%	0.06	0.13	0.53
	4.95	1.20	0.08	0.15	0.10	1.25	11.7%	0.08	0.06	0.64
	5.00	0.87	0.06	0.10	0.05	0.90	8.4%	0.05	0.02	0.49
	5.05	0.54	0.03	0.05	0.01	0.55	5.2%	0.02	0.00	0.29
	5.10	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Schafer Gulch
XS LOCATION: 800 ft. u/s from conf.w/ N. Fk. Henson Ck
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.59	cfs
CALCULATED FLOW (Qc)=	2.63	cfs
(Qm-Qc)/Qm * 100 =	-1.5	%
MEASURED WATERLINE (WLm)=	4.64	ft
CALCULATED WATERLINE (WLc)=	4.65	ft
(WLm-WLc)/WLm * 100 =	-0.3	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.45	ft
(Dm-Dc)/Dm * 100	-0.1	%
MEAN VELOCITY=	1.27	ft/sec
MANNING'S N=	0.090	
SLOPE=	0.042	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.5	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
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RATIONALE FOR RECOMMENDATION:
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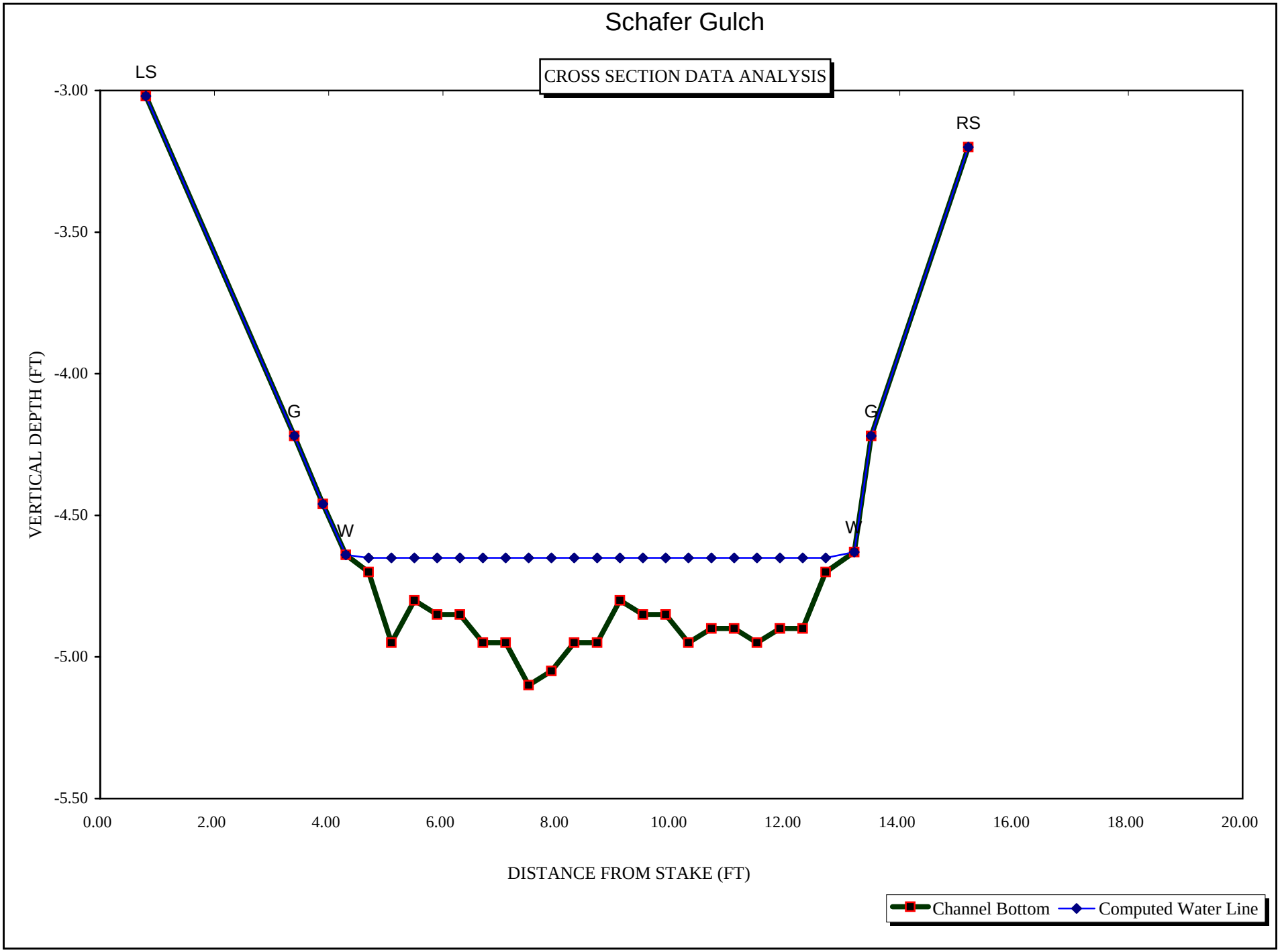
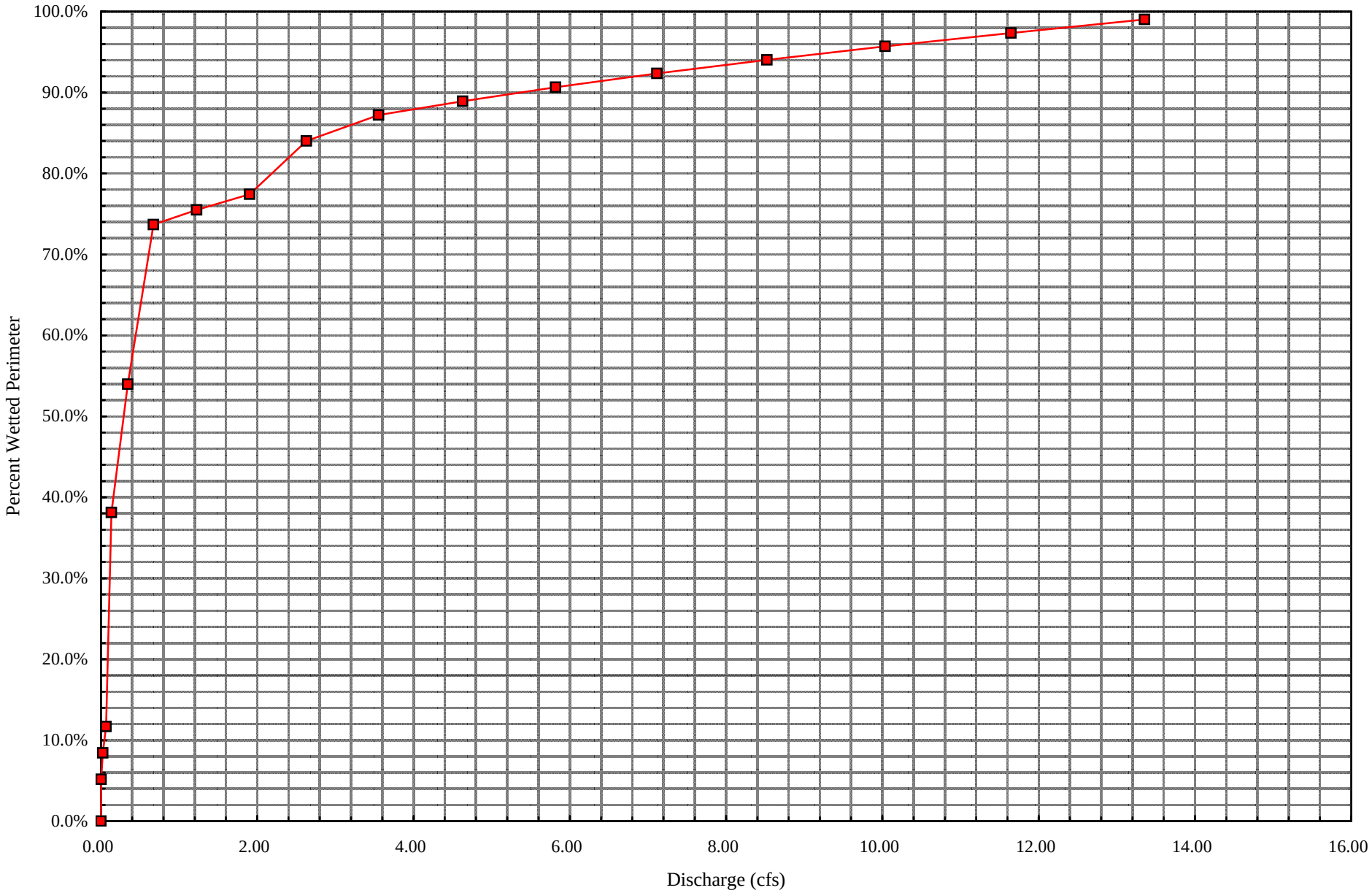
RECOMMENDATION BY: ……………………..………….…….............................. AGENCY..……………………….....……....…....…….…...... DATE:......…...…….......…………

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


Schafer Gulch
CROSS SECTION DATA ANALYSIS
LS
RS
G
G
W
W
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
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



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

LOCATION INFORMATION

STREAM NAME:	Schafer Gulch
XS LOCATION:	600 ft. u/s fr. Conf. w/ N. Fk. Henson Ck.
XS NUMBER:	2
DATE:	10-Oct-07
OBSERVERS:	R. Smith, J. Roach
1/4 SEC:	NE
SECTION:	20
TWP:	43N
RANGE:	6W
PM:	NM
COUNTY:	Hinsdale
WATERSHED:	Lake Fork Gunnison
DIVISION:	4
DOW CODE:	42228
USGS MAP:	Handies Peak 7.5'
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:	0.026

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

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

STREAM NAME: Schafer Gulch
XS LOCATION: 600 ft. u/s fr. Conf. w/ N. Fk. Henson 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
	LS	0.00	5.40			0.00		0.00	0.00	0.0%
1	G	1.70	5.63			0.00		0.00	0.00	0.0%
		2.10	6.04			0.00		0.00	0.00	0.0%
		4.00	6.10			0.00		0.00	0.00	0.0%
		5.90	6.11			0.00		0.00	0.00	0.0%
	W	6.80	6.34			0.00		0.00	0.00	0.0%
		7.20	6.50	0.15	0.03	0.43	0.15	0.06	0.00	0.1%
		7.60	6.40	0.05	0.00	0.41	0.05	0.02	0.00	0.0%
		8.00	6.45	0.10	0.00	0.40	0.10	0.04	0.00	0.0%
		8.40	6.65	0.30	1.25	0.45	0.30	0.12	0.15	5.5%
		8.80	6.75	0.40	1.43	0.41	0.40	0.16	0.23	8.4%
		9.20	6.90	0.55	1.55	0.43	0.55	0.22	0.34	12.5%
		9.60	6.85	0.50	0.70	0.40	0.50	0.20	0.14	5.1%
		10.00	6.85	0.50	1.17	0.40	0.50	0.20	0.23	8.6%
		10.40	6.75	0.45	2.80	0.41	0.45	0.18	0.50	18.5%
		10.80	6.70	0.40	2.80	0.40	0.40	0.16	0.45	16.4%
		11.20	6.75	0.45	1.75	0.40	0.45	0.18	0.32	11.5%
		11.60	6.45	0.15	1.78	0.50	0.15	0.06	0.11	3.9%
		12.00	6.50	0.20	1.62	0.40	0.20	0.08	0.13	4.7%
		12.40	6.50	0.20	1.01	0.40	0.20	0.08	0.08	3.0%
		12.80	6.45	0.15	0.49	0.40	0.15	0.06	0.03	1.1%
		13.20	6.40	0.10	0.37	0.40	0.10	0.04	0.01	0.5%
		13.60	6.35	0.05	0.25	0.40	0.05	0.03	0.01	0.2%
	W	14.20	6.30			0.60		0.00	0.00	0.0%
		15.50	6.11			0.00		0.00	0.00	0.0%
		16.70	5.88			0.00		0.00	0.00	0.0%
1	G	17.00	5.63			0.00		0.00	0.00	0.0%
	RS	18.00	5.56			0.00		0.00	0.00	0.0%
	TOTALS ----------					7.67	0.55 (Max.)	1.89	2.73	100.0%

Manning's n = 0.0649
Hydraulic Radius= 0.245790224

STREAM NAME: Schafer Gulch
XS LOCATION: 600 ft. u/s fr. Conf. w/ N. Fk. Henson Ck.
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.89	1.91	1.2%
6.07	1.89	4.15	120.4%
6.09	1.89	3.91	107.4%
6.11	1.89	3.69	95.5%
6.13	1.89	3.50	85.5%
6.15	1.89	3.31	75.6%
6.17	1.89	3.13	66.0%
6.19	1.89	2.95	56.6%
6.21	1.89	2.78	47.5%
6.23	1.89	2.61	38.5%
6.25	1.89	2.45	29.8%
6.27	1.89	2.29	21.4%
6.28	1.89	2.21	17.2%
6.29	1.89	2.13	13.1%
6.30	1.89	2.06	9.1%
6.31	1.89	1.98	5.1%
6.32	1.89	1.91	1.2%
6.33	1.89	1.84	-2.6%
6.34	1.89	1.77	-6.3%
6.35	1.89	1.70	-9.9%
6.36	1.89	1.63	-13.5%
6.37	1.89	1.56	-17.0%
6.39	1.89	1.44	-23.8%
6.41	1.89	1.31	-30.4%
6.43	1.89	1.20	-36.6%
6.45	1.89	1.09	-42.3%
6.47	1.89	0.99	-47.4%
6.49	1.89	0.90	-52.1%
6.51	1.89	0.83	-56.0%
6.53	1.89	0.76	-59.5%
6.55	1.89	0.70	-63.0%
6.57	1.89	0.63	-66.5%

WATERLINE AT ZERO
AREA ERROR = 6.323

STREAM NAME: Schafer Gulch
XS LOCATION: 600 ft. u/s fr. Conf. w/ N. Fk. Henson 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	5.63	15.30	0.69	1.27	10.59	15.90	100.0%	0.67	29.82	2.82
	5.67	15.21	0.65	1.23	9.93	15.77	99.2%	0.63	26.93	2.71
	5.72	15.10	0.61	1.18	9.17	15.62	98.3%	0.59	23.74	2.59
	5.77	14.99	0.56	1.13	8.42	15.47	97.3%	0.54	20.72	2.46
	5.82	14.88	0.52	1.08	7.67	15.33	96.4%	0.50	17.86	2.33
	5.87	14.77	0.47	1.03	6.93	15.18	95.5%	0.46	15.18	2.19
	5.92	14.49	0.43	0.98	6.20	14.87	93.5%	0.42	12.78	2.06
	5.97	14.18	0.39	0.93	5.48	14.53	91.4%	0.38	10.57	1.93
	6.02	13.87	0.34	0.88	4.78	14.20	89.3%	0.34	8.55	1.79
	6.07	12.54	0.33	0.83	4.11	12.86	80.9%	0.32	7.11	1.73
	6.12	9.46	0.38	0.78	3.56	9.77	61.4%	0.36	6.71	1.88
	6.17	8.92	0.35	0.73	3.10	9.22	58.0%	0.34	5.53	1.79
	6.22	8.38	0.32	0.68	2.67	8.67	54.5%	0.31	4.49	1.68
	6.27	7.84	0.29	0.63	2.26	8.12	51.1%	0.28	3.56	1.57
WL	6.32	7.19	0.26	0.58	1.88	7.46	46.9%	0.25	2.78	1.48
	6.37	6.53	0.24	0.53	1.54	6.79	42.7%	0.23	2.12	1.37
	6.42	5.73	0.22	0.48	1.23	5.97	37.5%	0.21	1.59	1.29
	6.47	4.52	0.22	0.43	0.98	4.73	29.8%	0.21	1.26	1.29
	6.52	3.36	0.23	0.38	0.79	3.52	22.2%	0.22	1.07	1.36
	6.57	3.19	0.19	0.33	0.62	3.33	20.9%	0.19	0.75	1.21
	6.62	3.02	0.15	0.28	0.47	3.13	19.7%	0.15	0.48	1.04
	6.67	2.81	0.11	0.23	0.32	2.89	18.2%	0.11	0.27	0.85
	6.72	2.17	0.09	0.18	0.19	2.23	14.0%	0.09	0.14	0.72
	6.77	1.45	0.07	0.13	0.10	1.48	9.3%	0.07	0.07	0.63
	6.82	1.11	0.04	0.08	0.04	1.13	7.1%	0.04	0.02	0.40
	6.87	0.29	0.01	0.03	0.00	0.29	1.8%	0.01	0.00	0.20

STREAM NAME: Schafer Gulch
XS LOCATION: 600 ft. u/s fr. Conf. w/ N. Fk. Henson Ck.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.73	cfs
CALCULATED FLOW (Qc)=	2.78	cfs
(Qm-Qc)/Qm * 100 =	-1.9	%
MEASURED WATERLINE (WLm)=	6.32	ft
CALCULATED WATERLINE (WLc)=	6.32	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.58	ft
(Dm-Dc)/Dm * 100	-4.9	%
MEAN VELOCITY=	1.48	ft/sec
MANNING'S N=	0.065	
SLOPE=	0.026	ft/ft
.4 * Qm =	1.1	cfs
2.5 * Qm=	6.8	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
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_____	_____
_____	_____
_____	_____
_____	_____

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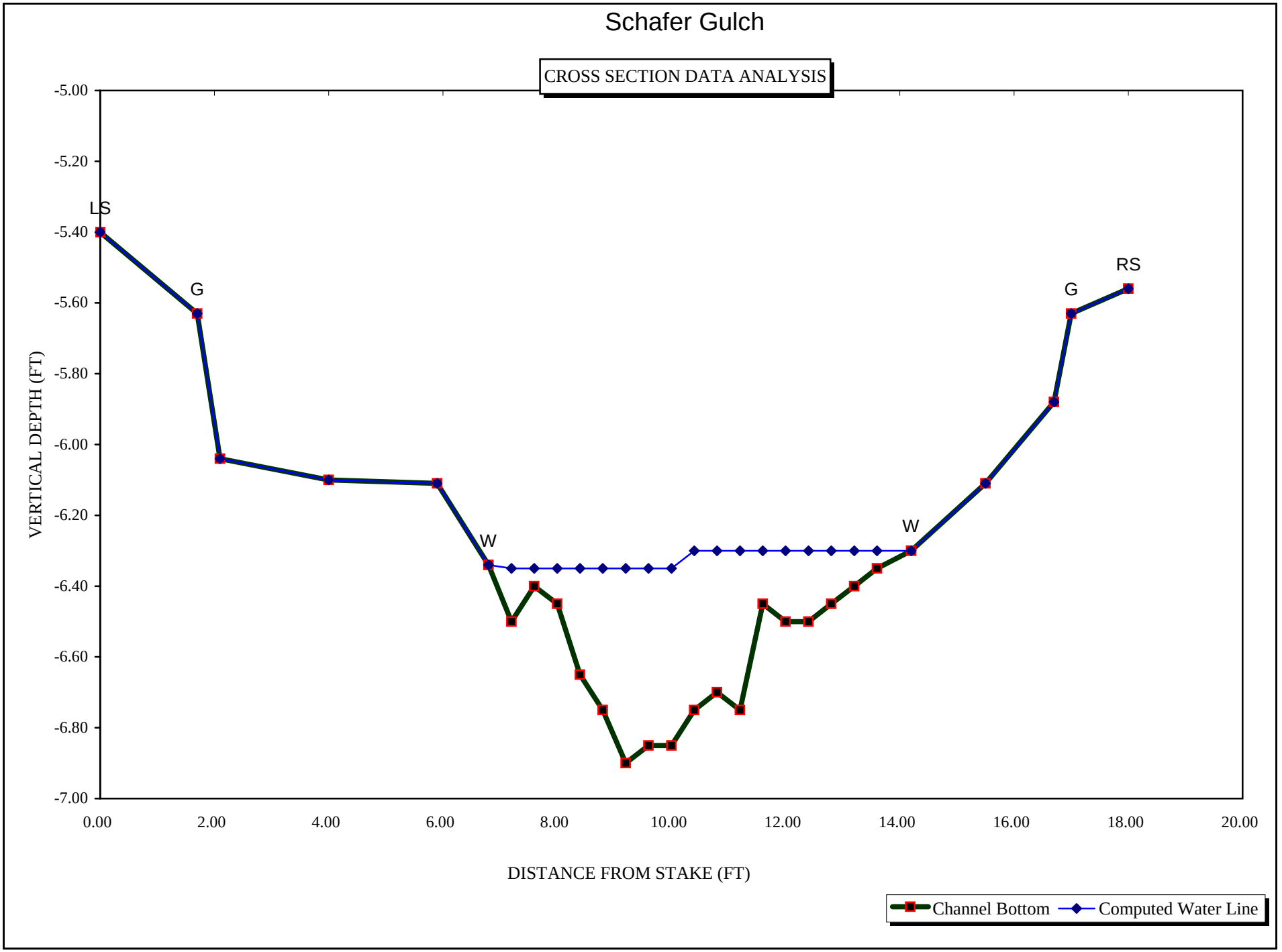
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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

Schafer Gulch



Percent Wetted Perimeter vs. Discharge