DRAFT INSTREAM FLOW RECOMMENDATION

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 increase to existing instream flow water rights on portions of the Slate River, located in Water Division 4. This is an atypical instream flow recommendation from BLM, because BLM owns and manages only a very small portion of the river. BLM's rationale for the instream flow recommendation is explained below.

One of the missions assigned to BLM by the U.S. Congress is to manage public lands in historical mining districts, and to facilitate community-based efforts to remediate water quality impacts from historic mining activities. Pursuant to this mission, BLM and multiple other partners have worked to address acid mine drainage impacts associated with the historic mining district in the upper Slate River watershed. These partners include other federal and state agencies, nonprofit groups, private companies, and private landowners.

Within the Slate River watershed, metamorphic formations have been historically mined for silver, zinc, lead, copper, and gold ores. Most of the mining has occurred on privately-held patents. The historic mining was concentrated in Redwell Basin (tributary to Oh-Be-Joyful Creek) and Poverty Gulch, a large tributary to the Slate River. The most conspicuous features of this historic mining are large waste rock piles and open adits with acid discharge as low as 2.3 pH. As a result of these discharges, the Colorado Department of Public Health and Environment has placed the Slate River of the 303(d) list for excessive concentrations of cadmium and zinc.

Projects implemented by the partnership within the Slate River watershed have included extensive characterization of water quality and heavy metal pollution sources within the watershed, a seven-acre wetland and upland restoration project near Gunsight Bridge, installation of J-hooks in the stream channel on private lands to improve aquatic habitat, reinforcement of headgate locations to prevent erosion, installation of root wads along the riverbank at the confluence of Slate River and Coal Creek, and installation of a fence to keep cattle away from sensitive areas around the confluence of Slate River and Coal Creek. The Upper Slate River Committee of the Coal Creek Watershed Coalition is developing a watershed management plan for the area in coordination with BLM and other agencies. The plan will be completed during 2013.

Once the water quality of impaired streams is sufficiently improved to be able to remove serious limitations on the abundance and diversity of aquatic life, that achievement can be comprised by new diversions that divert clean water necessary for dilution of heavy metals and maintenance of pH levels. BLM has worked with partners and private landowners in the Slate River watershed to

obtain support for instream flow water rights that will help ensure the flows necessary to maintain the improving natural environment in the Slate River Creek. These partners have asked BLM to take the lead in making an instream flow recommendation for the river to the Colorado Water Conservation Board.

The details of BLM's instream flow recommendation are outlined in the attachment to this letter. Data sheets, R2Cross output, fishery survey information, and photographs of the cross sections were included with BLM's draft recommendation in February 2013. If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940. We thank both the Division of Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

Sincerely,

Leigh Espy
Deputy State Director
Resources and Fire

Cc: Brian St. George, Gunnison Field Office
Andrew Breibart, Gunnison Field Office
Valori Armstrong, Southwest District

Enclosure

ENCLOSURE - DRAFT INSTREAM FLOW RECOMMENDATION FOR SLATE RIVER

Location and Land Status. The Slate River originates near Purple Mountain, approximately 10 miles northwest of Crested Butte, and flows into the East River at Crested Butte South. This recommendation covers two stream reaches. The first reach begins at the confluence with Poverty Gulch and terminates at the confluence with Oh Be Joyful Creek. The second reach begins at the confluence with Oh Be Joyful Creek and terminates at the confluence with Coal Creek.

The first stream reach covers a distance of approximately 4.1 miles. Within the first reach, 1.0 miles are managed by the BLM, 2.0 miles are managed by the U.S. Forest Service, and 1.1 miles are in private ownership.

The second reach covers a distance of approximately 5.4 miles. Within the second reach, 0.8 miles are managed by the BLM, and 4.6 miles are in private ownership.

Existing Instream Flow Water Rights. The CWCB currently holds the following water rights on these two stream reaches:

- Poverty Gulch to Oh Be Joyful Creek – 15.0 cfs, April 1 to November 30; 8.0 cfs December 1 to March 31

- Oh Be Joyful Creek to Coal Creek – 20 cfs, April 1 to November 30; 10 cfs December 1 to March 31

Biological Summary. Above Oh Be Joyful Creek, the Slate River is a moderate gradient stream flowing through a canyon where bedrock restricts movement of the channel. Below Oh Be Joyful Creek, the creek flows through a wider valley with lower gradient. This environment allows the stream to migrate more freely and create locations with a braided stream channel. The river carries a heavy load of large diameter sediments, due to natural erosional processes that occur in this type of metamorphic geology. In both reaches, the substrate is generally moderate in size, ranging from gravels up to cobbles eight inches in diameter.

Fishery surveys have revealed self-sustaining populations of brook trout and brown trout, with individuals up to 20 inches in length. Although fish distribution data is lacking before the 1970s, wild trout have been documented since that time. Colorado Parks and Wildlife have historically stocked the river with 10-inch rainbow trout, but limited fish numbers available for stocking resulted in the termination of stocking in 1994. Some portions of the recommended instream flow reaches have numbers and biomass that are similar to other streams in this area. However, other portions of the recommended segments have reduced habitat available and fish numbers because of the high bed load transport in this watershed, which results in poor pool development.

Comprehensive macroinvertebrate surveys have been performed on both reaches. Compared to other streams in the Southern Rocky Mountains ecoregion, the surveys revealed an above average

abundance of macroinvertebrates in the Slate River, but below average diversity. This is to be expected in a river system that is affected by excessive heavy metal concentrations. The surveys also revealed that the river is populated exclusively by taxa that are intolerant of other forms of water pollution, such as sediments and organic pollution. This indicates that the watershed is in good condition except for contributions of heavy metals by historic mining activities.

In parts of the river confined by narrow canyons, the riparian community consists of a blue spruce and willow community. In parts of the river that flow through a wider river valley, the riparian community consists of various willow species, river birch, rushes, and sedges. The nonconsumptive water needs assessment performed by the Basin Roundtable identified this stream segment as having significant riparian communities worthy of protection.

R2Cross Analysis. BLM collected the following R2Cross data from the between Poverty Gulch and Oh Be Joyful 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)
09/29/2011 #2	9.7 cfs	56.7 feet	9.59 cfs	Out of range
09/29/2011 #3	9.3 cfs	48.1 feet	9.64 cfs	Out of range
06/07/2012 #1	78.7 cfs	50.2 feet	Out of range	45.52 cfs
06/07/2012 #2	76.9 cfs	55.2 feet	Out of range	55.47 cfs
		Averages:	9.62 cfs	50.5 cfs

BLM collected the following R2Cross data from the reach between Oh Be Joyful Creek and Coal 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)
09/29/2011 #1	13.4 cfs	72.8 feet	Out of range	Out of range
09/29/2011 #4	13.7 cfs	53.6 feet	20.2 cfs	21.53 cfs
06/08/2012 #1	151.0 cfs	56.7 feet	Out of range	65.86 cfs
06/08/2012 #2	150.6 cfs	72.8 feet	Out of range	96.11 cfs
		Averages:	20.2 cfs	61.16 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:

<u>First Reach – Poverty Gulch to Oh Be Joyful Creek</u>

> 50.5 cubic feet per second is recommended during the snowmelt runoff period between May 1 and July 15. Protecting this flow rate would require an increase of

35.5 cfs between May 1 and July 15. This recommendation is driven by the average depth criteria. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff flows are available. In addition, protection of a higher flow rate will help scour fine sediments from important spawning areas.

BLM recommends that the current instream flow water right of 15 cfs remain unchanged for the period between April 1 and April 30, and for the period between July 16 and November 30. BLM also recommends that the current instream flow water right of 8.0 cfs for the period between December 1 and March 31 remain unchanged. The current instream flow water right for these periods appears to accurately reflect the limited water availability during these times.

Second Reach – Oh Be Joyful Creek to Coal Creek

61.0 cubic feet per second is recommended during the snowmelt runoff period between May 1 and July 15. Protecting this flow rate would require an increase of 41.0 cfs between May 1 and July 15. This recommendation is driven by the average depth criteria. The river experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff flows are available. In addition, protection of a higher flow rate will help scour fine sediments from important spawning areas.

BLM recommends that the current instream flow water right of 20.0 cfs remain unchanged for the period between April 1 and April 30, and for the period between July 16 and November 30. BLM also recommends that the current instream flow water right of 10.0 cfs for the period between December 1 and March 31 remain unchanged. The current instream flow water right for these periods appears to accurately reflect the limited water availability during these times.

Water Availability. Although there is no gage data available for the two recommended stream reaches, USGS gage 09111500 (Slate River near Crested Butte, CO) is located a few miles downstream. This stream gage incorporates inflow from Coal Creek and Washington Gulch. BLM recommends that a gage apportionment analysis be performed. It is important to note that Coal Creek and Washington Gulch drain watersheds that are lower in elevation than the watersheds that drain into the proposed instream flow reaches. Accordingly, a strict basin apportionment will be likely to slightly underestimate flows in the proposed reaches of the Slate River. Given this limitation, BLM recommends also consulting the StreamStats package developed jointly between the U.S. Geological Survey and the CWCB.

BLM is aware of the following decreed water rights within the proposed instream flow reach between Poverty Gulch and Oh Be Joyful Creek:

- Berg Irrigation Ditch No. 1 – 1.5 cfs, 1976 priority
- Slate River Intake – 30 cfs conditional, 1996 priority

BLM is aware of the following decreed water right within the proposed instream flow reach between Oh Be Joyful Creek and Coal Creek:

- Peanut No. 1 and 2 Ditch – 2.67 cfs, 1894 and 1903 priorities

BLM recommends that CWCB consult the diversion records for these ditches, because it appears that the Berg Ditch has diverted infrequently. In addition, it appears that diversions into the Peanut No. 1 and 2 Ditch are significantly reduced after July.

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE | PRINT | PRINT | DONE

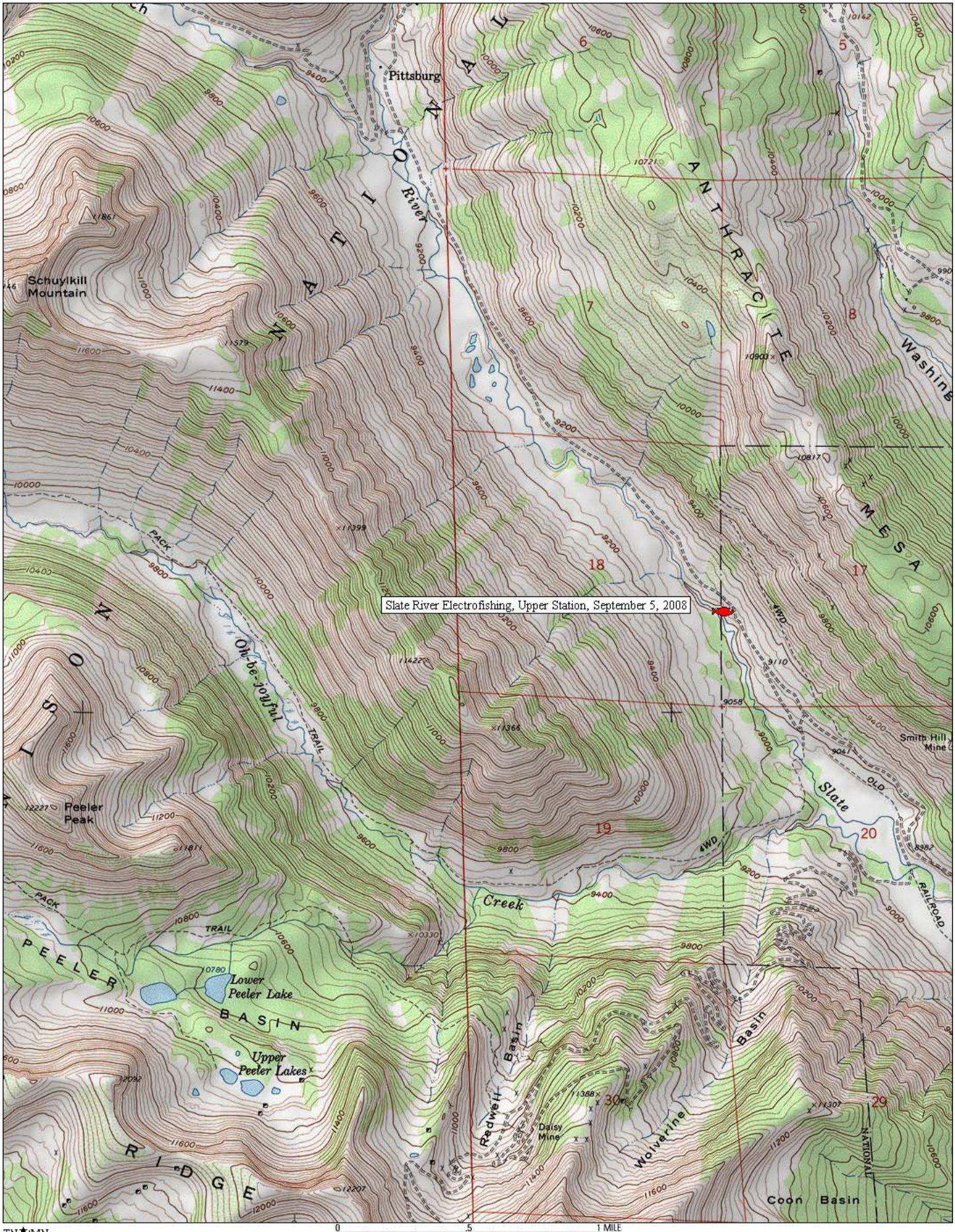
Water: **Slate River**
Date: 9/5/2008
Location: Above Confluence with Oh-Be-Joyful Creek
Drainage: Slate River
Water Code: 43116
Crew: Golder
Notes: Site sampled by Golder Associates
UTM Zone: 13T
UTM X: 323264
UTM Y: 4310128
Station Length (ft): 722
Station Width (ft): 18.0

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BRK	10	10	100	0.90	73	6	34	3	5	0
LOC	85	89	81	0.00	-12586	238660	-5768	109386	-482	9147
RBT	1	1	122	0.00	7	0	3	0	3	0

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BRK						1	1	1	1	2	2	2																			
LOC		4	6		10	26	15	13	7	5	2	1	3		2	1															
RBT																	1														



LJM-09-00

Golder Associates

First pass **BACKPACK ELECTROFISHING CATCH RECORD** Page 1 of 3

Proj./Task # _____ Proj. Title LJM Personnel JH, KK, CC

Date (d/m/y) 05-Sept-08 Stream/Waterbody Slate River Site Upper Slate

Location Description above confluence w OBJ

GPS UTM Coordinates: NAD____ Zone____ *Point Location*: E_____ N_____

Study Section: Upstream E wp016 N_____ Downstream E wp012 N_____

Time of Sampling: Start 9:50 Finish 10:20 Length of Stream Sampled 220 (m) Sampling Effort 826 (sec)

Equipment Type: __VII __12B ✓15D *Input Power*: Battery Voltage 24 (v) Generator Output _____(v)

Settings: P.O.W. Mode 12B Voltage 400 (v) Frequency 60 (Hz) Pulse Width 4 (ms)

~~*Output*: Voltage ____(v) Current ____(amp)~~

Support Data: Air Temp(°C) 18°C Cloud Cover(%) 1% Wind(dir/rate) South Precipitation None

Water Temp(°C) 12.86 D.O.(mg/L) 12.8 pH 8.22

Cond.(*u*S/cm) 0.134 Secchi Depth(m) ✓ Turbidity (NTU) _____

Species	# Captured				# Observed (not captured)				Total Combined #				Species
Code	Fry	Juv	Ad	Unk	Fry	Juv	Ad	Unk	Fry	Juv	Ad	Unk	Total

1st pass

Spp	Length (Fork)	Weight (g)
BRK	126	23
BRN	132	26
BRN	150	38
BRK	174	60
BRK	231	125
BRN	144	31
BRN	99	11
BRN	133	28
BRK	193	97
BRN	103	14
BRK	100	5
BRN	149	29
BRN	231	142
BRK	206	105
BRN	128	24
BRK	201	96
BRK	182	64
BRN	112	17
BRN	109	15
BRN	145	33
BRN	147	34
BRN	190	75
BRN	113	15
BRN	129	28
BRN	103	15
BRN	101	12
BRN	83	08
BRN	106	13
BRN	99	10
BRN	139	27
BRN	98	15
BRN	97	13
BRN	95	9

1st Paso

Spp	Length	Weight	
BRN	126	26	
BRN	104	15	
BRN	279	215	
BRN	249	185	
BRN	297	255	
BRN	201	96	missing ventral caudal
BRN	209	104	
BRN	126	23	
BRN	154	43	
BRN	171	50	
BRN	123	19	
BRK	139	34	
BRN	120	22	
BRN	136	32	
BRN	96	11	
BRN	127	25	
BRN	105	13	
BRN	88	10	

2nd Paso

Spp	Length	Weight	
RNB	314	354	
BRN	279	196	missing left eye
BRN	241	151	
BRK	221	114	
BRN	218	108	
BRN	188	81	
BRN	167	49	
	178	62	
	180	56	
	173	47	
	171	42	
	166	61	

Spp	length	Weight
BRN	154	33
	142	
	152	34
	162	43
	137	17
	146	32
	142	45
	95	8
	138	23
	106	21
	132	24
	97	11

Second Pass wp 012 downstream wp016 upstream

Golder Associates

BACKPACK ELECTROFISHING CATCH RECORD Page 3 of 3

Proj./Task # _____ Proj. Title LJM Personnel JH, KK, CC

Date (d/m/y) 05-Sept-08 Stream/Waterbody Slate River Site upper Slate

Location Description Above confluence w LJM

GPS UTM Coordinates: NAD____ Zone____ *Point Location*: E_____ N_____

Study Section: Upstream E_____ N_____ Downstream E_____ N_____

wp016 wp012

Time of Sampling: Start_____ Finish_____ Length of Stream Sampled _____(m) Sampling Effort 1119 (sec)

Equipment Type: __VII __12B __15D *Input Power*: Battery Voltage _____(v) Generator Output _____(v)

Settings: P.O.W. Mode _____ Voltage ____(v) Frequency _____ (Hz) Pulse Width ____ (ms)

Output: Voltage _____(v) Current _____(amp)

Support Data: Air Temp(°C) _____ Cloud Cover(%) _____ Wind(dir/rate) _____ Precipitation_____

Water Temp(°C) _____ D.O.(mg/L) _____ pH _____

Cond.(*u*S/cm) _____ Secchi Depth(m) _____ Turbidity (NTU) _____

Species	# Captured				# Observed (not captured)				Total Combined #				Species
Code	Fry	Juv	Ad	Unk	Fry	Juv	Ad	Unk	Fry	Juv	Ad	Unk	Total

3 of 3 2nd pass

Spp	length	Weight
BRN	100	6
BRN	99	6
BRN	132	22
BRN	103	
BRN	99	8
BRN	128	20
BRN	121	15
BRN	118	13
BRN	112	13
BRN	102	10
BRN	119	16
BRN	106	12
BRN	105	12
BRN	102	10
BRN	94	8
BRN	89	9
BRN	106	13
BRN	99	9
BRN	103	12
BRN	91	7
BRN	95	6
BRN	52	
BRN	51	
BRN	84	7
BRN	36	
	37	
	45	

Spp.	Len.	wt.
BRN	32	
BRN	47	
BRN	43	
BRN	33	
BRN	47	

Water: **Slate River**

Date: 9/28/2005

Location: Trampy's property below HW135 bridge

Drainage: East River

Water Code: 43116

Crew: Dan Brauch, Chris Blencowe, Doug Martin, Forest Service,

Notes

UTM Zone: 13

UTM X: 328576

UTM Y: 4304651

Station Length (ft): 525

Station Width (ft): 46.8

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE | PRINT | PRINT | DONE

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BRK	1	1	110	0.00	10	0	2	0	1	0
FMW	0	0	46	1.00	NaN	NaN	NaN	NaN	NaN	NaN
KOK	7	10	0	0.67	77	58	14	10	21	16
LOC	63	89	100	0.17	2267	6171	400	1088	106	287

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BRK												1																			
FMW			1																												
KOK																				2	4	1		2							
LOC			10	35	6	9	25	18	14	5	3	4			1	1		1	2	5	1		1		1						

Water **Slate River**

Location Below Gunsight Bridge

Drainage Gunnison

Crew Dan Brauch, Paul, Chris Blencowe, Christine, David, Lynn"

Notes

Walk - Shock

Date 9/26/2005

Water Code 43116

UTM Zone 13

UTM X 328576

UTM Y 4304651

Station Length (ft) 450

Station Width (ft) 36.0

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE PRINT PRINT DONE

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BRK	23	28	110	0.96	270	6	62	1	3	0
LOC	58	72	81	0.63	789	174	181	40	15	3

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BRK			10	26	6	4	13	6	1																						
LOC			4		3	22	12	12	5		1			1	1				1												

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE | PRINT | PRINT | DONE

Water: **Slate River**
Location: Oh-Be-Joyful Campground
Drainage: Gunnison
Crew: Brauch, Fresques, Brooks, Morris"
Notes: 3 Backpack shockers (2 15D, 1 LR24). "

Date: 6/27/2012
Water Code: 43116
UTM Zone: 13s
UTM X: 323916
UTM Y: 4308931
Station Length (ft): 450
Station Width (ft): 22.5

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BRK	40	54	114	0.83	482	38	177	14	15	1
LOC	34	46	89	0.65	452	118	166	43	23	6

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BRK				2	7	4	14	12	7	4	2																				
LOC				14	4	11	5	4	3	4			2	1		1					1										

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE | PRINT | PRINT | DONE

Water: **Slate River**
Location: Upstream Oh-Be-Joyful campground
Drainage: Gunnison
Crew: Brauch, Fresques, Brooks, Morris"
Notes: 3 Backpack shockers (2 15D, 1 LR24). Series of pools created by LWD"

Date: 6/27/2012
Water Code: 43116
UTM Zone: 13s
UTM X: 323657
UTM Y: 4309234
Station Length (ft): 204
Station Width (ft): 26.0

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BRK	5	25	114	0.80	129	50	41	16	6	2
LOC	15	75	102	0.77	405	87	129	28	58	12

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BRK								1	1	2	1																				
LOC				7	3	4	1	2	2	1	2					1					1					1					

Aquatic Invertebrate Report For Samples Collected By BLM - CO - Gunnison Field Office

Report prepared for:
Andrew Breibart
BLM - CO - Gunnison Field Office
216 N. Colorado St.
Gunnison, CO 81230
andrew_breibart@blm.gov

Report prepared by:
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U.S.D.I. Bureau of Land Management
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17 March 2011

Sampling Locations

Table 1. Sampling site locations

Station	Location	Latitude	Longitude	Elevation (meters)
385428107128	Slate River below Oh-Be Joyful Creek, Gunnison County, Colorado	38.908	-107.025	2726
385438107154	Oh-Be-Joyful Creek, Gunnison County, Colorado	38.911	-107.032	2733
385443107154	Slate River below BLM Campground, Gunnison County, Colorado	38.912	-107.032	2736
385453107124	Slate River above campground, Gunnison County, Colorado	38.915	-107.035	2744

Methods

Field sampling

Samples were collected on September 30, 2010 (Table 2). Aquatic invertebrates were collected quantitatively from all available habitats with a Surber net with a 500 micron mesh net.

Laboratory methods

General procedures for processing invertebrate samples were similar to those recommended by the United States Geological Survey (Cuffney et al. 1993) and are described in greater detail and rationalized in Vinson and Hawkins (1996). Samples were sub-sampled if the sample appeared to contain more than 600 organisms. Sub-samples were obtained by pouring the sample into an appropriate diameter 500 micron sieve, floating this material by placing the sieve within an enamel pan partially filled with water and leveling the material within the sieve. The sieve was then removed from the water pan and the material within the sieve was divided into two equal parts. One half of the sieve was then randomly chosen to be processed and the other half set aside. The sieve was then placed back in the enamel pan and the material in the sieve again leveled and split in half. This process was repeated until approximately 600 organisms remained in one-half of the sieve. This material was placed into a Petri dish and all organisms were removed under a dissecting microscope at 10-30 power. Additional sub-samples were taken until at least 600 organisms were removed, All organisms within a sub-sample were removed, and separated into taxonomic Orders. When the sorting of the sub-samples was completed, the entire sample was spread throughout a large white enamel pan and searched for 10 minutes to remove any taxa that might not have been picked up during the initial sample sorting process. The objective of this "big/rare" search was to provide a more complete taxa list by finding rarer taxa that may have been excluded during the sub-sampling process. These rarer bugs were placed into a separate vial and the data entered separately from the bugs removed during the sub-sampling process. All the organisms removed during the sorting process were then identified using appropriate identification keys (see literature cited list for list of taxonomic resources used). Once the data had been entered into a computer and checked, the unsorted portion of the sample was discarded. The identified portion of the sample was placed in a 20 ml glass scintillation vial with polypropylene lids in 70% ethanol, given a catalog number, and retained. In this report, metrics were calculated using data from the sub-sampled and big/rare portions of the sample. Abundance data are presented as the estimated number of individuals per square meter for quantitative samples and the estimated number per sample for qualitative samples.

Table 2. Field comments and laboratory processing information.

Sample	Station	Sampling Date	Habitat Sampled	Sampling Method	Sampling Area Sqmts	% of sample processed	Number of individuals identified	Field Comments
144553	385438107154	09/30/2010	Riffle	Surber net	0.09	100	364	
144554	385443107154	09/30/2010	Riffle	Surber net	0.09	100	112	
144555	385453107124	09/30/2010	Riffle	Surber net	0.09	100	184	
144556	385428107128	09/30/2010	Riffle	Surber net	0.09	100	441	

Data summarization

A number of metrics or ecological summaries can be calculated from an aquatic invertebrate sample. A summary and description of commonly used metrics is available in Barbour et al. (1999, http://www.epa.gov/owow/monitoring/rbp/index.html#Table%20of%20Contents) and Karr and Chu (1998). Both of these publications suggest use of the following metrics for assessing the health of aquatic invertebrate assemblages: Total taxa richness, EPT taxa richness, Ephemeroptera taxa richness, Plecoptera taxa richness, Trichoptera taxa richness, % EPT abundance, % Ephemeroptera abundance, % Chironomidae abundance, Intolerant taxa richness, % tolerant organisms, Hilsenhoff Biotic Index, % contribution of the dominant taxon, clinger taxa richness, % clinger abundance, % collector-filterer abundance, and the % scraper abundance. Assessments are best made by comparing samples to samples collected similarly at reference sites or from samples collected prior to impacts or management actions at a location. In this report, the following metrics were calculated for each sample.

Taxa richness - Richness is a component and estimate of community structure and stream health based on the number of distinct taxa. Taxa richness normally decreases with decreasing water quality. In some situations organic enrichment can cause an increase in the number of pollution tolerant taxa. Taxa richness was calculated for operational taxonomic units (OTUs) and the number of unique genera, and families. The values for operational taxonomic units may be overestimates of the true taxa richness at a site if individuals were the same taxon as those identified to lower taxonomic levels or they may be underestimates of the true taxa richness if multiple taxa were present within a larger taxonomic grouping but were not identified. All individuals within all samples were generally identified similarly, so that comparisons in operational taxonomic richness among samples within this dataset are appropriate, but comparisons to other data sets may not. Comparisons to other datasets should be made at the genera or family level.

Abundance - The abundance, density, or number of aquatic macroinvertebrates per unit area is an indicator of habitat availability and fish food abundance. Abundance may be reduced or increased depending on the type of impact or pollutant. Increased organic enrichment typically causes large increases in abundance of pollution tolerant taxa. High flows, increases in fine sediment, or the presence of toxic substances normally cause a decrease in invertebrate abundance. Invertebrate abundance is presented as the number of individuals per square meter for quantitative samples and the number of individuals collected in each sample for qualitative samples.

EPT - A summary of the taxonomic richness and abundance within the insect Orders Ephemeroptera, Plecoptera, and Trichoptera (EPT). These orders are commonly considered sensitive to pollution (Karr and Chu 1998).

Percent contribution of the dominant family or taxon - An assemblage largely dominated (>50%) by a single taxon or several taxa from the same family suggests environmental stress. Habitat conditions likely limit the number of taxa that can occur at the site.

Shannon diversity index - Ecological diversity is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundances. The Shannon diversity index was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. The calculations were made following Ludwig and Reynolds (1988, equation 8.9, page 92).

Evenness - Evenness is a measure of the distribution of taxa within a community. The evenness index used in this report was calculated following Ludwig and Reynolds (1988, equation 8.15, page 94). Value ranges from 0-1 and approach zero as a single taxa becomes more dominant.

Clinger taxa - The number of clinger taxa have been found by Karr and Chu (1998) to respond negatively to human disturbance. Clinger taxa were determined using information in Merritt et al. (2008). These taxa typically cling to the tops of rocks and are thought to be reduced by sedimentation or abundant algal growths.

Long-live taxa - The number of long-lived taxa was calculated the number of taxa collected that typically have 2-3 year life cycles. Disturbances and water quality and habitat impairment typically reduces the number of long-lived taxa Karr and Chu (1998). Life-cycle length determinations were based on information in Merritt et al. (2008).

Biotic indices - Biotic indices use the indicator taxa concept. Taxa are assigned water quality tolerance values based on their tolerance to pollution. Scores are typically weighted by taxa relative abundance. In the United States the most commonly used biotic index is the Hilsenhoff Biotic Index (Hilsenhoff 1987, Hilsenhoff 1988). The USFS and BLM

throughout the western United States have also frequently used the USFS Community Tolerance Quotient.

Hilsenhoff biotic index - The Hilsenhoff Biotic Index (HBI) summarizes the overall pollution tolerances of the taxa collected. This index has been used to detect nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts. It is best at detecting organic pollution. Families were assigned an index value from 0- taxa normally found only in high quality unpolluted water, to 10- taxa found only in severely polluted waters. Family level values were taken from Hilsenhoff (1987, 1988) and a family level HBI was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. Sampling locations with HBI values of 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched, and 7-10 polluted. Rather than using mean HBI values for a sample, taxon HBI values can also be used to determine the number of pollution intolerant and tolerant taxa occurring at a site. In this report, taxa with HBI values $\leq$ 2 were considered intolerant clean water taxa and taxa with HBI values $\geq$ 8 were considered pollution tolerant taxa. The number of tolerant and intolerant taxa and the abundances of tolerant and intolerant taxa were calculated for each sampling location.

USFS community tolerant quotient - Taxa are assigned a tolerant quotient (TQ) from 2 - taxa found only in high quality unpolluted water, to 108 - taxa found in severely polluted waters. TQ values were developed by Winget and Mangum (1979). The dominance weighted community tolerance quotient (CTQd) was calculated. Values can vary from about 20 to 100, in general the lower the value the better the water quality.

Functional feeding group measures - A common classification scheme for aquatic macroinvertebrates is to categorize them by feeding acquisition mechanisms. Categories are based on food particle size and food location, e.g., suspended in the water column, deposited in sediments, leaf litter, or live prey. This classification system reflects the major source of the resource, either within the stream itself or from riparian or upland areas and the primary location, either erosional or depositional habitats. The number of taxa and individuals of the following feeding groups were calculated for each sampling location. Functional feeding group designations were from Merritt et al. (2008).

Shredders - Shredders use both living vascular hydrophytes and decomposing vascular plant tissue - coarse particulate organic matter. Shredders are sensitive to changes in riparian vegetation. Shredders can be good indicators of toxicants that adhere to organic matter.

Scrapers - Scrapers feed on periphyton - attached algae and associated material. Scraper populations increase with increasing abundance of diatoms and can decrease as filamentous algae, mosses, and vascular plants increase, often in response to increases in nitrogen and phosphorus. Scrapers decrease in relative abundance in response to sedimentation and higher levels of organic pollution or nutrient enrichment.

Collector-filterers - Collector-filterers feed on suspended fine particulate organic matter. Collector-filterers are sensitive to toxicants in the water column and to pollutants that adhere to organic matter.

Collector-gatherers - Collector-gatherers feed on deposited fine particulate organic matter. Collector-gatherers are sensitive to deposited toxicants.

Predators - Predators feed on living animal tissue. Predators typically make up about 25% of the assemblage in stream environments and 50% of the assemblage in still-water environments.

Unknown feeding group - This category includes taxa that are highly variable, parasites, and those that for which the primary feeding mode is currently unknown.

Results

Abundance data and taxa richness are reported as the estimated number of individuals per square meter for quantitative samples and the number per sample for qualitative samples. NC = Not calculated. * = unable to calculate. EPT = totals for the insect orders, Ephemeroptera, Plecoptera, Trichoptera. QL = qualitative sample.

Sample	Sampling date	Station	Total abundance	EPT abundance	Dominant family	% contribution dominant family
144553	09/30/2010	385438107154	3918	3757	Baetidae	72.54
144554	09/30/2010	385443107154	2411	2347	Taeniopterygidae	31.23
144555	09/30/2010	385453107124	3961	3811	Heptageniidae	38.05
144556	09/30/2010	385428107128	4747	4252	Baetidae	75.96
Mean			3759.3	3541.8		54.44

Diversity indices

Sample	Sampling Date	Station	Total taxa richness	Total genera richness	Total family richness	EPT taxa richness	Shannon diversity index	Evenness
144553	09/30/2010	385438107154	19	9	14	14	1.700	0.580
144554	09/30/2010	385443107154	13	7	10	10	1.870	0.730
144555	09/30/2010	385453107124	18	9	14	14	2.160	0.750
144556	09/30/2010	385428107128	27	15	19	19	1.130	0.340
Mean			19.3	10.0	14.3	14.3	1.720	0.600

Genera richness by major taxonomic group.

Sample	Sampling Date	Station	Coleoptera	Diptera	Ephemerotpera	Heteroptera	Megaloptera	Odonata	Plecoptera	Trichoptera	Annelida	Custacea	Mollusca
144553	09/30/2010	385438107154	0	3	5	0	0	0	7	2	1	0	0
144554	09/30/2010	385443107154	0	3	4	0	0	0	6	0	0	0	0
144555	09/30/2010	385453107124	0	4	5	0	0	0	9	0	0	0	0
144556	09/30/2010	385428107128	1	3	9	0	0	0	7	3	0	0	0
Mean			**0.3**	**3.3**	**5.8**	**0.0**	**0.0**	0.0	**7.3**	**1.3**	0.3	**0.0**	**0.0**

Total abundance by major taxonomic group.

Sample	Sampling Date	Station	Coleoptera	Diptera	Ephemerotpera	Heteroptera	Megaloptera	Odonata	Plecoptera	Trichoptera	Annelida	Custacea	Mollusca
144553	09/30/2010	385438107154	0	140	3057	0	0	0	678	22	11	0	0
144554	09/30/2010	385443107154	0	65	1206	0	0	0	1141	0	0	0	0
144555	09/30/2010	385453107124	0	151	1830	0	0	0	1981	0	0	0	0
144556	09/30/2010	385428107128	22	420	3950	0	0	0	269	32	0	0	0
Mean			5.5	194.0	2510.8	0.0	0.0	0.0	1017.3	13.5	2.8	0.0	0.0

Biotic Indices

Sample	Sampling date	Station	Hilsenhoff Biotic Index		USFS Community CTQd
			Index	Indication	
144553	09/30/2010	385438107154	3.45	No apparent organic pollution	62
144554	09/30/2010	385443107154	2.83	No apparent organic pollution	47
144555	09/30/2010	385453107124	2.67	No apparent organic pollution	49
144556	09/30/2010	385428107128	3.89	Possible slight organic pollution	60
Mean			3.21		54.5

Taxa richness and relative abundance values with respect to tolerance or intolerance to pollution were based on the Hilsenhoff Biotic Index (HBI). Intolerant taxa have HBI score <= 2. Tolerant taxa have a HBI score >= 8. Data are presented as estimated count per square meter for quantitative samples and total number per sample for qualitative samples.

Sample	Sampling date	Station	Intolerant taxa				Tolerant Taxa			
			Richness		Abundance		Richness		Abundance	
144553	09/30/2010	385438107154	7	(37)	344	(9)	0	(0)	0	(0)
144554	09/30/2010	385443107154	6	(46)	1098	(46)	0	(0)	0	(0)
144555	09/30/2010	385453107124	9	(50)	1636	(41)	0	(0)	0	(0)
144556	09/30/2010	385428107128	11	(41)	312	(7)	0	(0)	0	(0)
Mean			8.3	(43)	847.5	(26)	0.0	(0)	0.0	(0)

Functional feeding groups

Taxa richness by functional feeding group. The percent of the total is shown in parentheses.

Sample	Sampling date	Station	Shredders		Scrapers		Collector-filterers		Collector-gatherers		Predators		Unknown	
144553	09/30/2010	385438107154	3	(16)	2	(11)	2	(11)	6	(32)	4	(21)	1	(5)
144554	09/30/2010	385443107154	3	(23)	2	(15)	0	(0)	3	(23)	4	(31)	0	(0)
144555	09/30/2010	385453107124	5	(28)	3	(17)	1	(6)	5	(28)	2	(11)	1	(6)
144556	09/30/2010	385428107128	3	(11)	5	(19)	2	(7)	6	(22)	8	(30)	1	(4)
Mean			3.5	(19)	3.0	(15)	1.3	(6)	5.0	(26)	4.5	(23)	0.8	(4)

Invertebrate abundance by functional feed group. The percent of the total is shown in parentheses.

Sample	Sampling date	Station	Shredders		Scrapers		Collector-filterers		Collector-gatherers		Predators		Unknown	
144553	09/30/2010	385438107154	237	(6)	43	(1)	86	(2)	3089	(79)	108	(3)	32	(1)
144554	09/30/2010	385443107154	840	(35)	151	(6)	0	(0)	1076	(45)	258	(11)	0	(0)
144555	09/30/2010	385453107124	1378	(35)	990	(25)	65	(2)	926	(23)	194	(5)	65	(2)
144556	09/30/2010	385428107128	118	(2)	194	(4)	22	(0)	4177	(88)	183	(4)	11	(0)
Mean			643.3	(20)	344.5	(9)	43.3	(1)	2317.0	(59)	185.8	(6)	27.0	(1)

The 10 metrics thought to be most responsive to human induced disturbance (Karr and Chu 1998).

Sample	Sampling Date	Station	Total taxa	Epheme-roptera taxa	Plecoptera taxa	Trichoptera taxa	Long-lived taxa	Intolerant taxa	Clinger taxa	% tolerant indi-viduals	% contribution dominant taxon	% predators
144553	09/30/2010	385438107154	19	3	2	2	2	7	6	0.00	44.51	2.76
144554	09/30/2010	385443107154	13	3	3	0	1	6	5	0.00	31.23	10.70
144555	09/30/2010	385453107124	18	3	4	0	1	9	7	0.00	26.08	4.90
144556	09/30/2010	385428107128	27	5	3	3	3	11	9	0.00	75.73	3.86
Mean			19.3	3.5	3.0	1.3	1.8	8.3	6.8	0.00	44.39	5.55

Taxonomic list and counts for 4 samples collected on September 30, 2010. Count is the total number of individuals identified and retained. Samples heading refers to the number of samples containing that taxon.

Order	Family	Subfamily/Genus/Species	Samples	Count
Phylum: Annelida				
Class: Clitellata	SubClass: Oligochaeta			
			1	1
Phylum: Arthropoda				
Class: Arachnida	SubClass: Acari			
Trombidiformes			1	1
Trombidiformes	Lebertiidae	Lebertia	1	1
Trombidiformes	Sperchonidae	Sperchon	1	2
Trombidiformes	Torrenticolidae	Torrenticola	2	2
Class: Insecta	SubClass: Pterygota			
Coleoptera	Elmidae		1	2
Diptera	Blephariceridae	Blephariceinae Blephariceini Bibiocephala	1	1
Diptera	Ceratopogonidae	Ceratopogoninae Sphaeromiini Probezzia	1	1
Diptera	Chironomidae	Chironominae	2	5
Diptera	Chironomidae	Orthocladiinae	4	42
Diptera	Chironomidae	Tanypodinae	2	2
Diptera	Simuliidae	Simuliinae Simuliini Simulium	2	10
Diptera	Tipulidae	Hexatoma	1	1
Ephemeroptera	Ameletidae	Ameletus	1	3
Ephemeroptera	Baetidae		2	171
Ephemeroptera	Baetidae		1	1
Ephemeroptera	Baetidae	Baetis	4	461
Ephemeroptera	Ephemerellidae		1	1
Ephemeroptera	Ephemerellidae	Drunella doddsii	4	6
Ephemeroptera	Heptageniidae		4	63
Ephemeroptera	Heptageniidae	Cinygmula	1	1
Ephemeroptera	Heptageniidae	Rhithrogena	4	84
Ephemeroptera	Leptophlebiidae		1	1
Plecoptera			3	7
Plecoptera	Capniidae	Capniinae	3	25
Plecoptera	Chloroperlidae	Chloroperlinae	4	53
Plecoptera	Chloroperlidae	Sweltsa	4	32
Plecoptera	Leuctridae		3	7
Plecoptera	Nemouridae	Zapada	1	1
Plecoptera	Perlidae	Hesperoperla pacifica	1	1
Plecoptera	Perlodidae	Megarcys signata	3	4
Plecoptera	Perlodidae	Perlodinae Perlodini Diura knowltoni	1	1
Plecoptera	Pteronarcyidae	Pteronarcyinae Pteronarcellini Pteronarcella	2	3
Plecoptera	Taeniopterygidae		4	99
Trichoptera	Brachycentridae	Brachycentrus americanus	1	1
Trichoptera	Hydropsychidae	Arctopsychinae Arctopsyche grandis	2	2
Trichoptera	Lepidostomatidae	Lepidostomatinae Lepidostoma	1	1
Trichoptera	Rhyacophilidae	Rhyacophila sibirica group A	1	1

Total: OTU Taxa : **38** Genera : **22** Families : **27** Individuals : **1101**

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Taxa Lists for Individual Samples

Taxonomic list and densities of aquatic invertebrates identified and retained from a sample collected September 30, 2010 at station 385438107154, Oh-Be-Joyful Creek, Gunnison county, Colorado. The sample was collected from riffle habitat using a surber net. The total area sampled was 0.093 square meters. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 364 individuals were removed, identified and retained. The sample identification number is 144553. OTU=operational taxonomic unit. Notes - identification to genus or species was not spported because: I - immature organisms, D- damaged organisms, M - poor slide mount, G - gender, U - indistint characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/Species	Life Stage	Density	Notes
Phylum: Annelida					
Class: Clitellata		SubClass: Oligochaeta			
			adult	10.76	
Phylum: Arthropoda					
Class: Arachnida		SubClass: Acari			
Trombidiformes	Torrenticolidae	Torrenticola	adult	10.76	
Class: Insecta		SubClass: Pterygota			
Diptera	Chironomidae	Chironominae	larvae	43.06	
Diptera	Chironomidae	Orthocladiinae	larvae	21.53	
Diptera	Simuliidae	Simuliinae Simuliini Simulium	larvae	37.67	
Ephemeroptera	Baetidae		larvae	1743.81	I
Ephemeroptera	Baetidae	Baetis	larvae	1097.95	
Ephemeroptera	Ephemerellidae	Drunella doddsii	larvae	10.76	
Ephemeroptera	Heptageniidae		larvae	32.29	D
Ephemeroptera	Heptageniidae	Rhithrogena	larvae	172.23	
Plecoptera			larvae	32.29	I
Plecoptera	Capniidae	Capniinae	larvae	53.82	I
Plecoptera	Chloroperlidae	Chloroperlinae	larvae	322.93	I
Plecoptera	Chloroperlidae	Sweltsa	larvae	75.35	
Plecoptera	Leuctridae		larvae	32.29	I
Plecoptera	Perlidae	Hesperoperla pacifica	larvae	10.76	
Plecoptera	Taeniopterygidae		larvae	150.70	
Trichoptera	Hydropsychidae	Arctopsychinae Arctopsyche grandis	larvae	10.76	
Trichoptera	Rhyacophilidae	Rhyacophila sibirica group A	larvae	10.76	
Total: OTU Taxa : **19**	Genera : **9**	Families : **14**		3918.19	

Taxonomic list and densities of aquatic invertebrates identified and retained from a sample collected September 30, 2010 at station 385443107154, Slate River below BLM Campground, Gunnison county, Colorado. The sample was collected from riffle habitat using a surber net. The total area sampled was 0.093 square meters. The percentage of the sample that was identified and retained was 200% of the collected sample. A total of 112 individuals were removed, identified and retained. The sample identification number is 144554. OTU=operational taxonomic unit. Notes - identification to genus or species was not spported because: I - immature organisms, D- damaged organisms, M - poor slide mount, G - gender, U - indistint characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/Species	Life Stage	Density	Notes
Phylum: Arthropoda					
Class: Insecta	SubClass: Pterygota				
Diptera	Ceratopogonidae	Ceratopogoninae Sphaeromiini Probezzia	larvae	21.53	
Diptera	Chironomidae	Orthocladiinae	larvae	21.53	
Diptera	Chironomidae	Tanypodinae	larvae	21.53	
Ephemeroptera	Baetidae	Baetis	larvae	452.10	
Ephemeroptera	Ephemerellidae	Drunella doddsii	larvae	43.06	
Ephemeroptera	Heptageniidae		larvae	107.64	
Ephemeroptera	Heptageniidae	Rhithrogena	larvae	602.80	
Plecoptera	Chloroperlidae	Chloroperlinae	larvae	86.11	I
Plecoptera	Chloroperlidae	Sweltsa	larvae	193.76	
Plecoptera	Leuctridae		larvae	43.06	I
Plecoptera	Perlodidae	Megarcys signata	larvae	21.53	
Plecoptera	Pteronarcyidae	Pteronarcyinae Pteronarcellini Pteronarcella badia	larvae	43.06	
Plecoptera	Taeniopterygidae		larvae	753.50	I
Total: OTU Taxa : **13**	Genera : **7**	Families : **10**		2411.19	

Taxonomic list and densities of aquatic invertebrates identified and retained from a sample collected September 30, 2010 at station 385453107124, Slate River above campground, Gunnison county, Colorado. The sample was collected from riffle habitat using a surber net. The total area sampled was 0.093 square meters. The percentage of the sample that was identified and retained was 200% of the collected sample. A total of 184 individuals were removed, identified and retained. The sample identification number is 144555. OTU=operational taxonomic unit. Notes - identification to genus or species was not spported because: I - immature organisms, D- damaged organisms, M - poor slide mount, G - gender, U - indistint characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/Species	Life Stage	Density	Notes
Phylum: Arthropoda					
Class: Insecta	SubClass: Pterygota				
Diptera	Blephariceridae	Blepharicerinae Blepharicerini Bibiocephala	larvae	21.53	
Diptera	Chironomidae	Chironominae	larvae	21.53	
Diptera	Chironomidae	Orthocladiinae	larvae	43.06	
Diptera	Simuliidae	Simuliinae Simuliini Simulium	larvae	64.59	
Ephemeroptera	Baetidae		larvae	193.76	I
Ephemeroptera	Baetidae	Baetis	larvae	86.11	
Ephemeroptera	Ephemerellidae	Drunella doddsii	larvae	43.06	
Ephemeroptera	Heptageniidae		larvae	925.73	I,U
Ephemeroptera	Heptageniidae	Rhithrogena	larvae	581.27	
Plecoptera			larvae	64.59	I,U
Plecoptera	Capniidae	Capniinae	larvae	258.34	U
Plecoptera	Chloroperlidae	Chloroperlinae	larvae	344.46	U
Plecoptera	Chloroperlidae	Sweltsa	larvae	150.70	
Plecoptera	Leuctridae		larvae	43.06	U
Plecoptera	Nemouridae	Zapada	larvae	21.53	
Plecoptera	Perlodidae	Megarcys signata	larvae	43.06	
Plecoptera	Pteronarcyidae	Pteronarcyinae Pteronarcellini Pteronarcella badia	larvae	21.53	
Plecoptera	Taeniopterygidae		larvae	1033.37	U
Total: OTU Taxa : **18**		Genera : **9**	Families : **14**	3961.25	

Taxonomic list and densities of aquatic invertebrates identified and retained from a sample collected September 30, 2010 at station 385428107128, Slate River below Oh-Be Joyful Creek, Gunnison county, Colorado. The sample was collected from riffle habitat using a surber net. The total area sampled was 0.093 square meters. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 441 individuals were removed, identified and retained. The sample identification number is 144556. OTU=operational taxonomic unit. Notes - identification to genus or species was not spported because: I - immature organisms, D- damaged organisms, M - poor slide mount, G - gender, U - indistint characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/Species	Life Stage	Density	Notes
Phylum: Arthropoda					
Class: Arachnida	SubClass: Acari				
Trombidiformes			adult	10.76	U
Trombidiformes	Lebertiidae	Lebertia	adult	10.76	
Trombidiformes	Sperchonidae	Sperchon	adult	21.53	
Trombidiformes	Torrenticolidae	Torrenticola	adult	10.76	
Class: Insecta	SubClass: Pterygota				
Coleoptera	Elmidae		larvae	21.53	I
Diptera	Chironomidae	Orthocladiinae	larvae	398.28	
Diptera	Chironomidae	Tanypodinae	larvae	10.76	
Diptera	Tipulidae	Hexatoma	larvae	10.76	
Ephemeroptera	Ameletidae	Ameletus	larvae	32.29	
Ephemeroptera	Baetidae		larvae	10.76	I
Ephemeroptera	Baetidae	Baetis	larvae	3595.26	
Ephemeroptera	Ephemerellidae		larvae	10.76	I
Ephemeroptera	Ephemerellidae	Drunella doddsii	larvae	10.76	
Ephemeroptera	Heptageniidae		larvae	129.17	I
Ephemeroptera	Heptageniidae	Cinygmula	larvae	10.76	
Ephemeroptera	Heptageniidae	Rhithrogena	larvae	139.94	
Ephemeroptera	Leptophlebiidae		larvae	10.76	I
Plecoptera			larvae	10.76	I
Plecoptera	Capniidae	Capniinae	larvae	86.11	I
Plecoptera	Chloroperlidae	Chloroperlinae	larvae	32.29	I
Plecoptera	Chloroperlidae	Sweltsa	larvae	96.88	
Plecoptera	Perlodidae	Megarcys signata	larvae	10.76	
Plecoptera	Perlodidae	Perlodinae Perlodini Diura knowltoni	larvae	10.76	
Plecoptera	Taeniopterygidae		larvae	21.53	I
Trichoptera	Brachycentridae	Brachycentrus americanus	larvae	10.76	
Trichoptera	Hydropsychidae	Arctopsychinae Arctopsyche grandis	larvae	10.76	
Trichoptera	Lepidostomatidae	Lepidostomatinae Lepidostoma	larvae	10.76	
Total: OTU Taxa : **27**	Genera : **15**	Families : **19**		4747.04	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: State River						CROSS-SECTION NO.: 3
CROSS-SECTION LOCATION: State Rec 3 Cutoff gage, upstream of confluence						
DATE: 9/19/11	OBSERVERS: [illegible]					
LEGAL DESCRIPTION	¼ SECTION: NW NW	SECTION: 20	TOWNSHIP: 13N (S)	RANGE: 86E (W)	PM: Sixth	
COUNTY: Routt	WATERSHED: Trail	WATER DIVISION: 4	DOW WATER CODE: 43113			
MAP(S): USGS:	GPS Zone 13 323598					
USFS:	4309303					

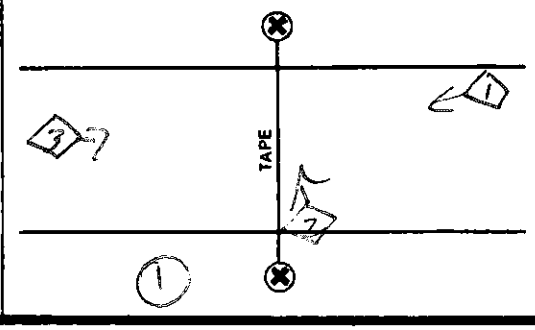
SUPPLEMENTAL DATA

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: 2 to 6 cobbles	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.30 / 5
② WS Upstream	42.5	5.30
③ WS Downstream	17.8	5.14
SLOPE	0.14/100.3 = .002	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly

COMMENTS

pH = 7.98
Cond = 130
Temp: 11.3°C
Salinity: 0.1

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River	CROSS-SECTION NO. 3	DATE: 7-29-11	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 2:05

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		3.52								
G	2.6		3.80								
LW	3.8		5.36								
	11.5		5.65	.3				0.07			
	6		5.95	.6				0.81			
	7.5		5.65	.3				0.86			
	9		5.55	.2				1.25			
	10.5		5.55	.2				1.42			
	12		5.65	.3				1.44			
	13.5		5.55	.2				1.04			
	15		5.65	.3				1.19			
	16.5		5.70	.35				1.10			
	18		5.60	.25				1.27			
	19.5		5.65	.30				1.13			
	21		5.75	.40				.26			
	22.5		5.75	.40				1.38			
	24		5.75	.40				0.98			
	25.5		5.80	.45				1.19			
	27		5.75	.40				1.00			
	28.5		5.65	.30				0.36			
	30		5.65	.30				0.12			
	31.5		5.55	.20				ϕ			
	33		5.40	.05				ϕ			
	34.5		5.40	.05				ϕ			
	36		5.40	.05				ϕ			
RW	36.8		5.36								
	42.0		5.16								
	LW 37		5.36								
	RW 37		2.60								
G	50.8		3.98								
RS	52.5		2.18								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	upstream from BLM campground
XS NUMBER:	3
DATE:	29-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW NW
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.002

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

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

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 3

DATA POINTS= 31

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	3.52			0.00		0.00	0.00	0.0%
1	G	2.60	3.86			0.00		0.00	0.00	0.0%
	W	3.80	5.36	0.00	0.00	0.00		0.00	0.00	0.0%
		4.50	5.65	0.30	0.07	0.76	0.30	0.33	0.02	0.2%
		6.00	5.95	0.60	0.81	1.53	0.60	0.90	0.73	7.9%
		7.50	5.65	0.30	0.86	1.53	0.30	0.45	0.39	4.2%
		9.00	5.55	0.20	1.25	1.50	0.20	0.30	0.38	4.0%
		10.50	5.55	0.20	1.42	1.50	0.20	0.30	0.43	4.6%
		12.00	5.65	0.30	1.44	1.50	0.30	0.45	0.65	7.0%
		13.50	5.55	0.20	1.04	1.50	0.20	0.30	0.31	3.4%
		15.00	5.65	0.30	1.19	1.50	0.30	0.45	0.54	5.8%
		16.50	5.70	0.35	1.10	1.50	0.35	0.53	0.58	6.2%
		18.00	5.60	0.25	1.27	1.50	0.25	0.38	0.48	5.1%
		19.50	5.65	0.30	1.13	1.50	0.30	0.45	0.51	5.5%
		21.00	5.75	0.40	1.26	1.50	0.40	0.60	0.76	8.1%
		22.50	5.75	0.40	1.38	1.50	0.40	0.60	0.83	8.9%
		24.00	5.75	0.40	0.98	1.50	0.40	0.60	0.59	6.3%
		25.50	5.80	0.45	1.19	1.50	0.45	0.68	0.80	8.7%
		27.00	5.75	0.40	1.00	1.50	0.40	0.60	0.60	6.5%
		28.50	5.65	0.30	0.86	1.50	0.30	0.45	0.39	4.2%
		30.00	5.65	0.30	0.72	1.50	0.30	0.45	0.32	3.5%
		31.50	5.55	0.20	0.00	1.50	0.20	0.30	0.00	0.0%
		33.00	5.40	0.05	0.00	1.51	0.05	0.08	0.00	0.0%
		34.50	5.40	0.05	0.00	1.50	0.05	0.08	0.00	0.0%
		36.00	5.40	0.05	0.00	1.50	0.05	0.06	0.00	0.0%
	W	36.80	5.36	0.00	0.00	0.80		0.00	0.00	0.0%
		42.00	5.16			0.00		0.00	0.00	0.0%
		48.70	5.36			0.00		0.00	0.00	0.0%
		49.40	4.60			0.00		0.00	0.00	0.0%
1	G	50.80	3.78			0.00		0.00	0.00	0.0%
	RS	52.50	2.18			0.00		0.00	0.00	0.0%
	TOTALS ----------					33.16	0.6 (Max.)	9.31	9.28	100.0%

Manning's n = 0.0286
Hydraulic Radius= 0.28087299

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 3

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.31	8.99	-3.5%
5.11	9.31	19.08	104.9%
5.13	9.31	18.17	95.1%
5.15	9.31	17.27	85.4%
5.17	9.31	16.37	75.7%
5.19	9.31	15.48	66.3%
5.21	9.31	14.63	57.1%
5.23	9.31	13.80	48.2%
5.25	9.31	12.99	39.5%
5.27	9.31	12.21	31.1%
5.29	9.31	11.45	23.0%
5.31	9.31	10.72	15.1%
5.32	9.31	10.36	11.2%
5.33	9.31	10.01	7.5%
5.34	9.31	9.66	3.8%
5.35	9.31	9.32	0.1%
5.36	9.31	8.99	-3.5%
5.37	9.31	8.66	-7.0%
5.38	9.31	8.33	-10.5%
5.39	9.31	8.01	-14.0%
5.40	9.31	7.69	-17.4%
5.41	9.31	7.40	-20.6%
5.43	9.31	6.82	-26.8%
5.45	9.31	6.25	-32.9%
5.47	9.31	5.68	-39.0%
5.49	9.31	5.12	-45.0%
5.51	9.31	4.56	-51.0%
5.53	9.31	4.01	-56.9%
5.55	9.31	3.46	-62.8%
5.57	9.31	2.96	-68.2%
5.59	9.31	2.49	-73.2%
5.61	9.31	2.06	-77.9%

WATERLINE AT ZERO
AREA ERROR = 5.350

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 3

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	3.86	48.06	1.61	2.09	77.30	49.48	100.0%	1.56	241.95	3.13
	4.35	46.83	1.15	1.60	54.04	47.88	96.8%	1.13	136.16	2.52
	4.40	46.71	1.11	1.55	51.70	47.72	96.4%	1.08	126.77	2.45
	4.45	46.58	1.06	1.50	49.37	47.56	96.1%	1.04	117.65	2.38
	4.50	46.46	1.01	1.45	47.04	47.39	95.8%	0.99	108.80	2.31
	4.55	46.33	0.97	1.40	44.72	47.23	95.5%	0.95	100.24	2.24
	4.60	46.21	0.92	1.35	42.41	47.07	95.1%	0.90	91.96	2.17
	4.65	46.12	0.87	1.30	40.10	46.94	94.9%	0.85	83.92	2.09
	4.70	46.04	0.82	1.25	37.79	46.80	94.6%	0.81	76.18	2.02
	4.75	45.95	0.77	1.20	35.49	46.67	94.3%	0.76	68.75	1.94
	4.80	45.86	0.72	1.15	33.20	46.54	94.1%	0.71	61.61	1.86
	4.85	45.78	0.68	1.10	30.91	46.41	93.8%	0.67	54.79	1.77
	4.90	45.69	0.63	1.05	28.62	46.28	93.5%	0.62	48.30	1.69
	4.95	45.61	0.58	1.00	26.34	46.14	93.3%	0.57	42.13	1.60
	5.00	45.52	0.53	0.95	24.06	46.01	93.0%	0.52	36.30	1.51
	5.05	45.43	0.48	0.90	21.79	45.88	92.7%	0.47	30.83	1.41
	5.10	45.35	0.43	0.85	19.52	45.75	92.5%	0.43	25.71	1.32
	5.15	45.26	0.38	0.80	17.25	45.62	92.2%	0.38	20.97	1.22
	5.20	42.78	0.35	0.75	15.04	43.08	87.1%	0.35	17.33	1.15
	5.25	39.71	0.33	0.70	12.98	39.97	80.8%	0.32	14.25	1.10
	5.30	36.65	0.30	0.65	11.07	36.87	74.5%	0.30	11.54	1.04
WL	5.35	33.59	0.28	0.60	9.31	33.76	68.2%	0.28	9.17	0.99
	5.40	29.10	0.26	0.55	7.68	29.25	59.1%	0.26	7.32	0.95
	5.45	28.48	0.22	0.50	6.24	28.61	57.8%	0.22	5.25	0.84
	5.50	27.86	0.17	0.45	4.83	27.98	56.5%	0.17	3.48	0.72
	5.55	25.72	0.13	0.40	3.45	25.83	52.2%	0.13	2.10	0.61
	5.60	21.83	0.10	0.35	2.26	21.92	44.3%	0.10	1.16	0.51
	5.65	14.22	0.09	0.30	1.33	14.29	28.9%	0.09	0.63	0.48
	5.70	9.99	0.07	0.25	0.72	10.04	20.3%	0.07	0.29	0.40
	5.75	4.98	0.05	0.20	0.27	5.02	10.1%	0.05	0.09	0.33
	5.80	1.50	0.07	0.15	0.11	1.53	3.1%	0.07	0.05	0.41
	5.85	1.00	0.05	0.10	0.05	1.02	2.1%	0.05	0.02	0.31
	5.90	0.50	0.02	0.05	0.01	0.51	1.0%	0.02	0.00	0.20

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 3

SUMMARY SHEET

MEASURED FLOW (Qm)=	9.28	cfs
CALCULATED FLOW (Qc)=	9.17	cfs
(Qm-Qc)/Qm * 100 =	1.2	%
MEASURED WATERLINE (WLm)=	5.36	ft
CALCULATED WATERLINE (WLc)=	5.35	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.60	ft
(Dm-Dc)/Dm * 100	0.1	%
MEAN VELOCITY=	0.99	ft/sec
MANNING'S N=	0.029	
SLOPE=	0.002	ft/ft
.4 * Qm =	3.7	cfs
2.5 * Qm=	23.2	cfs

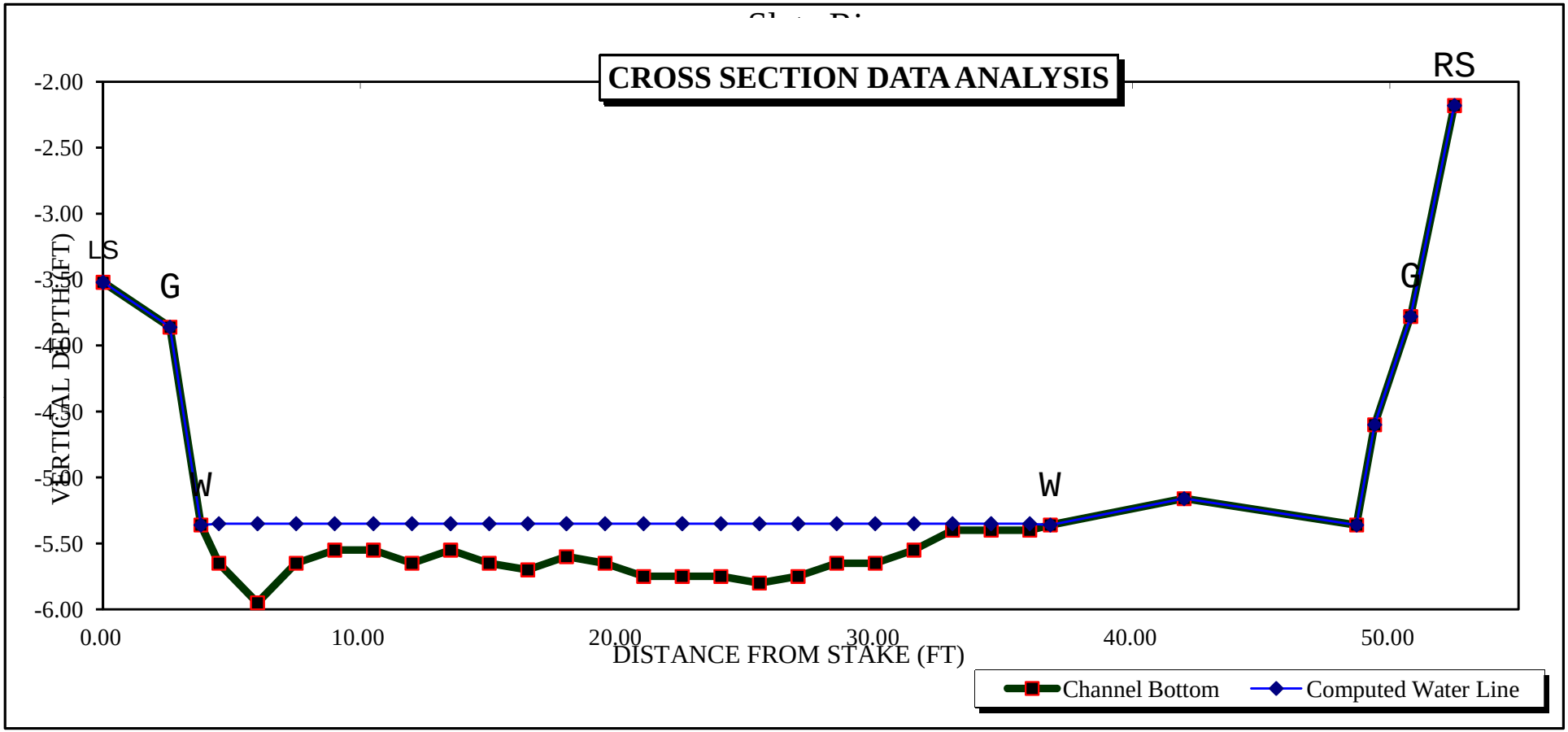
RECOMMENDED INSTREAM FLOW:
=============================

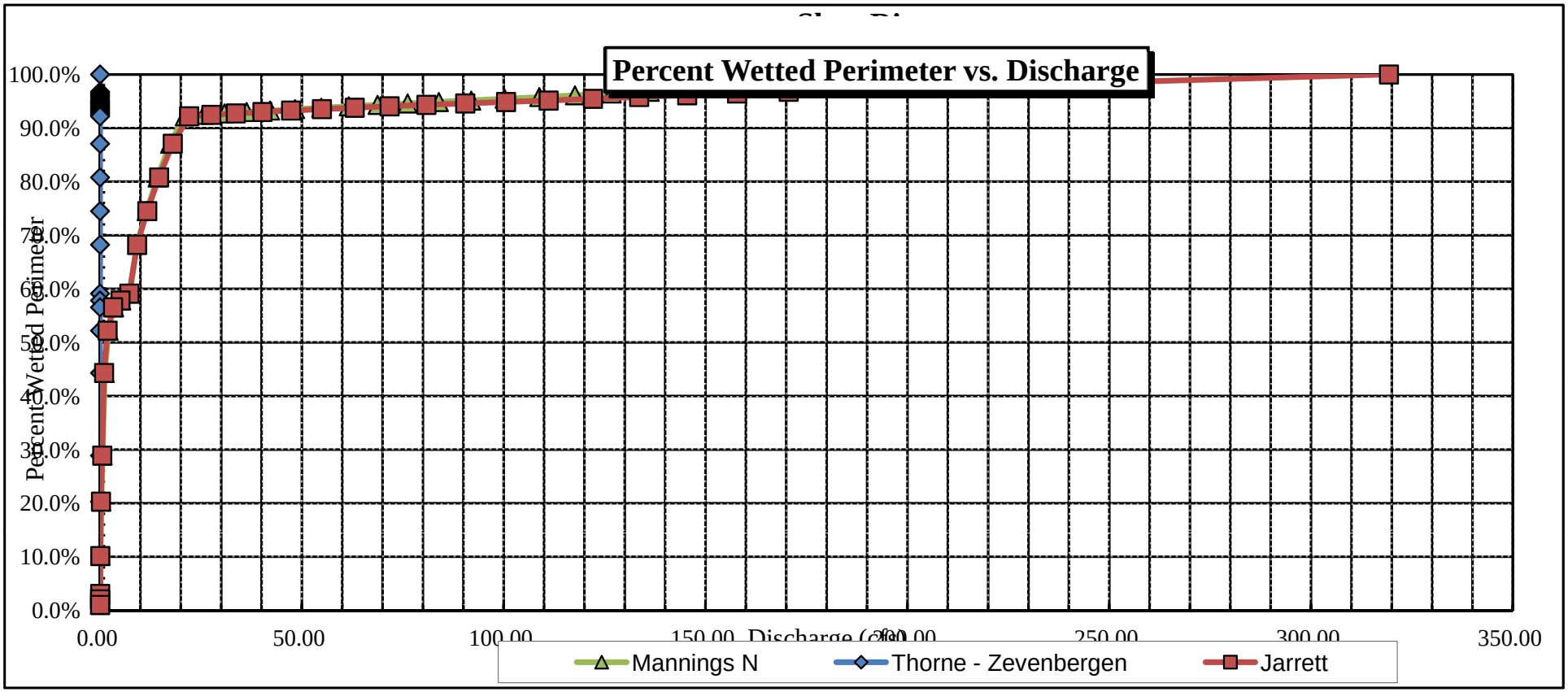
FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

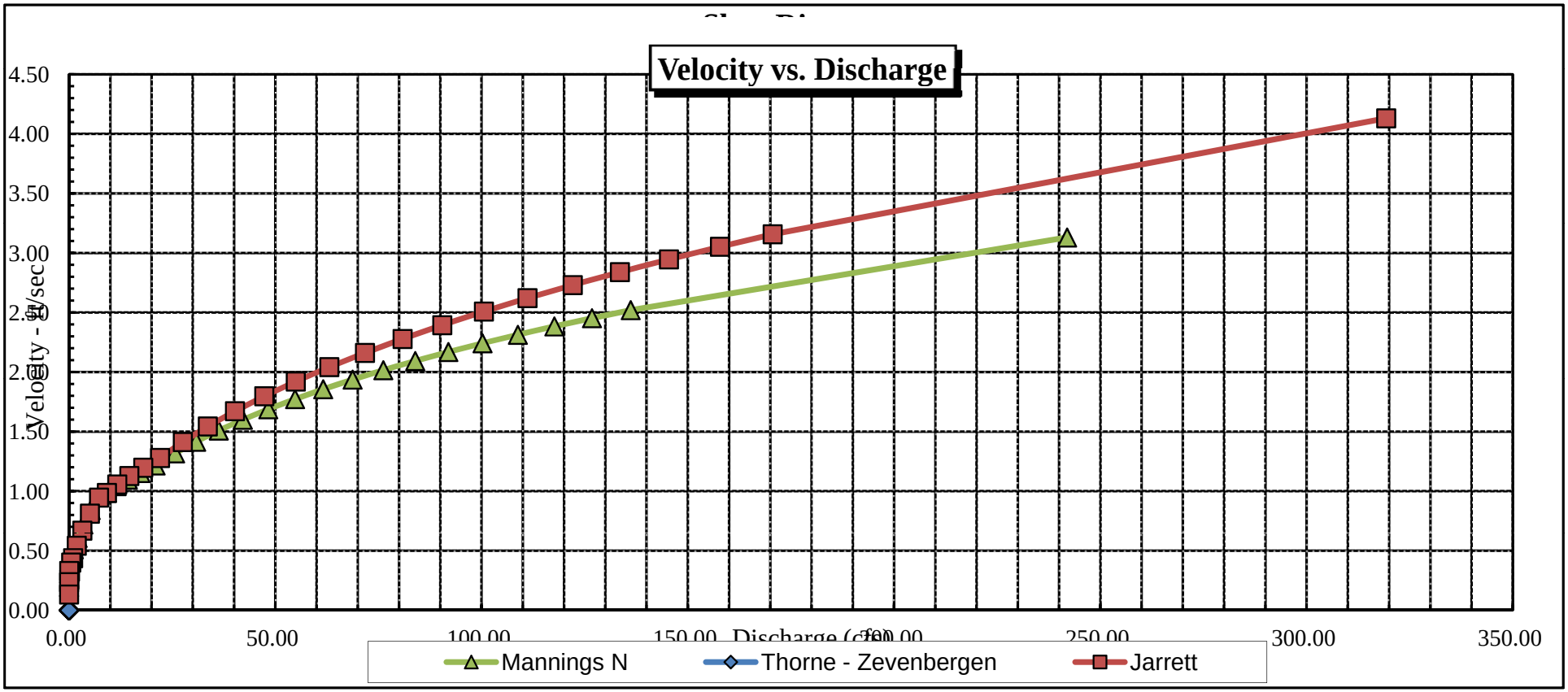
RATIONALE FOR RECOMMENDATION:
=============================

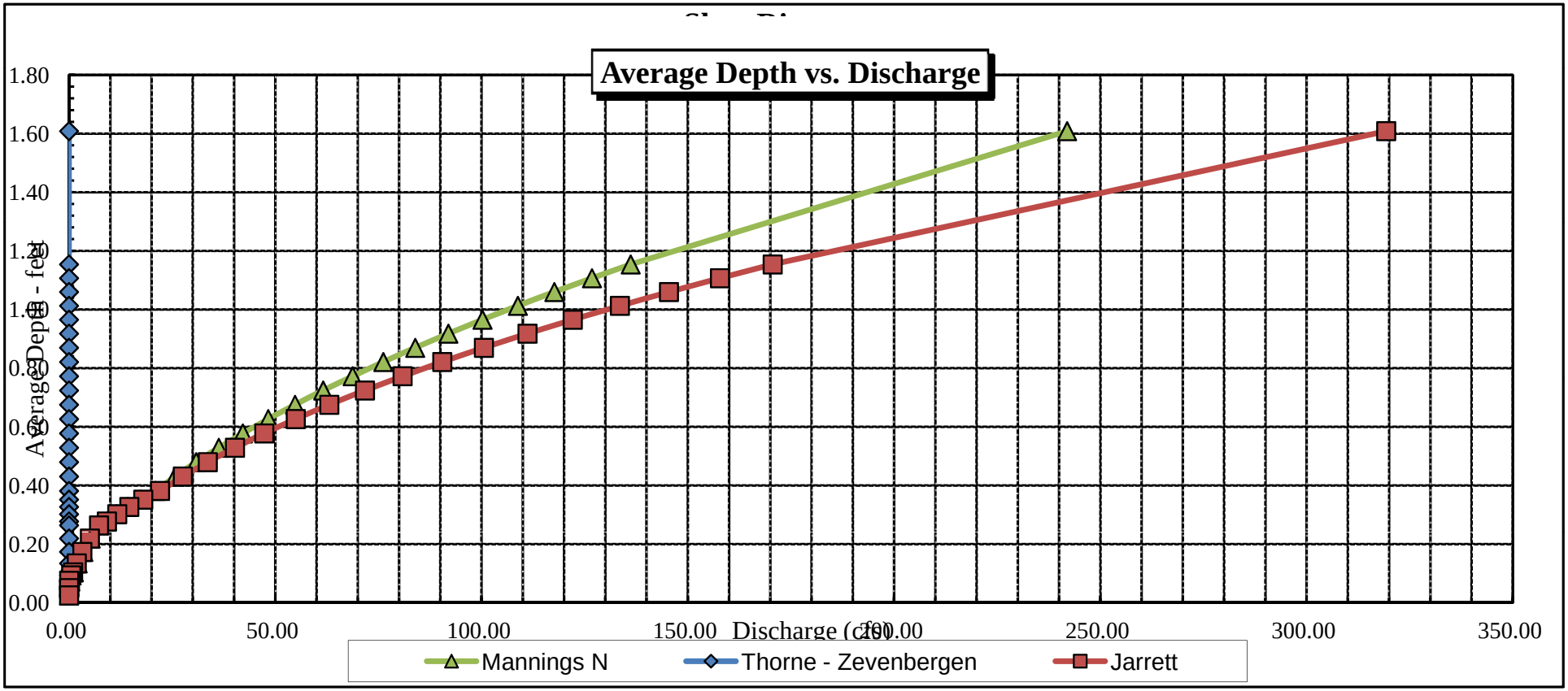
RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………......…...…....…...…....... DATE:......…...…......……………

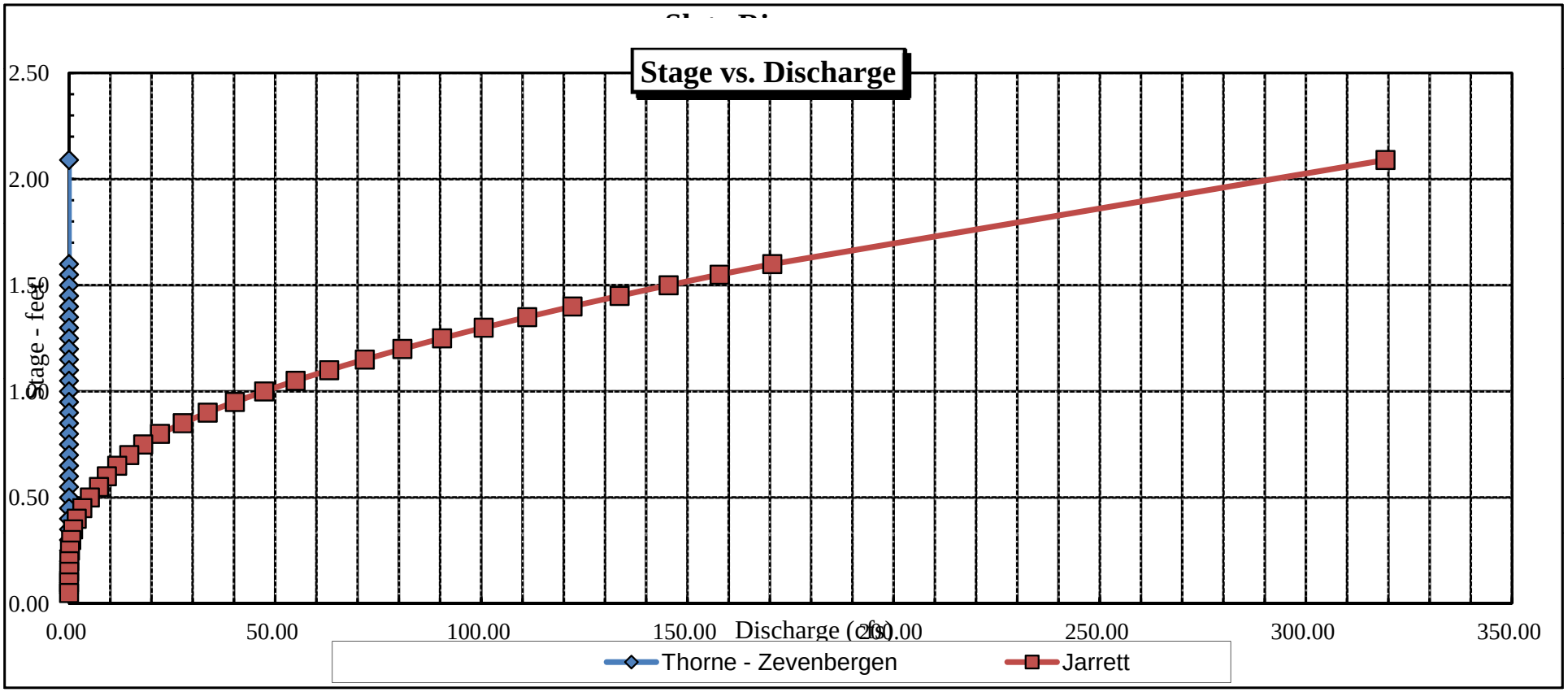
CWCB REVIEW BY: ..……………………….....………………………………………………...…............. DATE:..................…………….....


CROSS SECTION DATA ANALYSIS
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
VERTICAL DEPTH (FT)
LS
G
W
W
G
RS
0.00
10.00
20.00
30.00
40.00
50.00
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
50.00
100.00
150.00
250.00
300.00
350.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
50.00
100.00
150.00
250.00
300.00
350.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slade River					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: upstream from BLM campground					
DATE: 9-29-11	OBSERVERS: Bakart + Swihart				
LEGAL DESCRIPTION	¼ SECTION: NW NW	SECTION: 20	TOWNSHIP: 13 N(S)	RANGE: 86E(W)	PM: Sixth
COUNTY: Gunnison	WATERSHED: East River	WATER DIVISION: 4		DOW WATER CODE: 43113	
MAP(S): USGS:			GPS Zone 13 323492		
USFS:			4309506		

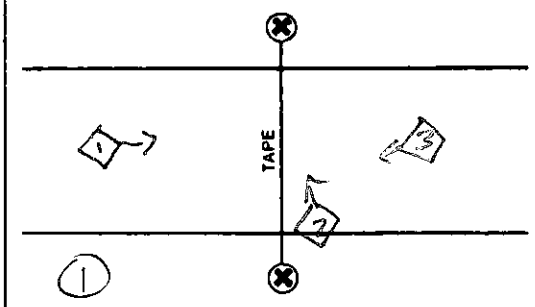
SUPPLEMENTAL DATA

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: 2" to 8" inch cobbles		PHOTOGRAPHS TAKEN (YES) NO	NUMBER OF PHOTOGRAPHS: 3	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.00 / 5.04
② WS Upstream	17.1	4.92
③ WS Downstream	47.3	5.48
SLOPE	0.56/64.4 = .009	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

mayfly, caddisfly, stonefly

COMMENTS

Ph = 7.98
Temp = 11.3
Cond = 130
Salinity = 0.1

Spruce - willow riparian

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River	CROSS-SECTION NO.: 2	DATE: 9-29-11	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 1:20 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	0.0		2.46								
G	3.0		3.74								
	6.0		4.48								
WLW	7.5		5.00								
	8.0		5.2	.2				0.23			
	9.5		5.2	.2				0.90			
	11		5.3	.3				0.90			
	12.5		5.4	.4				0.94			
	14		5.45	.45				0.75			
	15.5		5.35	.35				1.57			
	17		5.50	.50				1.58			
	18.5		5.35	.35				1.71			
	20		5.5	.5				1.02			
	21.5		5.4	.4				1.76			
	23		5.3	.3				0.87			
	24.5		5.25	.25				1.17			
	26		5.25	.25				1.08			
	27.5		5.3	.30				0.22			
	29		5.3	.30				1.16			
	30.5		5.35	.35				0.97			
	32		5.25	.25				0.95			
	33.5		5.25	.20				1.16			
	35		5.20	.15				0.50			
	36.5		5.10	.05				Ø			
RS	37.0		5.04								
	40.0		4.50								
	43.0		4.40								
	47.0		4.82								
	56.3		5.28								
	57		4.12								
G	60.5		3.94								
RS	60		3.88								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	upstream from BLM campground
XS NUMBER:	2
DATE:	29-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW NW
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.009

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

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

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 2

DATA POINTS= 32

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	2.46			0.00		0.00	0.00	0.0%
1	G	3.00	3.74			0.00		0.00	0.00	0.0%
		6.00	4.48			0.00		0.00	0.00	0.0%
	W	7.50	5.00	0.00	0.00	0.00		0.00	0.00	0.0%
		8.00	5.20	0.20	0.23	0.54	0.20	0.20	0.05	0.5%
		9.50	5.20	0.20	0.90	1.50	0.20	0.30	0.27	2.8%
		11.00	5.30	0.30	0.90	1.50	0.30	0.45	0.41	4.2%
		12.50	5.40	0.40	0.94	1.50	0.40	0.60	0.56	5.8%
		14.00	5.45	0.45	0.75	1.50	0.45	0.68	0.51	5.2%
		15.50	5.35	0.35	1.57	1.50	0.35	0.53	0.82	8.5%
		17.00	5.50	0.50	1.58	1.51	0.50	0.75	1.19	12.2%
		18.50	5.35	0.35	1.71	1.51	0.35	0.53	0.90	9.3%
		20.00	5.50	0.50	1.02	1.51	0.50	0.75	0.77	7.9%
		21.50	5.40	0.40	1.76	1.50	0.40	0.60	1.06	10.9%
		23.00	5.30	0.30	0.87	1.50	0.30	0.45	0.39	4.0%
		24.50	5.25	0.25	1.17	1.50	0.25	0.38	0.44	4.5%
		26.00	5.25	0.25	1.08	1.50	0.25	0.38	0.41	4.2%
		27.50	5.30	0.30	0.22	1.50	0.30	0.45	0.10	1.0%
		29.00	5.30	0.30	1.16	1.50	0.30	0.45	0.52	5.4%
		30.50	5.35	0.35	0.97	1.50	0.35	0.53	0.51	5.2%
		32.00	5.25	0.25	0.95	1.50	0.25	0.38	0.36	3.7%
		33.50	5.25	0.20	1.16	1.50	0.20	0.30	0.35	3.6%
		35.00	5.20	0.15	0.50	1.50	0.15	0.23	0.11	1.2%
		36.50	5.10	0.05	0.00	1.50	0.05	0.05	0.00	0.0%
	W	37.00	5.04	0.00	0.00	0.50		0.00	0.00	0.0%
		40.00	4.50			0.00		0.00	0.00	0.0%
		43.00	4.40			0.00		0.00	0.00	0.0%
		47.00	4.82			0.00		0.00	0.00	0.0%
		56.30	5.28			0.00		0.00	0.00	0.0%
		57.00	4.14			0.00		0.00	0.00	0.0%
1	G	60.50	3.94			0.00		0.00	0.00	0.0%
	RS	66.00	3.88			0.00		0.00	0.00	0.0%
	TOTALS ----------					29.59	0.5 (Max.)	8.95	9.70	100.0%

Manning's n = 0.0586
Hydraulic Radius= 0.3024464

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	8.95	9.28	3.6%
4.77	8.95	18.92	111.4%
4.79	8.95	18.09	102.1%
4.81	8.95	17.26	92.9%
4.83	8.95	16.45	83.8%
4.85	8.95	15.64	74.8%
4.87	8.95	14.85	65.9%
4.89	8.95	14.07	57.2%
4.91	8.95	13.30	48.6%
4.93	8.95	12.54	40.1%
4.95	8.95	11.80	31.8%
4.97	8.95	11.06	23.6%
4.98	8.95	10.70	19.5%
4.99	8.95	10.34	15.5%
5.00	8.95	9.98	11.5%
5.01	8.95	9.63	7.6%
5.02	8.95	9.28	3.6%
5.03	8.95	8.93	-0.3%
5.04	8.95	8.58	-4.1%
5.05	8.95	8.24	-7.9%
5.06	8.95	7.90	-11.7%
5.07	8.95	7.56	-15.5%
5.09	8.95	6.90	-22.9%
5.11	8.95	6.25	-30.1%
5.13	8.95	5.62	-37.2%
5.15	8.95	5.00	-44.2%
5.17	8.95	4.39	-50.9%
5.19	8.95	3.81	-57.5%
5.21	8.95	3.25	-63.7%
5.23	8.95	2.73	-69.5%
5.25	8.95	2.24	-75.0%
5.27	8.95	1.85	-79.4%

WATERLINE AT ZERO
AREA ERROR = 5.029

STREAM NAME: Slate River
XS LOCATION: upstream from BLM campground
XS NUMBER: 2

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	3.94	56.69	1.06	1.56	60.13	57.66	100.0%	1.04	148.78	2.47
	4.03	54.76	1.01	1.47	55.15	55.72	96.6%	0.99	131.79	2.39
	4.08	53.69	0.98	1.42	52.44	54.64	94.8%	0.96	122.77	2.34
	4.13	52.61	0.95	1.37	49.79	53.55	92.9%	0.93	114.09	2.29
	4.18	52.19	0.90	1.32	47.17	53.11	92.1%	0.89	104.85	2.22
	4.23	51.96	0.86	1.27	44.56	52.84	91.6%	0.84	95.70	2.15
	4.28	51.73	0.81	1.22	41.97	52.57	91.2%	0.80	86.90	2.07
	4.33	51.49	0.76	1.17	39.39	52.31	90.7%	0.75	78.45	1.99
	4.38	51.26	0.72	1.12	36.82	52.04	90.3%	0.71	70.35	1.91
	4.43	49.87	0.69	1.07	34.28	50.61	87.8%	0.68	63.62	1.86
	4.48	47.66	0.67	1.02	31.84	48.36	83.9%	0.66	57.99	1.82
	4.53	46.22	0.64	0.97	29.51	46.89	81.3%	0.63	52.13	1.77
	4.58	45.29	0.60	0.92	27.22	45.91	79.6%	0.59	46.21	1.70
	4.63	44.37	0.56	0.87	24.98	44.94	77.9%	0.56	40.62	1.63
	4.68	43.44	0.52	0.82	22.78	43.97	76.3%	0.52	35.35	1.55
	4.73	42.51	0.49	0.77	20.63	43.00	74.6%	0.48	30.42	1.47
	4.78	41.58	0.45	0.72	18.53	42.03	72.9%	0.44	25.82	1.39
	4.83	40.55	0.41	0.67	16.47	40.95	71.0%	0.40	21.60	1.31
	4.88	39.09	0.37	0.62	14.48	39.45	68.4%	0.37	17.87	1.23
	4.93	37.62	0.33	0.57	12.57	37.94	65.8%	0.33	14.47	1.15
	4.98	36.16	0.30	0.52	10.72	36.44	63.2%	0.29	11.41	1.06
WL	5.03	34.71	0.26	0.47	8.95	34.94	60.6%	0.26	8.68	0.97
	5.08	33.15	0.22	0.42	7.25	33.34	57.8%	0.22	6.31	0.87
	5.13	31.37	0.18	0.37	5.64	31.53	54.7%	0.18	4.30	0.76
	5.18	29.46	0.14	0.32	4.12	29.57	51.3%	0.14	2.66	0.65
	5.23	25.23	0.11	0.27	2.75	25.31	43.9%	0.11	1.50	0.55
	5.28	17.61	0.10	0.22	1.68	17.65	30.6%	0.09	0.84	0.50
	5.33	12.05	0.08	0.17	0.95	12.08	21.0%	0.08	0.42	0.44
	5.38	8.30	0.05	0.12	0.44	8.32	14.4%	0.05	0.15	0.34
	5.43	4.11	0.03	0.07	0.12	4.12	7.1%	0.03	0.03	0.23
	5.48	0.93	0.01	0.02	0.01	0.93	1.6%	0.01	0.00	0.11

STREAM NAME:	Slate River
XS LOCATION:	upstream from BLM campground
XS NUMBER:	2

SUMMARY SHEET

MEASURED FLOW (Qm)=	9.70	cfs
CALCULATED FLOW (Qc)=	8.68	cfs
(Qm-Qc)/Qm * 100 =	10.5	%
MEASURED WATERLINE (WLm)=	5.02	ft
CALCULATED WATERLINE (WLc)=	5.03	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.47	ft
(Dm-Dc)/Dm * 100	5.9	%
MEAN VELOCITY=	0.97	ft/sec
MANNING'S N=	0.059	
SLOPE=	0.009	ft/ft
.4 * Qm =	3.9	cfs
2.5 * Qm=	24.3	cfs

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

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

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

____
____
____
____
____
____
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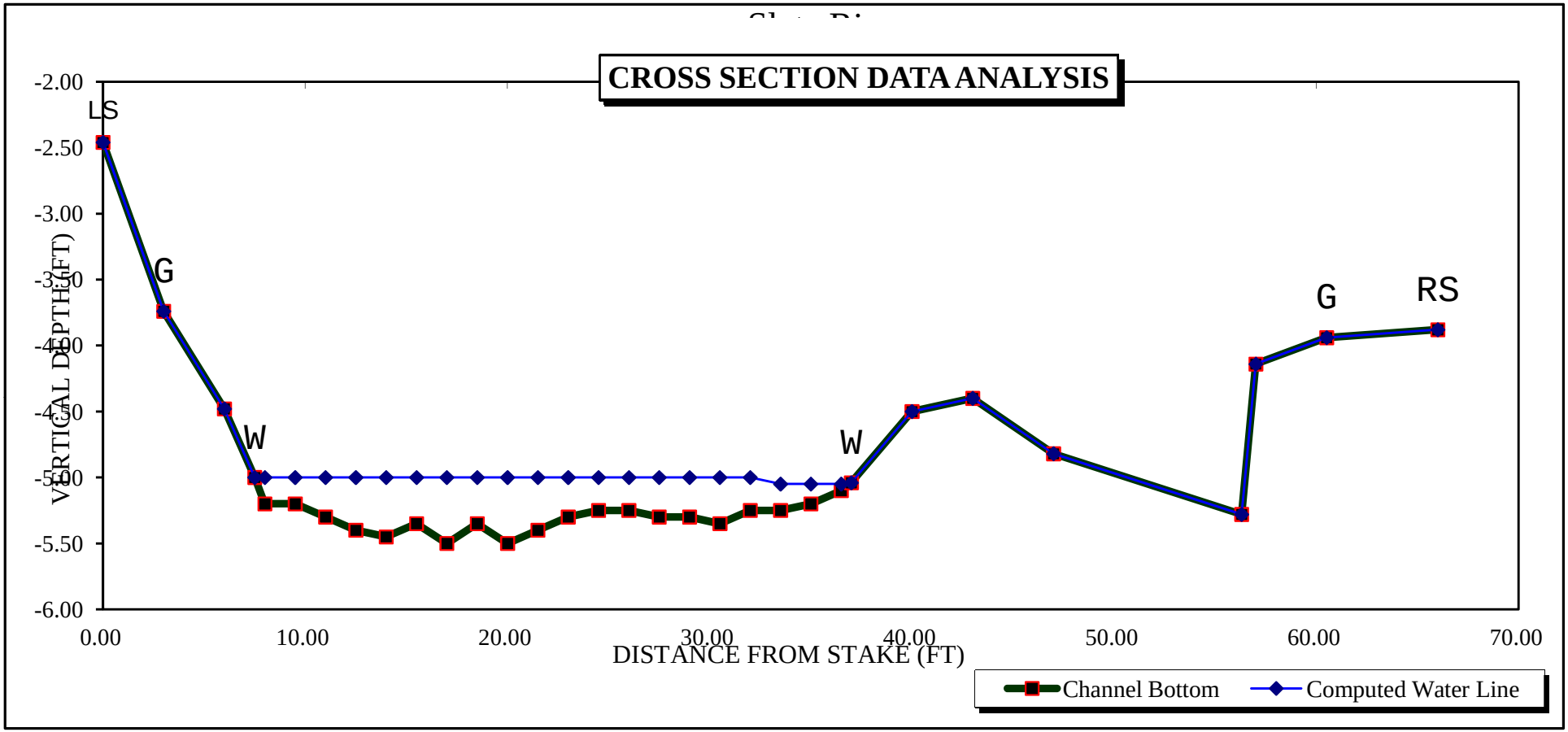
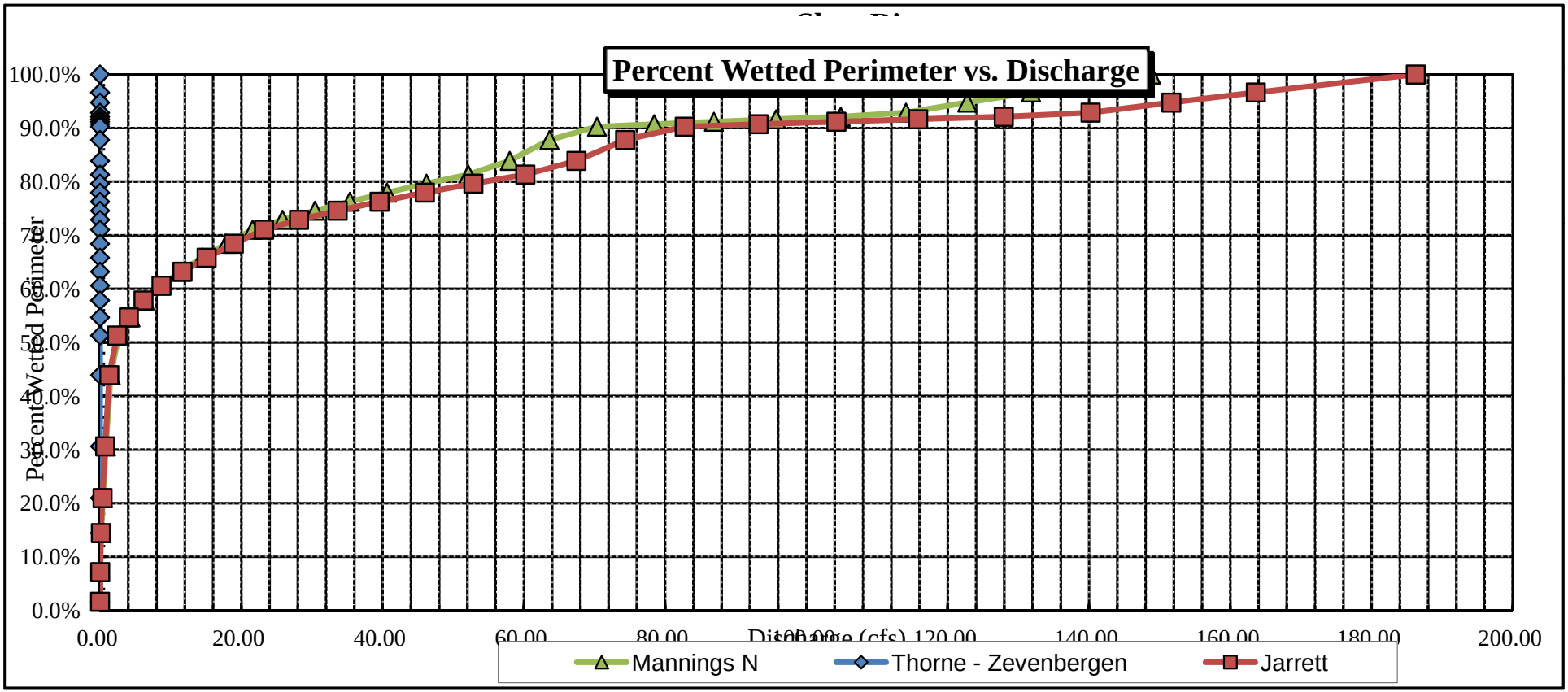
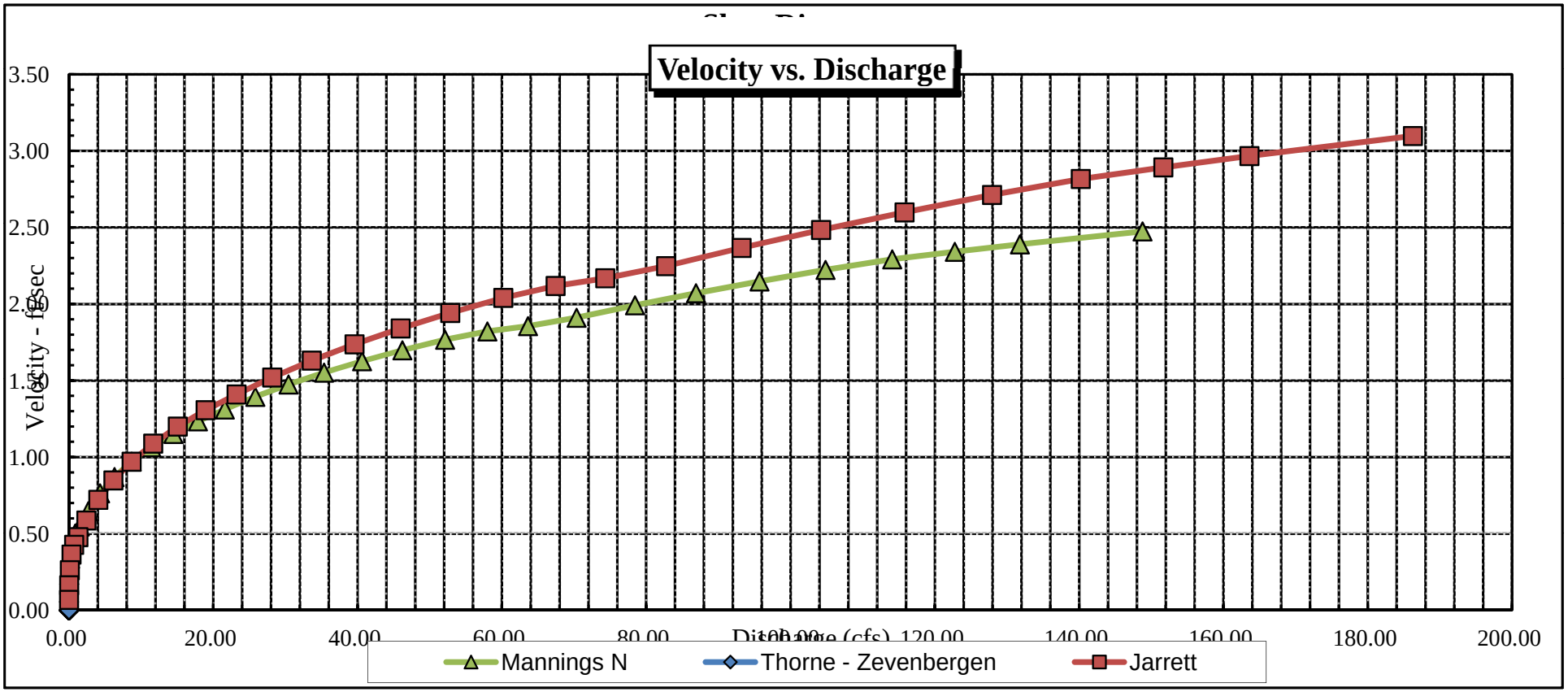
____
____
____

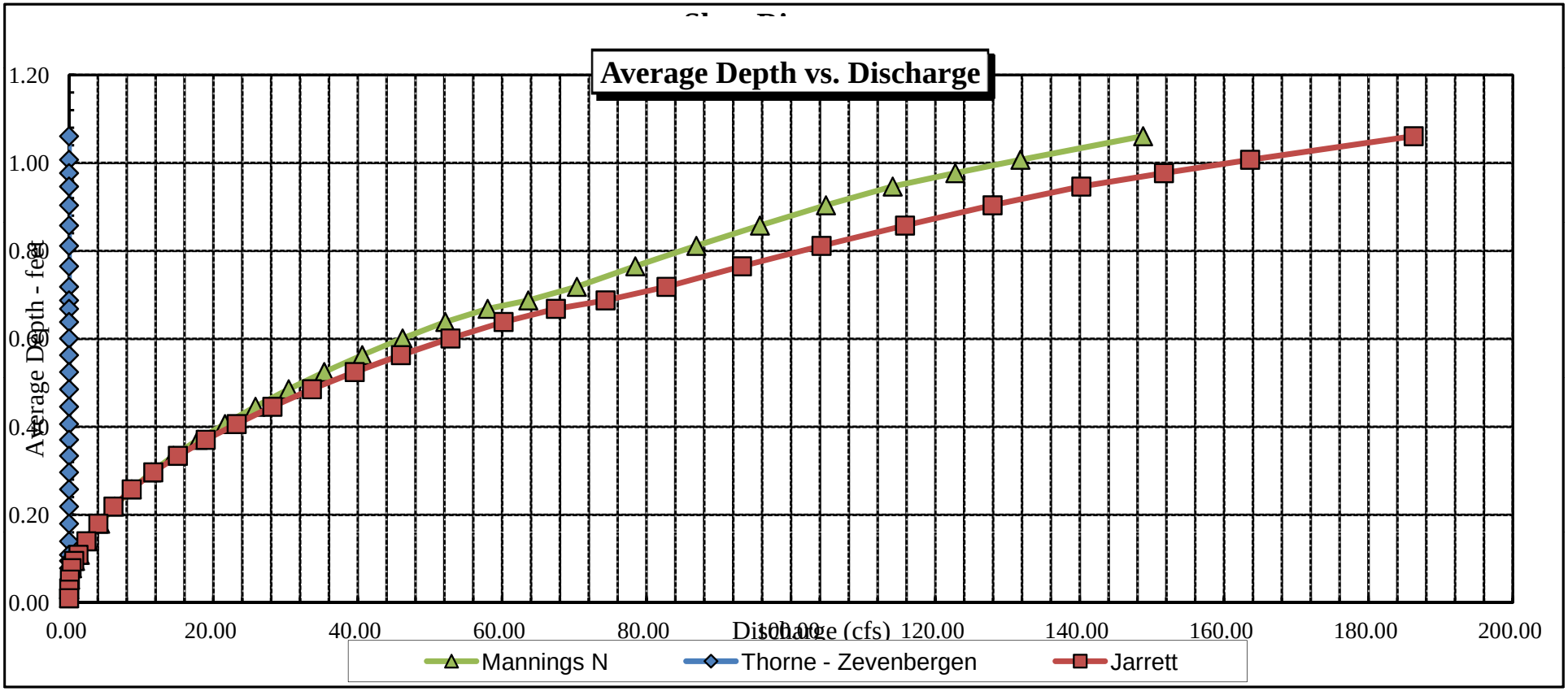
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......…....…...….…....... DATE:......….....…......……………

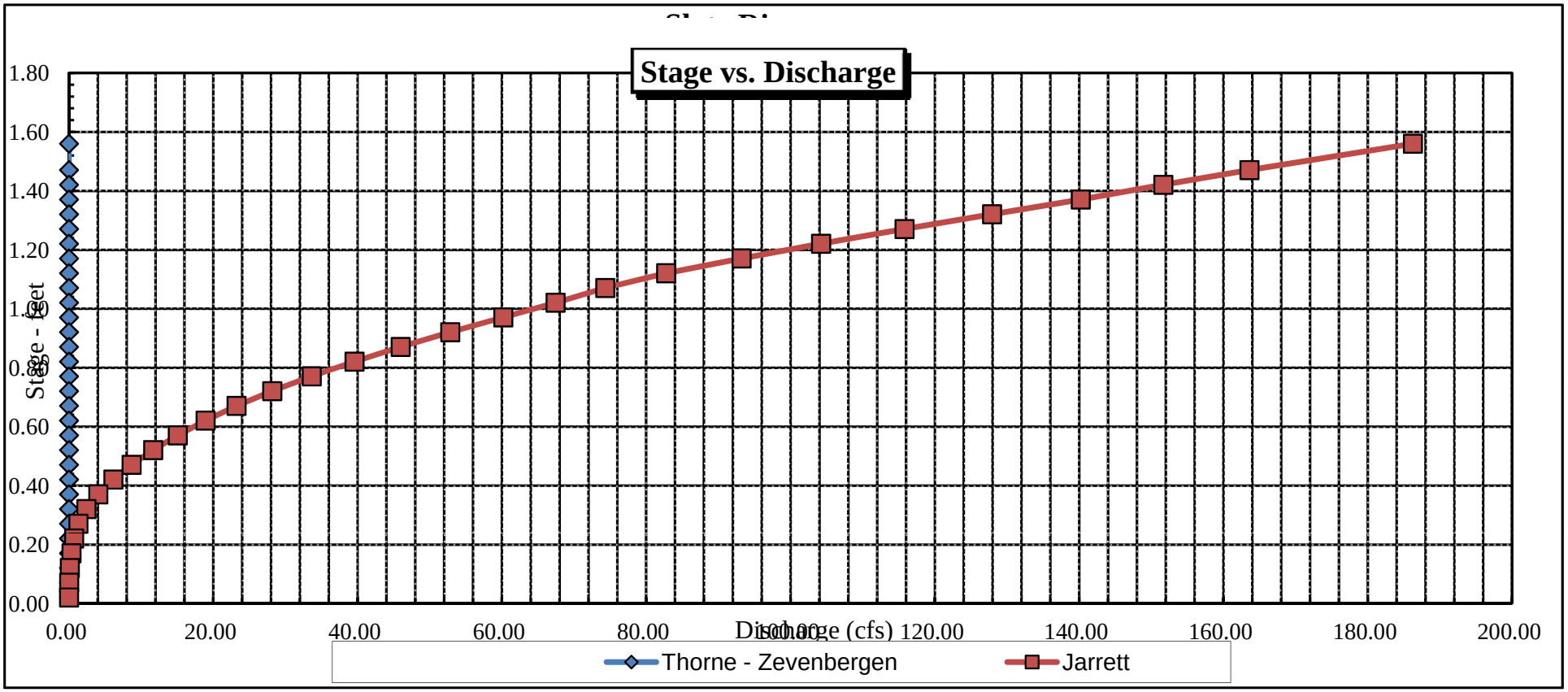
CWCB REVIEW BY: ..……………………….....………………………………………………...…............. DATE:..................……………...…


CROSS SECTION DATA ANALYSIS
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
VERTICAL DEPTH (FT)
LS
G
W
W
G
RS
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
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
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
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
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River						CROSS-SECTION NO. 1
CROSS-SECTION LOCATION: At BLM - Land Trust Boundary - near wetlands reclamation site - 700 ft. downstream from Oh-Be-Joyful confluence						
DATE: 9-29-11	OBSERVERS: R. Smith, A. Breibart					
LEGAL DESCRIPTION	¼ SECTION: SW NE	SECTION: 20	TOWNSHIP: 13 N/S	RANGE: 86 E/W	PM: Sixth	
COUNTY: Gunnison	WATERSHED: East River	WATER DIVISION: 4	DOW WATER CODE: 43113			
MAP(S): USGS:	GPS Zone 13 324267					
USFS:	4308734					

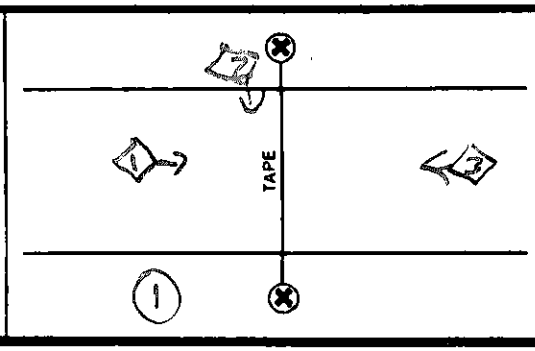
SUPPLEMENTAL DATA

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: 2 - 8" cobbles	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.6 / 5.6
② WS Upstream	59.8	5.54
③ WS Downstream	45.1	5.78
SLOPE	0.24 / 104.9 = .002	

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:

mayfly, caddisfly, stonefly

COMMENTS

pH = 7.38
Temp = 10.40C
Salinity = 0.1
Cond = 128

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River	CROSS-SECTION NO: 1	DATE: 9-29-11	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 11:30 am

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
RS	0.0		4.0								
G	0.7		4.06								
	2.0		4.88								
	4.0		5.36								
RW	6.0		5.60								
	7.5		5.8	.2				0.19			
	9		5.9	.3				0.50			
	10.5		5.9	.3				0.82			
	12		5.95	.35				0.96			
	13.5		6.0	.4				1.05			
	15		6.15	.55				1.58			
	16		6.3	.70				1.69			
	17		6.3	.70				1.81			
	18		6.3	.70				1.88			
	19		6.35	.75				1.86			
	20		6.25	.65				1.85			
	21		6.2	.60				1.66			
	22		6.15	.55				1.61			
	23		6.15	.55				1.20			
	24.5		6.0	.40				1.28			
	26		5.9	.30				0.98			
	27.5		5.75	.15				0.64			
	29		5.7	.10				0.09			
LW	30.5		5.60								
	42		4.76								
	52		4.18								
	58		3.96								
	70		4.90								
G	79		3.74								
ES	83		3.38								
TOTALS:											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	700 ft dwnstr fr conf w. Oh Be Joyful CK
XS NUMBER:	1
DATE:	29-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	SW NE
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.002

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

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

STREAM NAME: Slate River
XS LOCATION: 700 ft dwnstr fr conf w. Oh Be Joyful CK
XS NUMBER: 1

DATA POINTS= 30

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	0.00	4.00			0.00		0.00	0.00	0.0%
1	G	0.70	4.06			0.00		0.00	0.00	0.0%
		2.00	4.88			0.00		0.00	0.00	0.0%
		4.00	5.36			0.00		0.00	0.00	0.0%
	RW	6.00	5.60	0.00	0.00	0.00		0.00	0.00	0.0%
		7.50	5.80	0.20	0.19	1.51	0.20	0.30	0.06	0.4%
		9.00	5.90	0.30	0.80	1.50	0.30	0.45	0.36	2.7%
		10.50	5.90	0.30	0.82	1.50	0.30	0.45	0.37	2.7%
		12.00	5.95	0.35	0.96	1.50	0.35	0.53	0.50	3.7%
		13.50	6.00	0.40	1.05	1.50	0.40	0.60	0.63	4.7%
		15.00	6.15	0.55	1.58	1.51	0.55	0.69	1.09	8.1%
		16.00	6.30	0.70	1.69	1.01	0.70	0.70	1.18	8.8%
		17.00	6.30	0.70	1.81	1.00	0.70	0.70	1.27	9.4%
		18.00	6.30	0.70	1.88	1.00	0.70	0.70	1.32	9.8%
		19.00	6.35	0.75	1.86	1.00	0.75	0.75	1.40	10.4%
		20.00	6.25	0.65	1.85	1.00	0.65	0.65	1.20	8.9%
		21.00	6.20	0.60	1.66	1.00	0.60	0.60	1.00	7.4%
		22.00	6.15	0.55	1.61	1.00	0.55	0.55	0.89	6.6%
		23.00	6.15	0.55	1.20	1.00	0.55	0.69	0.83	6.1%
		24.50	6.00	0.40	1.28	1.51	0.40	0.60	0.77	5.7%
		26.00	5.90	0.30	0.98	1.50	0.30	0.45	0.44	3.3%
		27.50	5.75	0.15	0.64	1.51	0.15	0.23	0.14	1.1%
		29.00	5.70	0.10	0.09	1.50	0.10	0.15	0.01	0.1%
	LW	30.50	5.60	0.00	0.00	1.50		0.00	0.00	0.0%
		42.00	4.76			0.00		0.00	0.00	0.0%
		52.00	4.18			0.00		0.00	0.00	0.0%
		58.00	3.96			0.00		0.00	0.00	0.0%
		76.00	4.90			0.00		0.00	0.00	0.0%
1	G	79.00	3.74			0.00		0.00	0.00	0.0%
	LS	83.00	3.38			0.00		0.00	0.00	0.0%
	TOTALS ----------					24.57	0.75 (Max.)	9.78	13.44	100.0%

Manning's n = 0.0261
Hydraulic Radius= 0.39787319

STREAM NAME: Slate River
XS LOCATION: 700 ft dwnstr fr conf w. Oh Be Joyful CK
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.78	9.78	0.0%
5.35	9.78	16.59	69.7%
5.37	9.78	15.99	63.6%
5.39	9.78	15.41	57.6%
5.41	9.78	14.83	51.7%
5.43	9.78	14.26	45.9%
5.45	9.78	13.70	40.1%
5.47	9.78	13.15	34.5%
5.49	9.78	12.60	28.9%
5.51	9.78	12.07	23.5%
5.53	9.78	11.54	18.1%
5.55	9.78	11.03	12.8%
5.56	9.78	10.77	10.2%
5.57	9.78	10.52	7.6%
5.58	9.78	10.27	5.1%
5.59	9.78	10.02	2.5%
5.60	9.78	9.78	0.0%
5.61	9.78	9.53	-2.5%
5.62	9.78	9.29	-5.0%
5.63	9.78	9.05	-7.4%
5.64	9.78	8.81	-9.8%
5.65	9.78	8.58	-12.2%
5.67	9.78	8.12	-17.0%
5.69	9.78	7.66	-21.6%
5.71	9.78	7.22	-26.2%
5.73	9.78	6.79	-30.6%
5.75	9.78	6.37	-34.8%
5.77	9.78	5.97	-38.9%
5.79	9.78	5.57	-43.0%
5.81	9.78	5.18	-47.0%
5.83	9.78	4.80	-50.9%
5.85	9.78	4.43	-54.7%

WATERLINE AT ZERO
AREA ERROR = 5.600

STREAM NAME: Slate River
XS LOCATION: 700 ft dwnstr fr conf w. Oh Be Joyful 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	4.06	72.83	1.07	2.29	77.85	73.44	100.0%	1.06	205.75	2.64
	4.60	49.72	0.91	1.75	45.01	50.04	68.1%	0.90	106.61	2.37
	4.65	47.69	0.89	1.70	42.57	47.99	65.3%	0.89	99.92	2.35
	4.70	45.67	0.88	1.65	40.24	45.93	62.5%	0.88	93.65	2.33
	4.75	43.64	0.87	1.60	38.00	43.88	59.7%	0.87	87.79	2.31
	4.80	41.75	0.86	1.55	35.87	41.97	57.1%	0.85	82.13	2.29
	4.85	39.90	0.85	1.50	33.83	40.09	54.6%	0.84	76.80	2.27
	4.90	38.00	0.84	1.45	31.88	38.16	52.0%	0.84	71.89	2.25
	4.95	37.11	0.81	1.40	30.00	37.26	50.7%	0.81	66.01	2.20
	5.00	36.21	0.78	1.35	28.17	36.36	49.5%	0.77	60.41	2.14
	5.05	35.32	0.75	1.30	26.38	35.46	48.3%	0.74	55.06	2.09
	5.10	34.43	0.72	1.25	24.64	34.56	47.1%	0.71	49.98	2.03
	5.15	33.54	0.68	1.20	22.94	33.66	45.8%	0.68	45.16	1.97
	5.20	32.64	0.65	1.15	21.28	32.76	44.6%	0.65	40.59	1.91
	5.25	31.75	0.62	1.10	19.67	31.86	43.4%	0.62	36.27	1.84
	5.30	30.86	0.59	1.05	18.11	30.96	42.2%	0.58	32.20	1.78
	5.35	29.96	0.55	1.00	16.59	30.06	40.9%	0.55	28.37	1.71
	5.40	28.90	0.52	0.95	15.12	28.99	39.5%	0.52	24.89	1.65
	5.45	27.80	0.49	0.90	13.70	27.89	38.0%	0.49	21.68	1.58
	5.50	26.70	0.46	0.85	12.34	26.78	36.5%	0.46	18.70	1.52
	5.55	25.60	0.43	0.80	11.03	25.67	35.0%	0.43	15.96	1.45
WL	5.60	24.50	0.40	0.75	9.77	24.57	33.5%	0.40	13.44	1.38
	5.65	23.38	0.37	0.70	8.58	23.44	31.9%	0.37	11.16	1.30
	5.70	22.25	0.33	0.65	7.44	22.31	30.4%	0.33	9.09	1.22
	5.75	20.37	0.31	0.60	6.37	20.43	27.8%	0.31	7.45	1.17
	5.80	19.50	0.28	0.55	5.37	19.55	26.6%	0.27	5.78	1.07
	5.85	18.25	0.24	0.50	4.43	18.29	24.9%	0.24	4.38	0.99
	5.90	15.50	0.23	0.45	3.55	15.54	21.2%	0.23	3.37	0.95
	5.95	13.25	0.21	0.40	2.83	13.29	18.1%	0.21	2.57	0.91
	6.00	11.00	0.20	0.35	2.23	11.03	15.0%	0.20	1.94	0.87
	6.05	10.00	0.17	0.30	1.70	10.03	13.7%	0.17	1.32	0.78
	6.10	9.00	0.14	0.25	1.23	9.02	12.3%	0.14	0.82	0.67
	6.15	7.00	0.11	0.20	0.80	7.02	9.6%	0.11	0.48	0.60
	6.20	5.67	0.09	0.15	0.48	5.68	7.7%	0.09	0.24	0.49
	6.25	4.33	0.05	0.10	0.23	4.34	5.9%	0.05	0.08	0.36
	6.30	1.50	0.03	0.05	0.04	1.50	2.0%	0.02	0.01	0.22
	6.35	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Slate River
XS LOCATION: 700 ft dwnstr fr conf w. Oh Be Joyful CK
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	13.44	cfs
CALCULATED FLOW (Qc)=	13.44	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.60	ft
CALCULATED WATERLINE (WLc)=	5.60	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.75	ft
MAX CALCULATED DEPTH (Dc)=	0.75	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	1.38	ft/sec
MANNING'S N=	0.026	
SLOPE=	0.002	ft/ft
.4 * Qm =	5.4	cfs
2.5 * Qm=	33.6	cfs

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

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

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

_____
_____
_____
_____
_____
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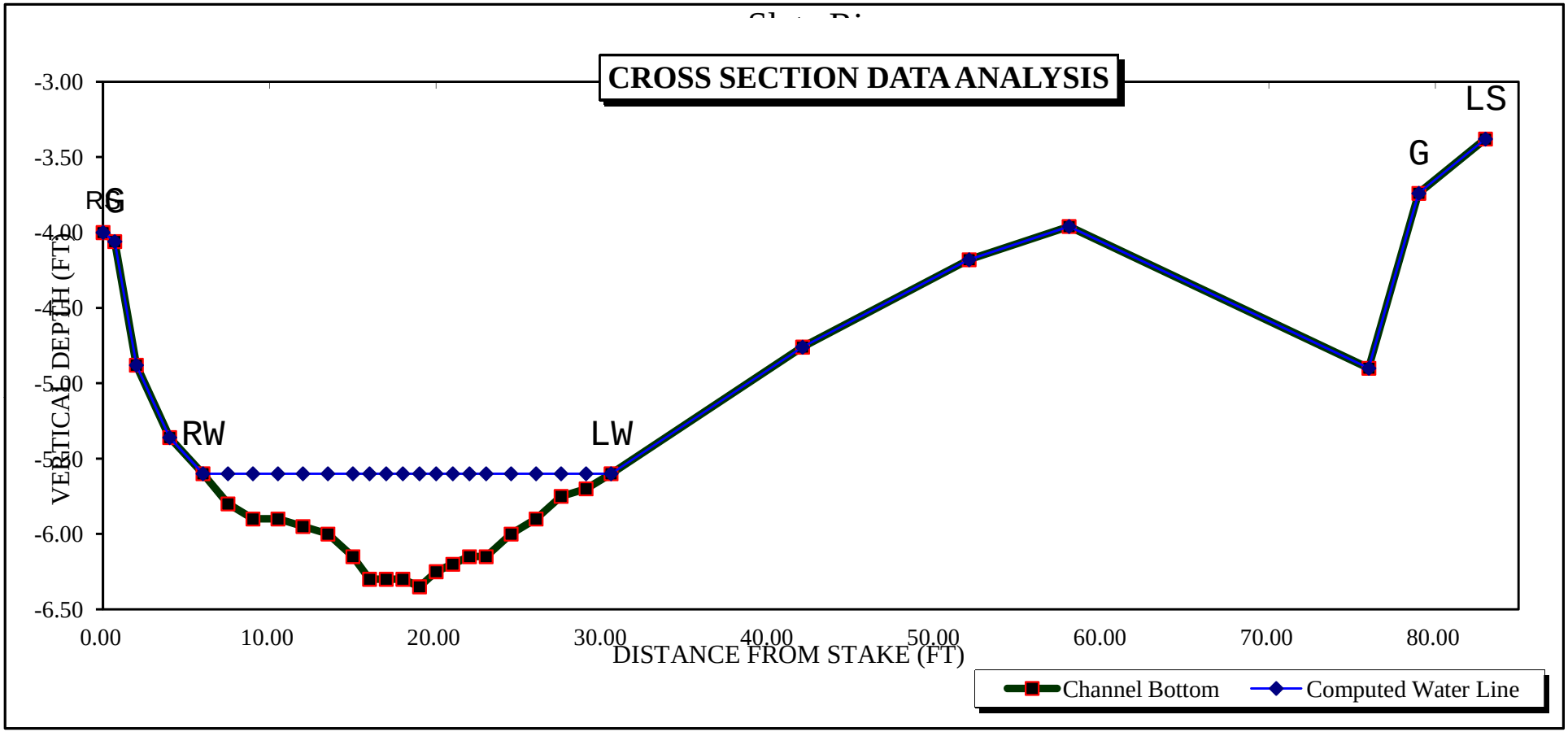
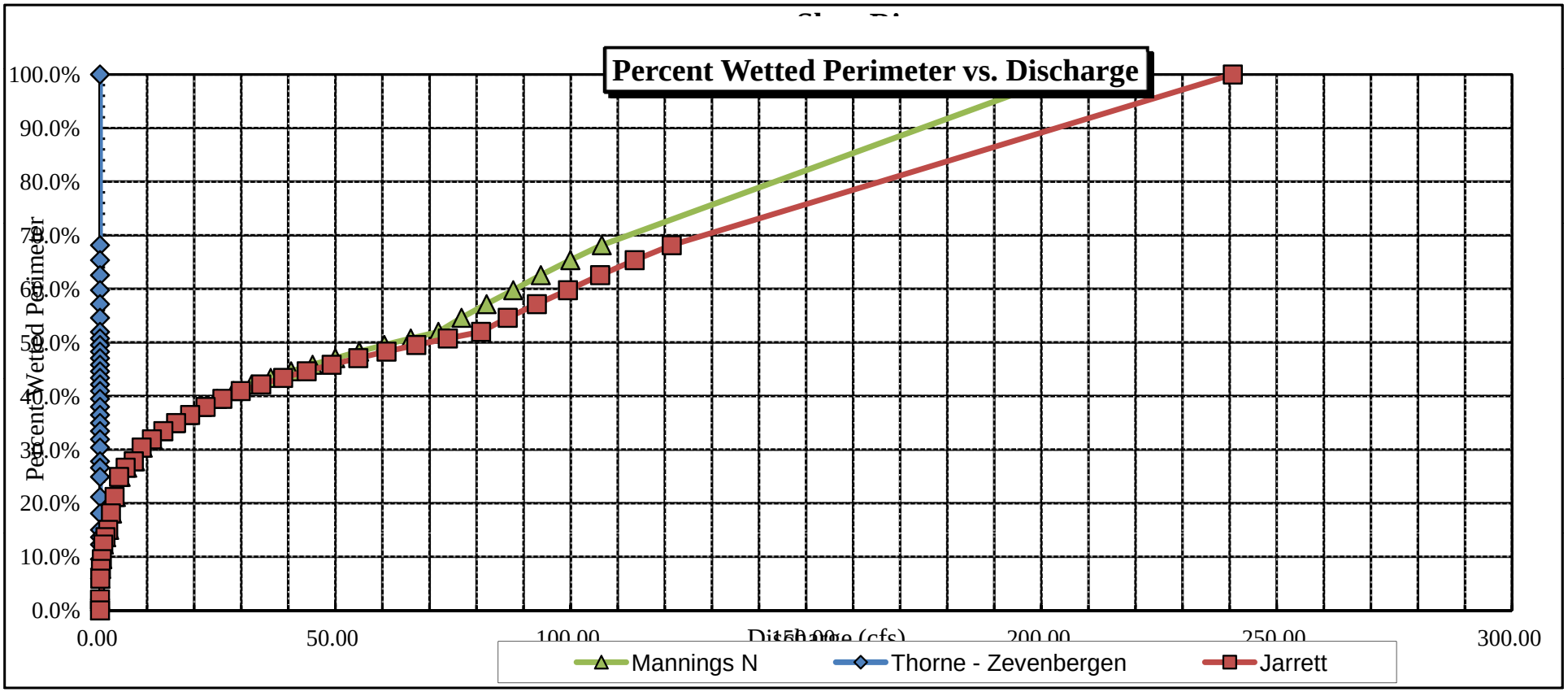
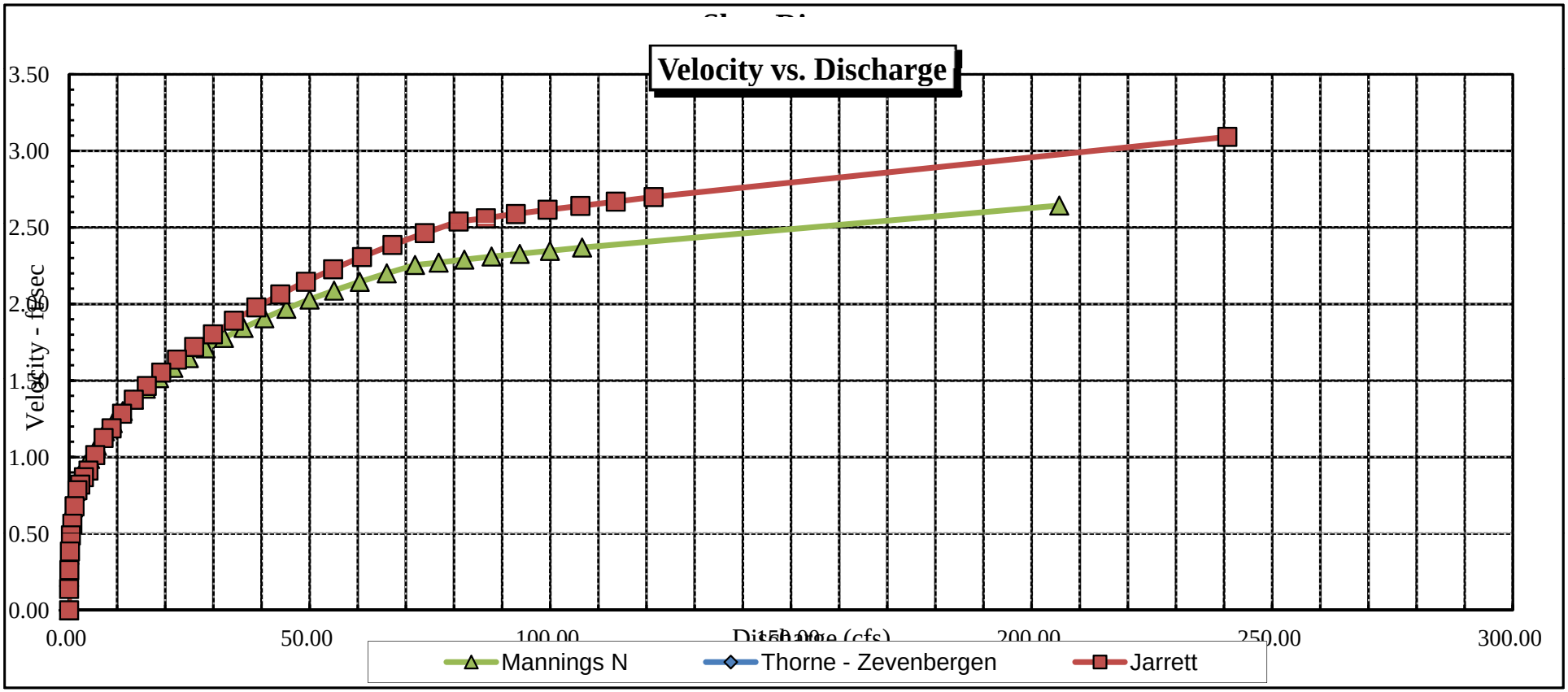
_____
_____

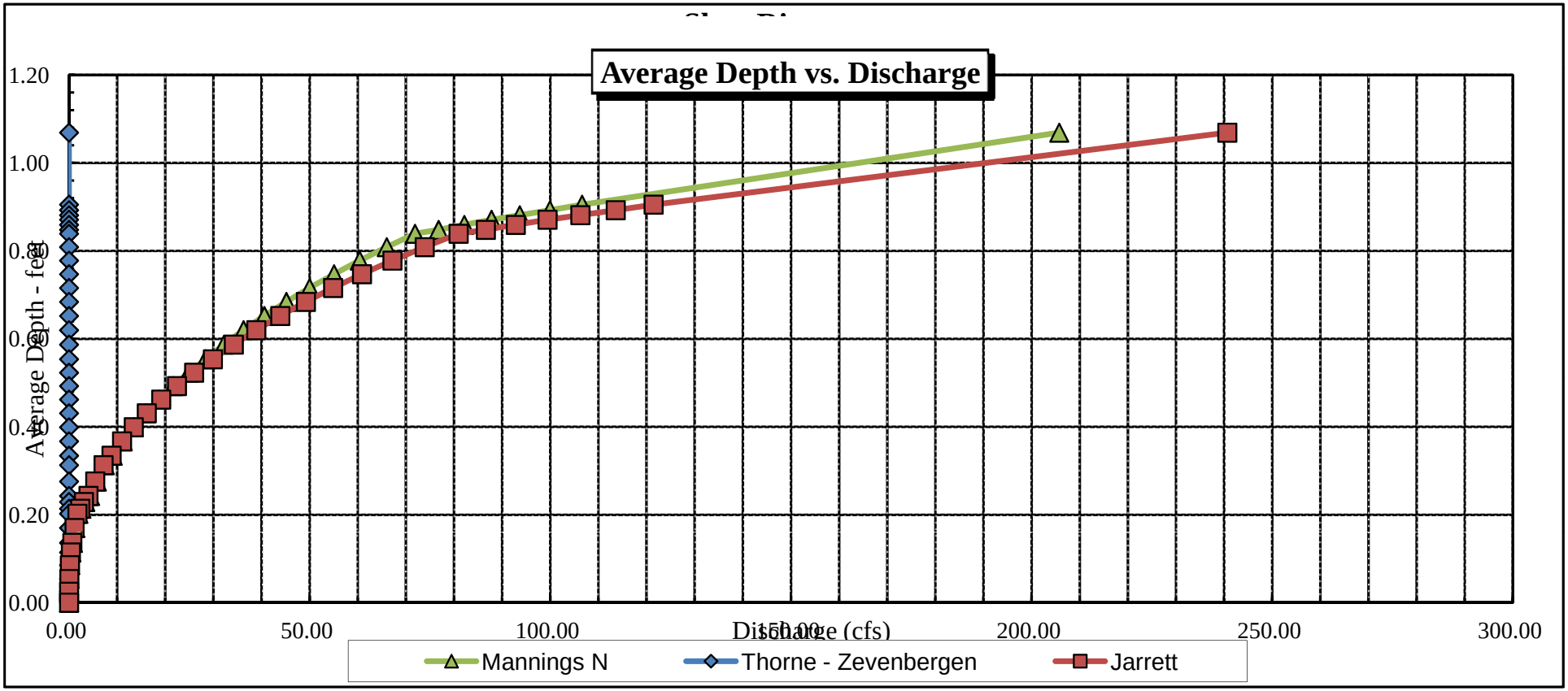
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

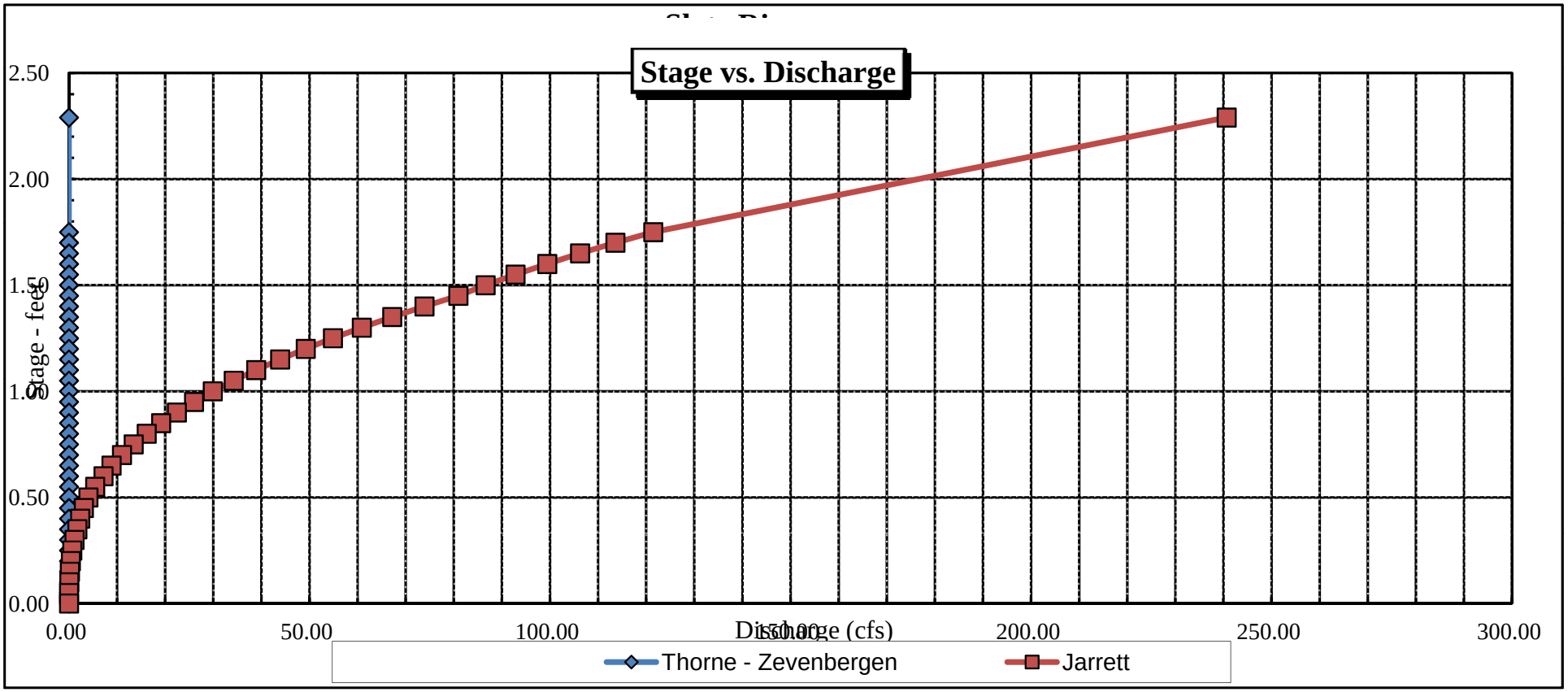
CWCB REVIEW BY: ..... DATE:.....


CROSS SECTION DATA ANALYSIS
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
VERTICAL DEPTH (FT)
RG
RW
LW
G
LS
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
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
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: at Wildbird Property					
DATE: 6-8-12	OBSERVERS: R. Smith, A. Belhart				
LEGAL DESCRIPTION	¼ SECTION: NW NW	SECTION: 28	TOWNSHIP: 13N (S)	RANGE: 86 E (W)	PM: 6th
COUNTY: Gunnison	WATERSHED: East River	WATER DIVISION: 4	DOW WATER CODE: 43113		
MAP(S): USGS:			GPS Zone 13S 0326866		
USFS:			4306284		

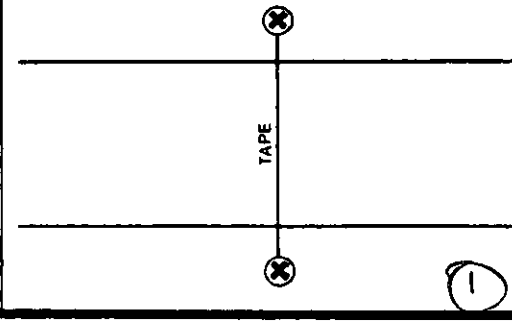
SUPPLEMENTAL DATA

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: gravel to 6" cobbles		PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 4	

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	5.25 / 5.25
② WS Upstream	110.0	5.05
③ WS Downstream	54.9	5.35
SLOPE	0.30 / 164.9 = .0018	

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

mayfly, caddisfly, stonefly

COMMENTS

pH = 5.92
Temp: 5.8°C
Cond = 39
Salinity = 0

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River | CROSS-SECTION NO. 2 | DATE 6-8-12 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: ____ ft | TIME 10:15 am

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		3.26								
G	6.4		3.95								
	7.3		4.48								
W	7.4		5.25								
	8		6.15	0.9				0			
	10		6.45	1.2				1.16			
	12		6.90	1.65				0.49			
	14		6.90	1.65				1.72			
	16		6.25	1.0				2.04			
	18		6.00	0.75				2.15			
	20		6.00	0.75				2.26			
	22		6.15	0.9				2.58			
	24		6.25	1.0				2.32			
	26		6.45	1.2				2.4			
	28		6.65	1.4				2.46			
	30		6.60	1.35				2.67			
	32		6.50	1.25				2.77			
	34		6.50	1.25				2.69			
	36		6.55	1.3				2.68			
	38		6.55	1.3				2.69			
	40		6.40	1.15				2.7			
	42		6.30	1.05				2.59			
	45		6.10	0.85				2.4			
	48		5.95	0.7				2.45			
	51		6.00	0.75				2.50			
	54		6.0	0.75				2.11			
	57		6.0	0.75				2.28			
	60		5.95	0.7				2.41			
	63		6.05	0.8				2.56			
	66		6.05	0.8				2.56			
	69		6.05	0.8				2.56			
	72		6.00	0.75				2.23			
	75		5.85	0.6				2.03			
	78		5.55	0.3				1.48			
W	80.2		5.25								
	83.0		4.40								
	86.7		4.70								
G	91.5		3.85								
LS	100.7		2.70								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	At Wildbird Property
XS NUMBER:	2
DATE:	8-Jun-12
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW NW
SECTION:	28
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
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:	0.0018

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

ASSIGNED TO: ….....…….....DATE.....

STREAM NAME: Slate River
XS LOCATION: At Wildbird Property
XS NUMBER: 2

DATA POINTS= 39

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				0.00		0.00	0.00	0.0%
1	G	6.40				0.00		0.00	0.00	0.0%
		7.30				0.00		0.00	0.00	0.0%
	W	7.40	0.00	0.00	0.00	0.00		0.00	0.00	0.0%
		8.00	0.90	0.90	0.00	1.08	0.90	1.17	0.00	0.0%
		10.00	1.20	1.20	1.16	2.02	1.20	2.40	2.78	1.8%
		12.00	1.65	1.65	0.49	2.05	1.65	3.30	1.62	1.1%
		14.00	1.65	1.65	1.72	2.00	1.65	3.30	5.68	3.8%
		16.00	1.00	1.00	2.04	2.10	1.00	2.00	4.08	2.7%
		18.00	0.75	0.75	2.15	2.02	0.75	1.50	3.23	2.1%
		20.00	0.75	0.75	2.26	2.00	0.75	1.50	3.39	2.3%
		22.00	0.90	0.90	2.58	2.01	0.90	1.80	4.64	3.1%
		24.00	1.00	1.00	2.32	2.00	1.00	2.00	4.64	3.1%
		26.00	1.20	1.20	2.40	2.01	1.20	2.40	5.76	3.8%
		28.00	1.40	1.40	2.46	2.01	1.40	2.80	6.89	4.6%
		30.00	1.35	1.35	2.67	2.00	1.35	2.70	7.21	4.8%
		32.00	1.25	1.25	2.77	2.00	1.25	2.50	6.93	4.6%
		34.00	1.25	1.25	2.69	2.00	1.25	2.50	6.73	4.5%
		36.00	1.30	1.30	2.68	2.00	1.30	2.60	6.97	4.6%
		38.00	1.30	1.30	2.69	2.00	1.30	2.60	6.99	4.6%
		40.00	1.15	1.15	2.70	2.01	1.15	2.30	6.21	4.1%
		42.00	1.05	1.05	2.59	2.00	1.05	2.63	6.80	4.5%
		45.00	0.85	0.85	2.40	3.01	0.85	2.55	6.12	4.1%
		48.00	0.70	0.70	2.45	3.00	0.70	2.10	5.15	3.4%
		51.00	0.75	0.75	2.50	3.00	0.75	2.25	5.63	3.7%
		54.00	0.75	0.75	2.11	3.00	0.75	2.25	4.75	3.2%
		57.00	0.75	0.75	2.28	3.00	0.75	2.25	5.13	3.4%
		60.00	0.70	0.70	2.41	3.00	0.70	2.10	5.06	3.4%
		63.00	0.80	0.80	2.56	3.00	0.80	2.40	6.14	4.1%
		66.00	0.80	0.80	2.56	3.00	0.80	2.40	6.14	4.1%
		69.00	0.80	0.80	2.56	3.00	0.80	2.40	6.14	4.1%
		72.00	0.75	0.75	2.23	3.00	0.75	2.25	5.02	3.3%
		75.00	0.60	0.60	2.03	3.00	0.60	1.80	3.65	2.4%
		78.00	0.30	0.30	1.48	3.01	0.30	0.78	1.15	0.8%
	W	80.20	0.00	0.00	0.00	2.22		0.00	0.00	0.0%
		83.00				0.00		0.00	0.00	0.0%
		86.20				0.00		0.00	0.00	0.0%
1	G	91.50				0.00		0.00	0.00	0.0%
	LS	100.70				0.00		0.00	0.00	0.0%
	TOTALS ----------					73.56	1.65 (Max.)	67.53	150.62	100.0%

Manning's n = 0.0267
Hydraulic Radius= 0.91789696

STREAM NAME: Slate River
XS LOCATION: At Wildbird Property
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	67.53	67.53	0.0%
-0.25	67.53	92.70	37.3%
-0.23	67.53	90.69	34.3%
-0.21	67.53	88.67	31.3%
-0.19	67.53	86.66	28.3%
-0.17	67.53	84.65	25.4%
-0.15	67.53	82.63	22.4%
-0.13	67.53	80.62	19.4%
-0.11	67.53	78.60	16.4%
-0.09	67.53	76.59	13.4%
-0.07	67.53	74.58	10.4%
-0.05	67.53	72.56	7.5%
-0.04	67.53	71.56	6.0%
-0.03	67.53	70.55	4.5%
-0.02	67.53	69.54	3.0%
-0.01	67.53	68.53	1.5%
0.00	67.53	67.53	0.0%
0.01	67.53	66.80	-1.1%
0.02	67.53	66.07	-2.1%
0.03	67.53	65.35	-3.2%
0.04	67.53	64.62	-4.3%
0.05	67.53	63.90	-5.4%
0.07	67.53	62.45	-7.5%
0.09	67.53	61.01	-9.7%
0.11	67.53	59.57	-11.8%
0.13	67.53	58.13	-13.9%
0.15	67.53	56.70	-16.0%
0.17	67.53	55.27	-18.2%
0.19	67.53	53.84	-20.3%
0.21	67.53	52.42	-22.4%
0.23	67.53	51.00	-24.5%
0.25	67.53	49.58	-26.6%

WATERLINE AT ZERO
AREA ERROR = 0.000

STREAM NAME: Slate River
XS LOCATION: At Wildbird Property
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	0.00	72.80	0.93	1.65	67.53	73.57	100.0%	0.92	150.64	2.23
WL	0.00	72.80	0.93	1.65	67.52	73.56	100.0%	0.92	150.62	2.23
	0.05	72.40	0.88	1.60	63.89	73.13	99.4%	0.87	137.91	2.16
	0.10	72.00	0.84	1.55	60.28	72.70	98.8%	0.83	125.66	2.08
	0.15	71.60	0.79	1.50	56.69	72.27	98.2%	0.78	113.89	2.01
	0.20	71.20	0.75	1.45	53.12	71.84	97.7%	0.74	102.59	1.93
	0.25	70.80	0.70	1.40	49.57	71.41	97.1%	0.69	91.79	1.85
	0.30	70.40	0.65	1.35	46.04	70.98	96.5%	0.65	81.49	1.77
	0.35	69.87	0.61	1.30	42.54	70.42	95.7%	0.60	71.79	1.69
	0.40	69.33	0.56	1.25	39.06	69.86	95.0%	0.56	62.60	1.60
	0.45	68.80	0.52	1.20	35.60	69.30	94.2%	0.51	53.94	1.52
	0.50	68.27	0.47	1.15	32.18	68.73	93.4%	0.47	45.82	1.42
	0.55	67.73	0.42	1.10	28.78	68.17	92.7%	0.42	38.25	1.33
	0.60	67.20	0.38	1.05	25.41	67.61	91.9%	0.38	31.24	1.23
	0.65	66.17	0.33	1.00	22.07	66.55	90.5%	0.33	24.97	1.13
	0.70	65.14	0.29	0.95	18.79	65.49	89.0%	0.29	19.30	1.03
	0.75	47.60	0.33	0.90	15.77	47.92	65.1%	0.33	17.75	1.13
	0.80	35.00	0.39	0.85	13.55	35.29	48.0%	0.38	16.92	1.25
	0.85	32.90	0.36	0.80	11.86	33.15	45.1%	0.36	14.11	1.19
	0.90	31.05	0.33	0.75	10.26	31.27	42.5%	0.33	11.52	1.12
	0.95	28.57	0.31	0.70	8.77	28.78	39.1%	0.30	9.38	1.07
	1.00	26.08	0.28	0.65	7.40	26.28	35.7%	0.28	7.51	1.01
	1.05	24.35	0.25	0.60	6.14	24.53	33.3%	0.25	5.76	0.94
	1.10	22.36	0.22	0.55	4.97	22.53	30.6%	0.22	4.29	0.86
	1.15	20.37	0.19	0.50	3.91	20.53	27.9%	0.19	3.05	0.78
	1.20	18.72	0.16	0.45	2.93	18.86	25.6%	0.16	2.00	0.68
	1.25	15.18	0.13	0.40	2.03	15.30	20.8%	0.13	1.25	0.61
	1.30	8.63	0.16	0.35	1.39	8.73	11.9%	0.16	0.96	0.69
	1.35	6.76	0.15	0.30	1.00	6.84	9.3%	0.15	0.66	0.66
	1.40	3.88	0.19	0.25	0.73	3.95	5.4%	0.19	0.57	0.77
	1.45	3.50	0.16	0.20	0.55	3.56	4.8%	0.15	0.37	0.68
	1.50	3.13	0.12	0.15	0.38	3.17	4.3%	0.12	0.22	0.58
	1.55	2.75	0.09	0.10	0.24	2.78	3.8%	0.09	0.11	0.46
	1.60	2.38	0.05	0.05	0.11	2.39	3.2%	0.05	0.03	0.30

STREAM NAME: Slate River
XS LOCATION: At Wildbird Property
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	150.62	cfs
CALCULATED FLOW (Qc)=	150.62	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	0.00	ft
CALCULATED WATERLINE (WLc)=	0.00	ft
(WLm-WLc)/WLm * 100 =	-77.7	%
MAX MEASURED DEPTH (Dm)=	1.65	ft
MAX CALCULATED DEPTH (Dc)=	1.65	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	2.23	ft/sec
MANNING'S N=	0.027	
SLOPE=	0.0018	ft/ft
.4 * Qm =	60.2	cfs
2.5 * Qm=	376.6	cfs

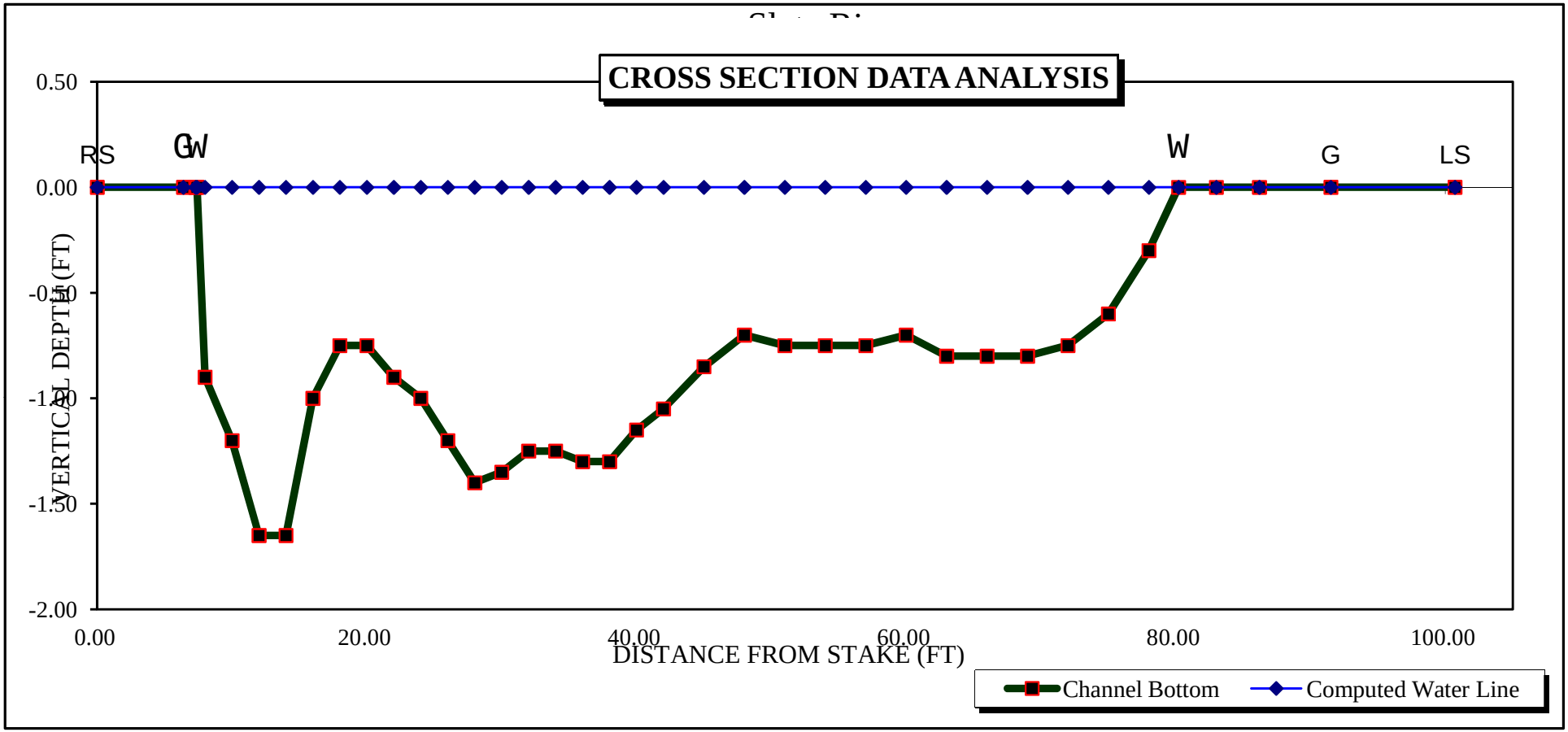
RECOMMENDED INSTREAM FLOW:
=============================

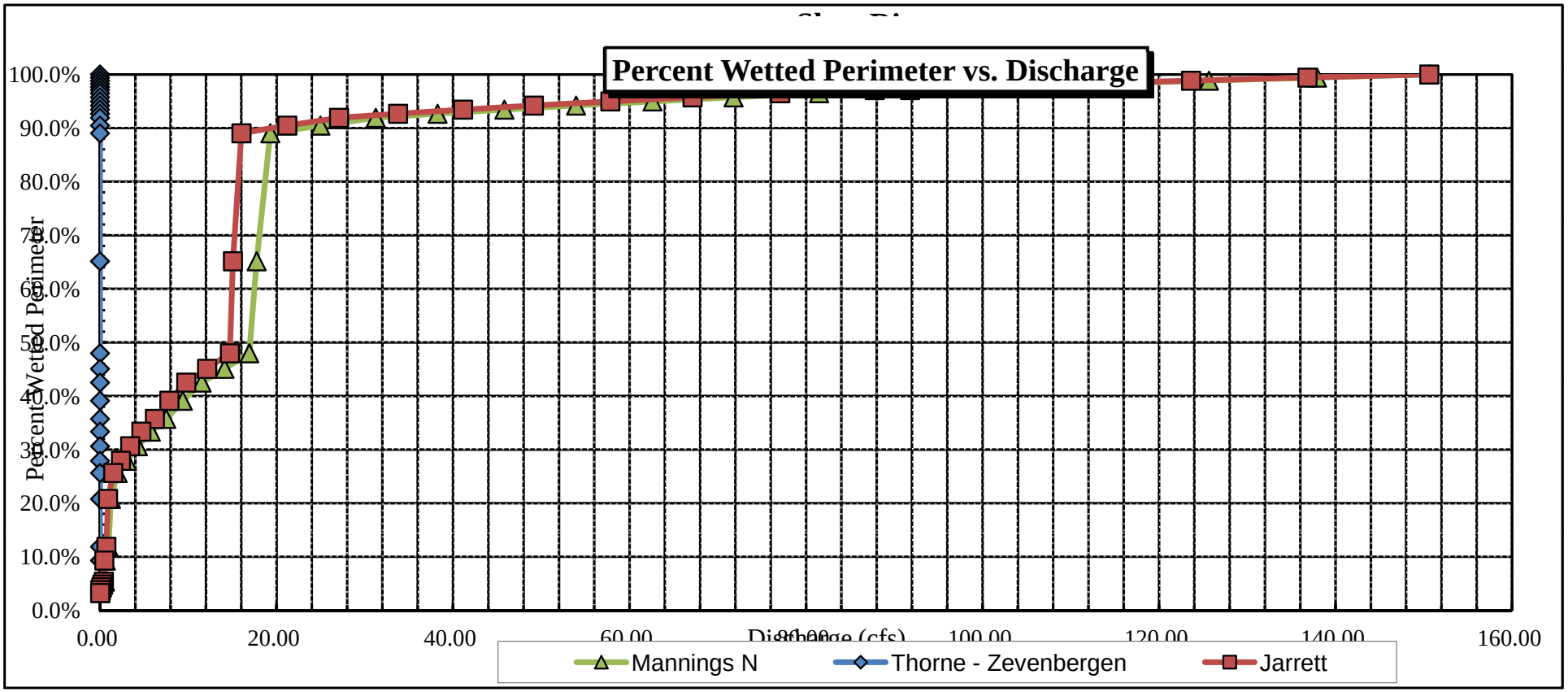
FLOW (CFS)	PERIOD
___________	________
___________	________
___________	________
___________	________

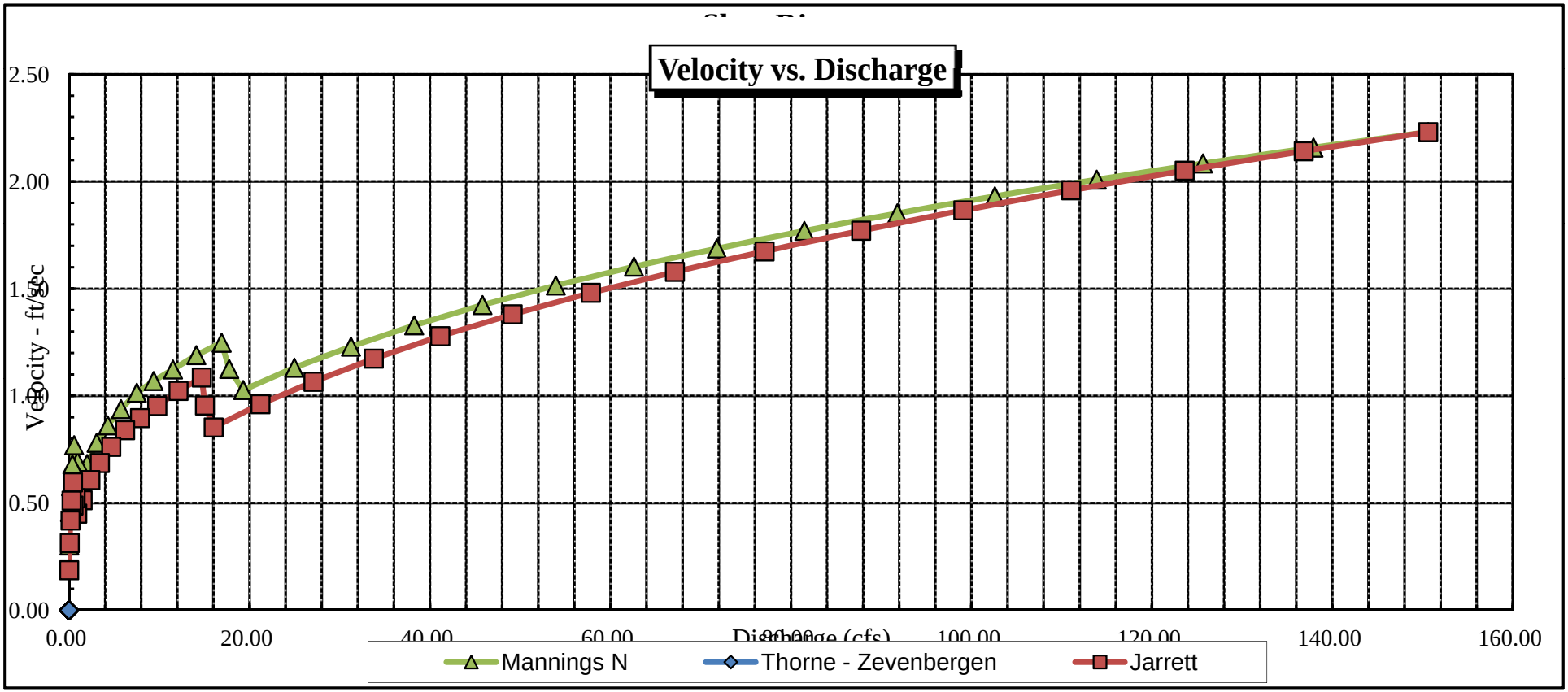
RATIONALE FOR RECOMMENDATION:
=============================

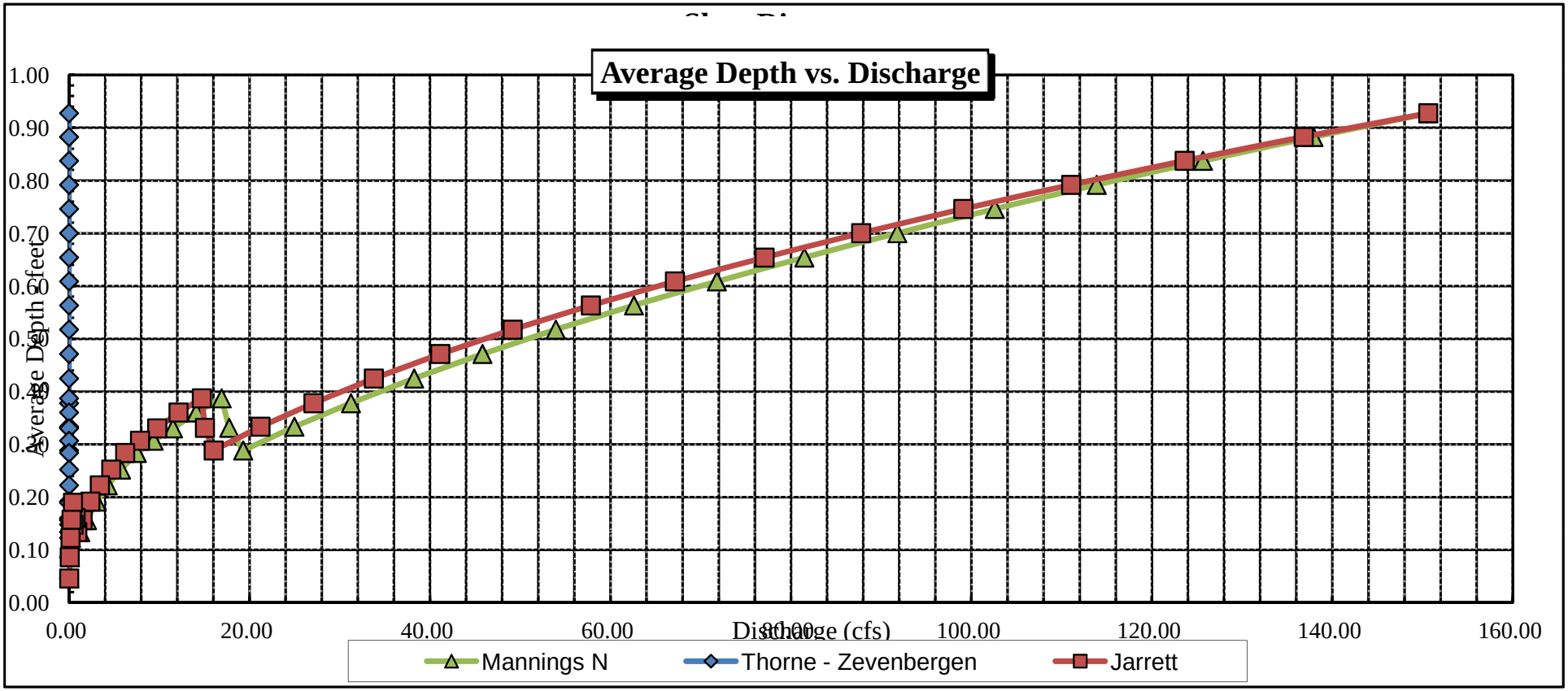
RECOMMENDATION BY: ………………...………..…….............................. AGENCY...……………………......…....…...…....... DATE:......…...….......……………

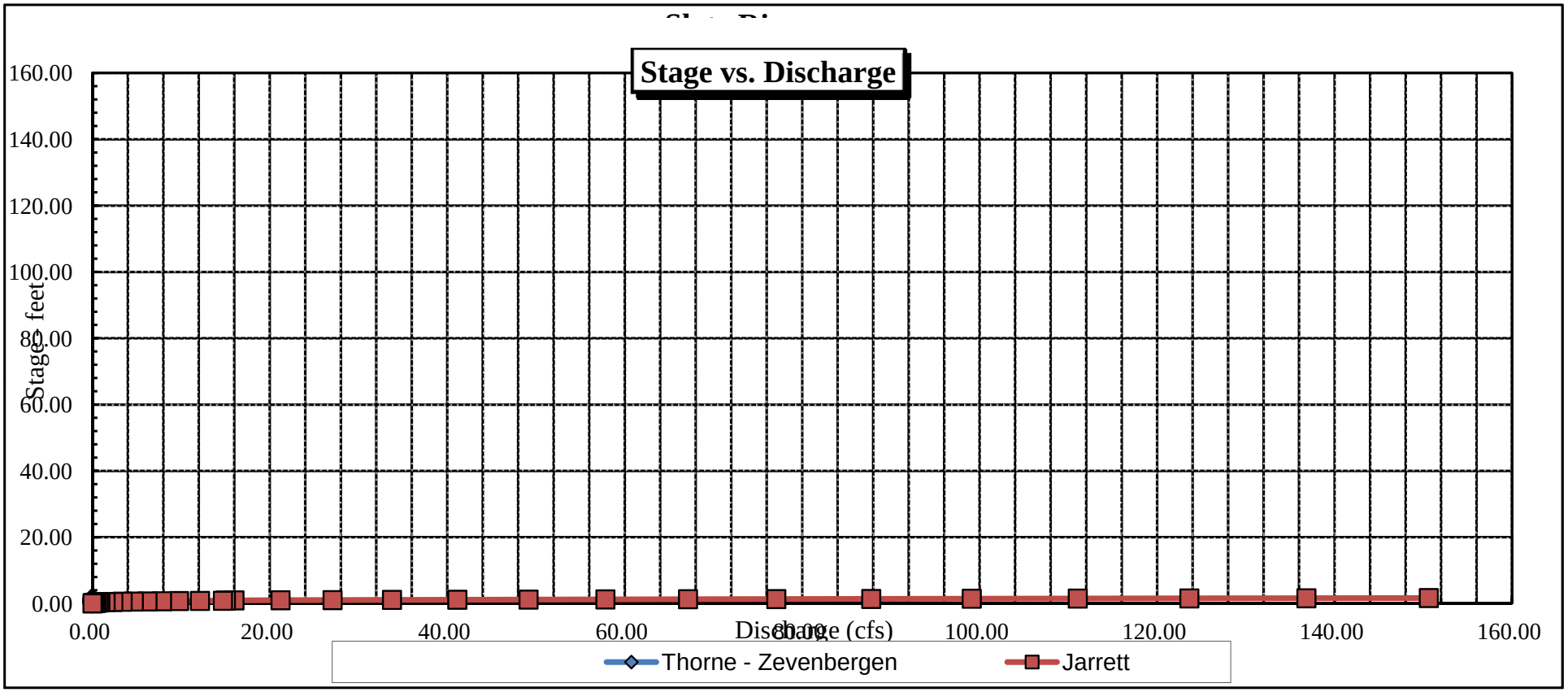
CWCB REVIEW BY: ..……………………….....…………………………………………...…............. DATE:.................………………..…


CROSS SECTION DATA ANALYSIS
0.50
0.00
-0.50
-1.00
-1.50
-2.00
RS
GW
W
G
LS
VERTICAL DEPTH (FT)
0.00
20.00
40.00
60.00
80.00
100.00
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
20.00
40.00
60.00
Discharge (cfs)
100.00
120.00
140.00
160.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Velocity - ft/sec
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth (feet)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Stage, feet
0.00
20.00
40.00
60.00
Discharge (cfs)
100.00
120.00
140.00
160.00
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: West of Mile Marker 3 on Slate River Road						
DATE: 6-8-12	OBSERVERS: R. Smith, A. Brelsford					
LEGAL DESCRIPTION	¼ SECTION: SE SE	SECTION: 20	TOWNSHIP: 13 N/S	RANGE: 86 E/W	PM: 6th	
COUNTY: Gunnison	WATERSHED: East River	WATER DIVISION: 4	DOW WATER CODE: 43113			
MAP(S): USGS:	GPS Zone 13 325267					
USFS:	4307539					

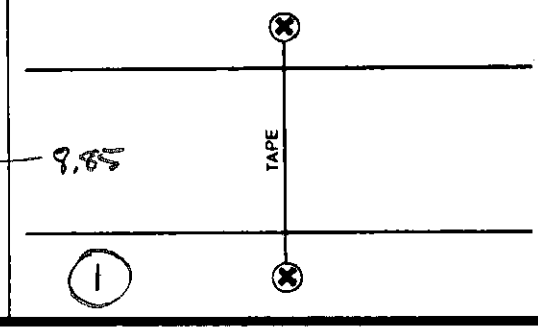
SUPPLEMENTAL DATA

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: gravel to 6" cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
Tape @ Stake LB	0.0	surveyed
Tape @ Stake RB	0.0	surveyed
1 WS @ Tape LB/RB	0.0	5.65/5.68
2 WS Upstream	124.2	5.25
3 WS Downstream	43.0	5.90
SLOPE	0.65 / 167.2 =	

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:
mayfly, caddisfly, stonefly

COMMENTS

pH: 5.92
Temp: 5.8°C
Cond: 39
Salinity: 0

Riparian: willow, river birch, rush, sedge

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River | CROSS-SECTION NO: 1 | DATE: 6-8-12 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 9 am

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&RS	0.0		4.60								
	5.3		4.60								
	7.0		5.00								
W	8.8		5.68								
	10		5.95	0.3				1.31			
	12		6.15	0.5				2.60			
	14		6.45	0.8				3.02			
	16		6.60	0.95				3.35			
	18		6.75	1.1				3.55			
	20		6.8	1.15				3.44			
	22		6.9	1.25				3.54			
	24		6.95	1.3				3.60			
	26		7.0	1.35				3.29			
	28		6.95	1.3				3.53			
	30		6.95	1.3				3.63			
	32		6.85	1.2				3.61			
	34		6.85	1.2				3.60			
	36		6.55	0.9				3.56			
	38		6.75	1.1				2.99			
	40		6.65	1.0				3.05			
	42		6.55	0.9				3.41			
	44		6.50	0.85				2.58			
	46		6.30	0.65				3.03			
	48		6.20	0.55				2.46			
	50		6.20	0.55				2.84			
	52		6.25	0.6				3.01			
	54		6.15	0.5				3.14			
	56		6.40	0.75				3.16			
	58		6.75	1.1				2.59			
	60		6.85	1.2				0.71			
W	60.9		5.65								
	61.0		5.15								
G	62.2		4.48								
LS	66.2		4.47								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	West of Mile Marker 3 on Slate R. Road
XS NUMBER:	1
DATE:	8-Jun-12
OBSERVERS:	R. Smith, A Breibart
1/4 SEC:	SE SE
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.0038

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

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

STREAM NAME: Slate River
XS LOCATION: West of Mile Marker 3 on Slate R. Road
XS NUMBER: 1

DATA POINTS= 34

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	G & RS	0.00	4.60			0.00		0.00	0.00	0.0%
		5.30	4.60			0.00		0.00	0.00	0.0%
		7.00	5.00			0.00		0.00	0.00	0.0%
	W	8.80	5.68	0.00	0.00	0.00		0.00	0.00	0.0%
		10.00	5.95	0.30	1.31	1.23	0.30	0.48	0.63	0.4%
		12.00	6.15	0.50	2.60	2.01	0.50	1.00	2.60	1.7%
		14.00	6.45	0.80	3.02	2.02	0.80	1.60	4.83	3.2%
		16.00	6.60	0.95	3.35	2.01	0.95	1.90	6.37	4.2%
		18.00	6.75	1.10	3.55	2.01	1.10	2.20	7.81	5.2%
		20.00	6.80	1.15	3.44	2.00	1.15	2.30	7.91	5.2%
		22.00	6.90	1.25	3.54	2.00	1.25	2.50	8.85	5.9%
		24.00	6.95	1.30	3.60	2.00	1.30	2.60	9.36	6.2%
		26.00	7.00	1.35	3.29	2.00	1.35	2.70	8.88	5.9%
		28.00	6.95	1.30	3.53	2.00	1.30	2.60	9.18	6.1%
		30.00	6.95	1.30	3.63	2.00	1.30	2.60	9.44	6.3%
		32.00	6.85	1.20	3.61	2.00	1.20	2.40	8.66	5.7%
		34.00	6.85	1.20	3.60	2.00	1.20	2.40	8.64	5.7%
		36.00	6.55	0.90	3.56	2.02	0.90	1.80	6.41	4.2%
		38.00	6.75	1.10	2.99	2.01	1.10	2.20	6.58	4.4%
		40.00	6.65	1.00	3.05	2.00	1.00	2.00	6.10	4.0%
		42.00	6.55	0.90	3.41	2.00	0.90	1.80	6.14	4.1%
		44.00	6.55	0.85	2.58	2.00	0.85	1.70	4.39	2.9%
		46.00	6.30	0.65	3.03	2.02	0.65	1.30	3.94	2.6%
		48.00	6.20	0.55	2.46	2.00	0.55	1.10	2.71	1.8%
		50.00	6.20	0.55	2.84	2.00	0.55	1.10	3.12	2.1%
		52.00	6.25	0.60	3.01	2.00	0.60	1.20	3.61	2.4%
		54.00	6.15	0.50	3.14	2.00	0.50	1.00	3.14	2.1%
		56.00	6.40	0.75	3.16	2.02	0.75	1.50	4.74	3.1%
		58.00	6.75	1.10	2.59	2.03	1.10	2.20	5.70	3.8%
		60.00	6.85	1.20	0.71	2.00	1.20	1.74	1.24	0.8%
	W	60.90	5.65	0.00	0.00	1.50		0.00	0.00	0.0%
		61.00	5.15			0.00		0.00	0.00	0.0%
1	G	62.20	4.48			0.00		0.00	0.00	0.0%
	LS	66.20	4.47			0.00		0.00	0.00	0.0%
	TOTALS ----------					52.89	1.35 (Max.)	47.92	150.97	100.0%

Manning's n = 0.0272
Hydraulic Radius= 0.90606444

STREAM NAME: Slate River
XS LOCATION: West of Mile Marker 3 on Slate R. Road
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	47.92	47.26	-1.4%
5.42	47.92	60.38	26.0%
5.44	47.92	59.32	23.8%
5.46	47.92	58.27	21.6%
5.48	47.92	57.22	19.4%
5.50	47.92	56.16	17.2%
5.52	47.92	55.11	15.0%
5.54	47.92	54.06	12.8%
5.56	47.92	53.01	10.6%
5.58	47.92	51.96	8.4%
5.60	47.92	50.91	6.2%
5.62	47.92	49.87	4.1%
5.63	47.92	49.35	3.0%
5.64	47.92	48.82	1.9%
5.65	47.92	48.30	0.8%
5.66	47.92	47.78	-0.3%
5.67	47.92	47.26	-1.4%
5.68	47.92	46.74	-2.5%
5.69	47.92	46.22	-3.6%
5.70	47.92	45.70	-4.6%
5.71	47.92	45.18	-5.7%
5.72	47.92	44.66	-6.8%
5.74	47.92	43.62	-9.0%
5.76	47.92	42.59	-11.1%
5.78	47.92	41.55	-13.3%
5.80	47.92	40.52	-15.4%
5.82	47.92	39.49	-17.6%
5.84	47.92	38.47	-19.7%
5.86	47.92	37.44	-21.9%
5.88	47.92	36.42	-24.0%
5.90	47.92	35.40	-26.1%
5.92	47.92	34.38	-28.3%

WATERLINE AT ZERO
AREA ERROR = 5.652

STREAM NAME: Slate River
XS LOCATION: West of Mile Marker 3 on Slate R. Road
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	4.60	56.69	1.85	2.40	104.77	58.20	100.0%	1.80	521.65	4.98
	4.65	56.37	1.81	2.35	101.81	57.86	99.4%	1.76	499.26	4.90
	4.70	56.07	1.77	2.30	99.00	57.54	98.9%	1.72	478.27	4.83
	4.75	55.76	1.73	2.25	96.20	57.22	98.3%	1.68	457.67	4.76
	4.80	55.46	1.68	2.20	93.42	56.90	97.8%	1.64	437.47	4.68
	4.85	55.16	1.64	2.15	90.66	56.58	97.2%	1.60	417.67	4.61
	4.90	54.86	1.60	2.10	87.91	56.26	96.7%	1.56	398.27	4.53
	4.95	54.56	1.56	2.05	85.17	55.94	96.1%	1.52	379.28	4.45
	5.00	54.26	1.52	2.00	82.45	55.62	95.6%	1.48	360.67	4.37
	5.05	54.04	1.48	1.95	79.74	55.37	95.2%	1.44	342.15	4.29
	5.10	53.81	1.43	1.90	77.05	55.13	94.7%	1.40	324.04	4.21
	5.15	53.60	1.39	1.85	74.36	54.89	94.3%	1.35	306.33	4.12
	5.20	53.45	1.34	1.80	71.69	54.70	94.0%	1.31	288.85	4.03
	5.25	53.31	1.29	1.75	69.02	54.50	93.7%	1.27	271.79	3.94
	5.30	53.17	1.25	1.70	66.35	54.31	93.3%	1.22	255.14	3.85
	5.35	53.03	1.20	1.65	63.70	54.12	93.0%	1.18	238.92	3.75
	5.40	52.88	1.15	1.60	61.05	53.93	92.7%	1.13	223.13	3.65
	5.45	52.74	1.11	1.55	58.41	53.73	92.3%	1.09	207.77	3.56
	5.50	52.60	1.06	1.50	55.78	53.54	92.0%	1.04	192.86	3.46
	5.55	52.46	1.01	1.45	53.15	53.35	91.7%	1.00	178.39	3.36
	5.60	52.32	0.97	1.40	50.53	53.16	91.3%	0.95	164.37	3.25
WL	5.65	52.17	0.92	1.35	47.92	52.96	91.0%	0.90	150.82	3.15
	5.70	51.96	0.87	1.30	45.32	52.72	90.6%	0.86	137.83	3.04
	5.75	51.70	0.83	1.25	42.72	52.43	90.1%	0.81	125.41	2.94
	5.80	51.44	0.78	1.20	40.15	52.14	89.6%	0.77	113.47	2.83
	5.85	51.18	0.73	1.15	37.58	51.85	89.1%	0.72	102.02	2.71
	5.90	50.92	0.69	1.10	35.03	51.56	88.6%	0.68	91.07	2.60
	5.95	50.65	0.64	1.05	32.49	51.26	88.1%	0.63	80.65	2.48
	6.00	50.11	0.60	1.00	29.97	50.69	87.1%	0.59	71.02	2.37
	6.05	49.58	0.55	0.95	27.48	50.13	86.1%	0.55	61.92	2.25
	6.10	49.04	0.51	0.90	25.01	49.56	85.2%	0.50	53.34	2.13
	6.15	48.44	0.47	0.85	22.57	48.94	84.1%	0.46	45.34	2.01
	6.20	44.54	0.45	0.80	20.20	45.00	77.3%	0.45	39.84	1.97
	6.25	39.90	0.45	0.75	18.09	40.33	69.3%	0.45	35.67	1.97
	6.30	38.16	0.42	0.70	16.14	38.55	66.2%	0.42	30.39	1.88
	6.35	36.99	0.39	0.65	14.26	37.35	64.2%	0.38	25.26	1.77
	6.40	35.82	0.35	0.60	12.44	36.15	62.1%	0.34	20.56	1.65
	6.45	34.75	0.31	0.55	10.68	35.04	60.2%	0.30	16.27	1.52
	6.50	33.36	0.27	0.50	8.98	33.62	57.8%	0.27	12.52	1.39
	6.55	29.91	0.25	0.45	7.35	30.13	51.8%	0.24	9.65	1.31
	6.60	27.08	0.22	0.40	5.92	27.26	46.8%	0.22	7.20	1.22
	6.65	24.26	0.19	0.35	4.64	24.40	41.9%	0.19	5.16	1.11
	6.70	21.44	0.16	0.30	3.50	21.54	37.0%	0.16	3.50	1.00
	6.75	18.59	0.13	0.25	2.49	18.65	32.1%	0.13	2.19	0.88
	6.80	15.26	0.11	0.20	1.65	15.30	26.3%	0.11	1.26	0.76
	6.85	10.91	0.09	0.15	0.95	10.91	18.8%	0.09	0.63	0.66
	6.90	8.86	0.05	0.10	0.45	8.87	15.2%	0.05	0.21	0.46
	6.95	3.82	0.02	0.05	0.09	3.82	6.6%	0.02	0.03	0.28

STREAM NAME: Slate River
XS LOCATION: West of Mile Marker 3 on Slate R. Road
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	150.97	cfs
CALCULATED FLOW (Qc)=	150.82	cfs
(Qm-Qc)/Qm * 100 =	0.1	%
MEASURED WATERLINE (WLm)=	5.67	ft
CALCULATED WATERLINE (WLc)=	5.65	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	1.35	ft
MAX CALCULATED DEPTH (Dc)=	1.35	ft
(Dm-Dc)/Dm * 100	0.2	%
MEAN VELOCITY=	3.15	ft/sec
MANNING'S N=	0.027	
SLOPE=	0.0038	ft/ft
.4 * Qm =	60.4	cfs
2.5 * Qm=	377.4	cfs

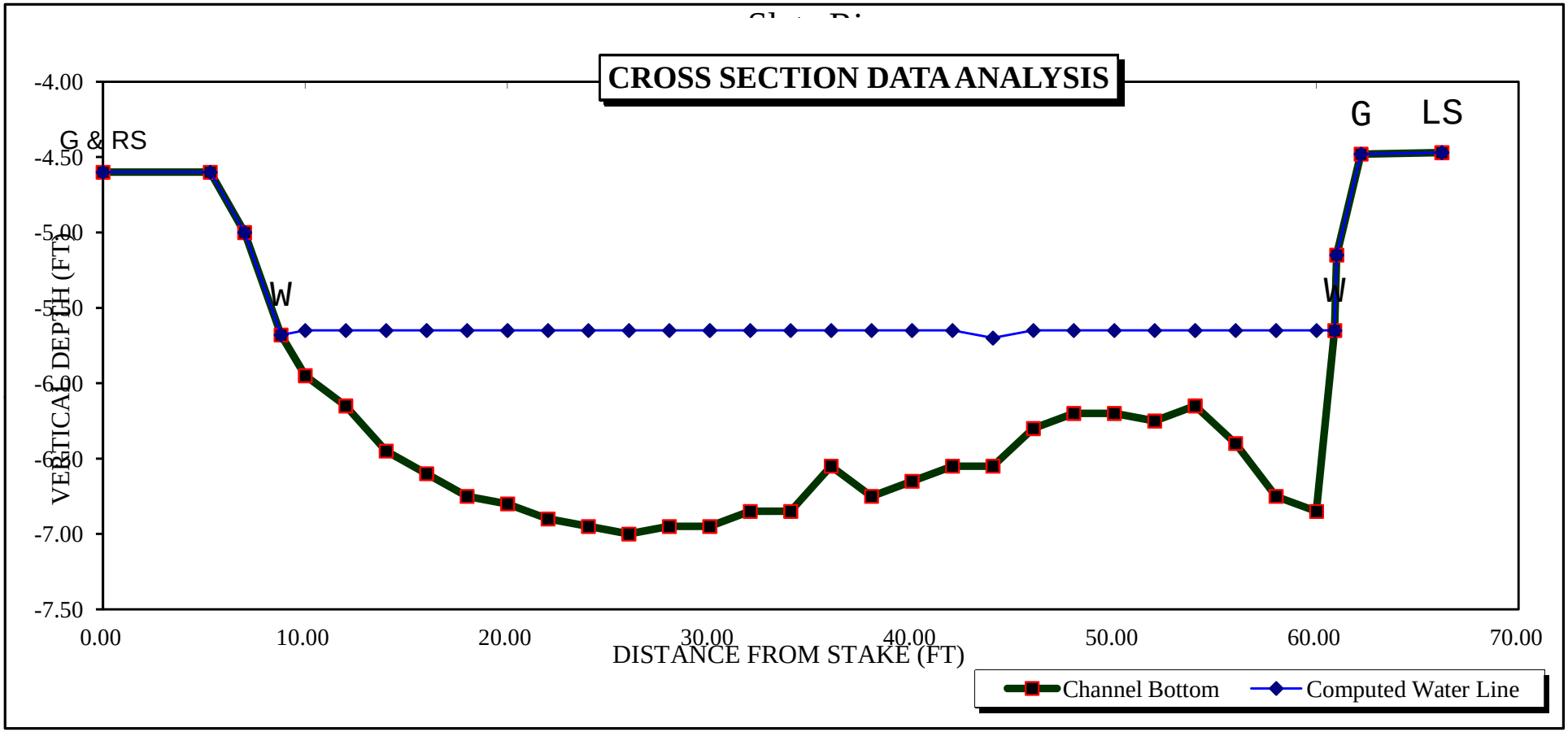
RECOMMENDED INSTREAM FLOW:
=============================

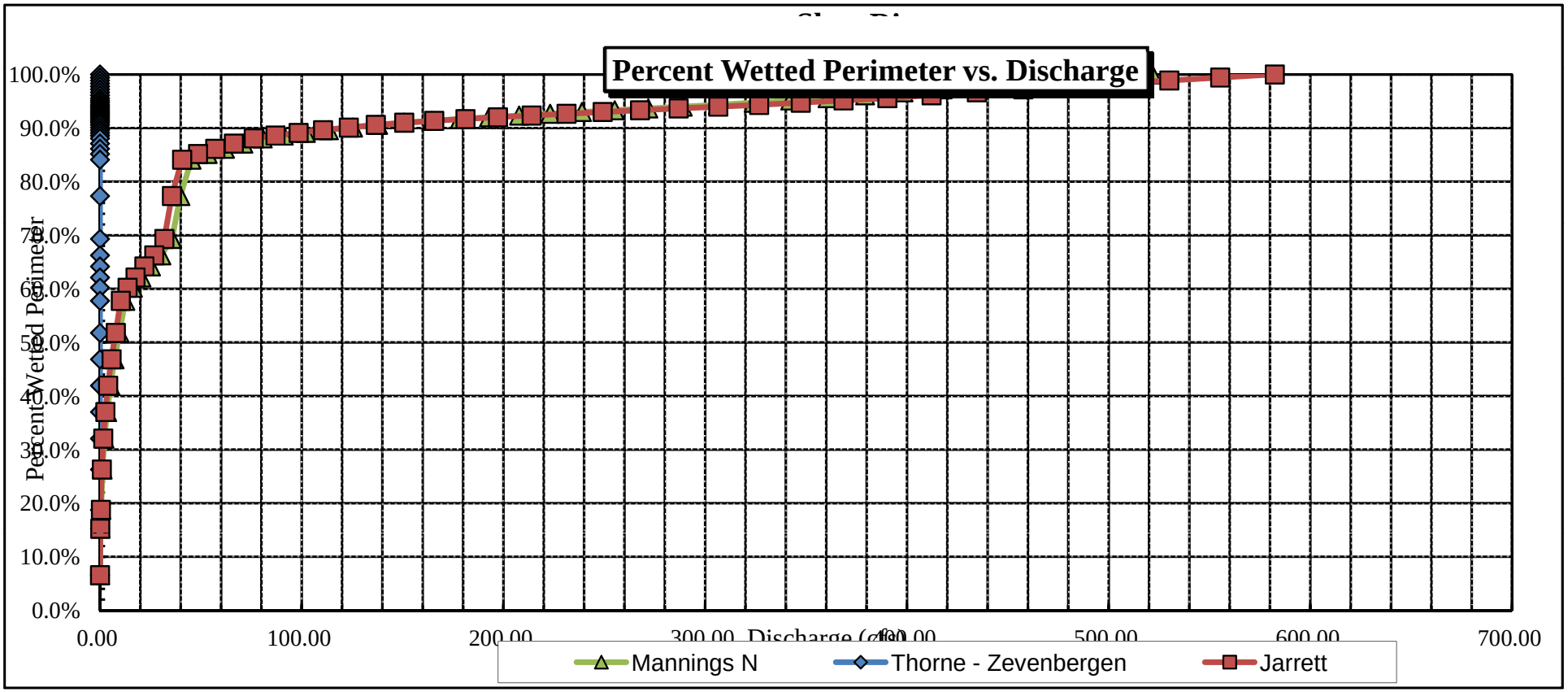
FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

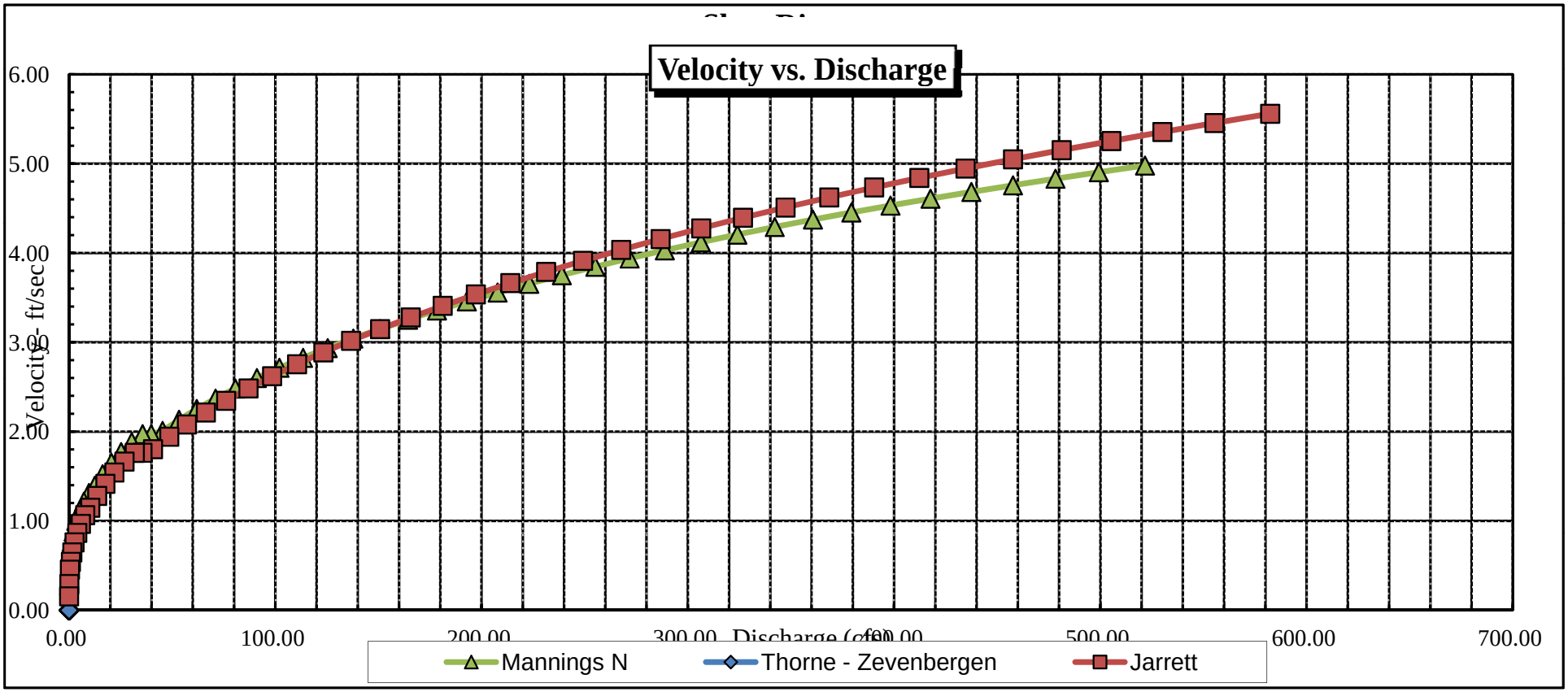
RATIONALE FOR RECOMMENDATION:
=============================

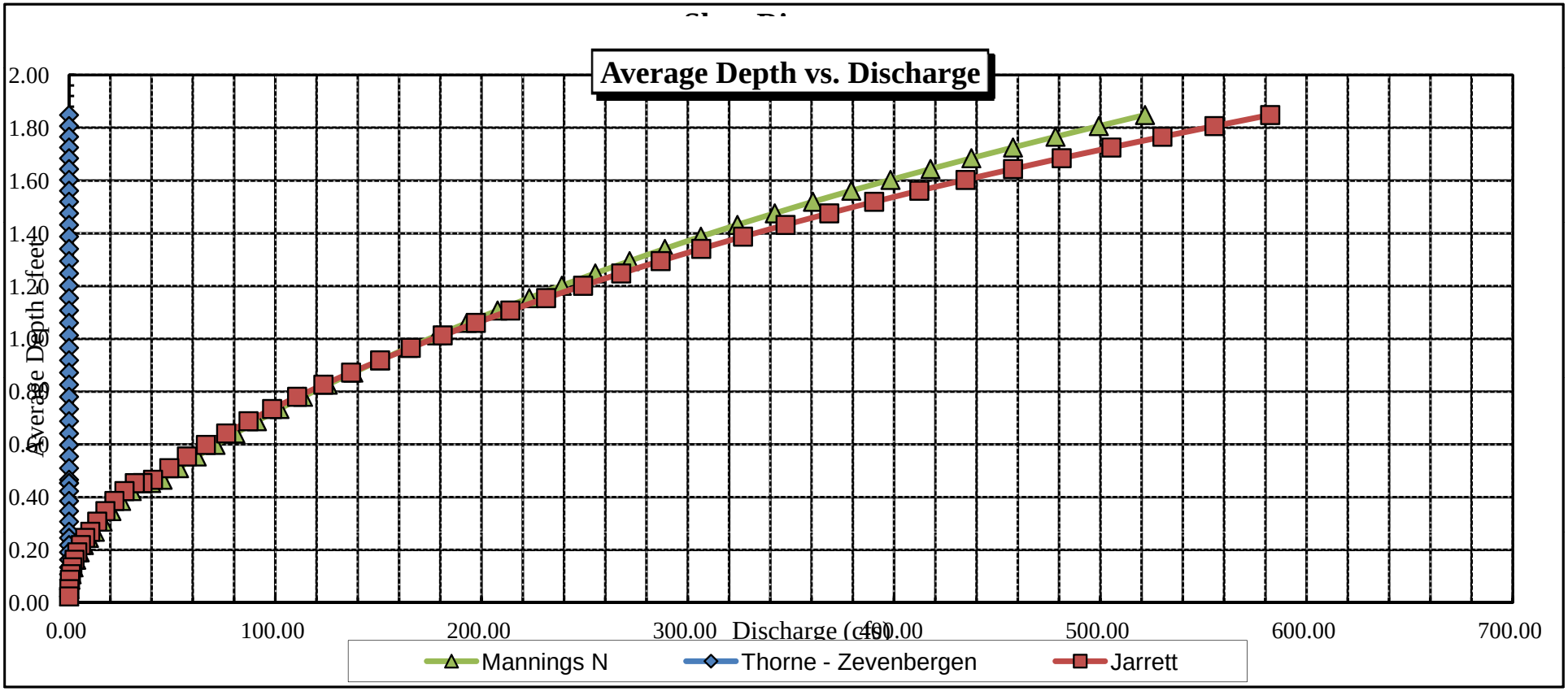
RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………......……...…...……....... DATE:.......…...…......……………

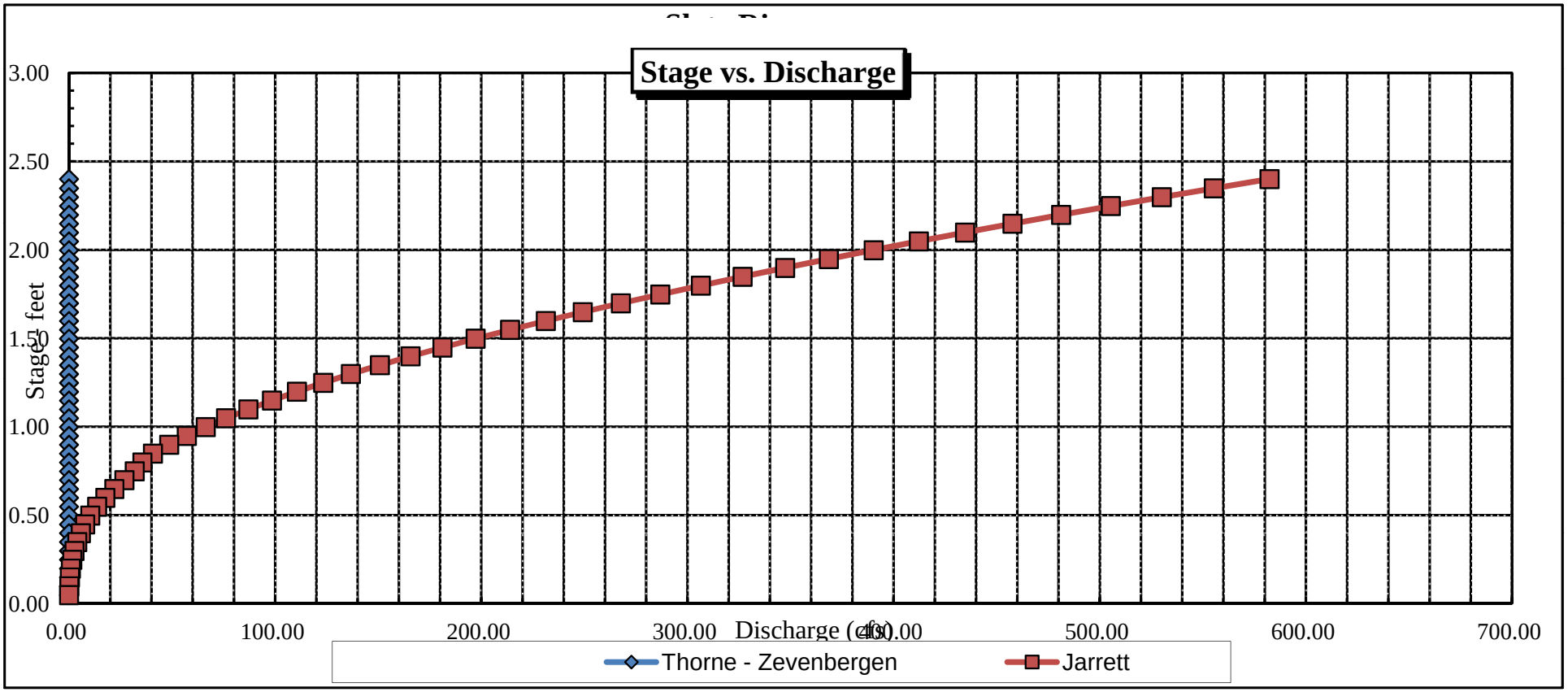
CWCB REVIEW BY: ..…………………………....………………………………………………...…............. DATE:.................…………….....…


CROSS SECTION DATA ANALYSIS
G & RS
W
W
G
LS
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
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
100.00
200.00
300.00
500.00
600.00
700.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
100.00
200.00
300.00
Discharge (cfs)
500.00
600.00
700.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth (feet)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Stage, feet
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: upstream from BLM campground						
DATE: 6-7-12	OBSERVERS: R. Smith, A. Breibart					
LEGAL DESCRIPTION	¼ SECTION: NW NW	SECTION: 20	TOWNSHIP: 13 N (S)	RANGE: 86 E (W)	PM: 6th	
COUNTY: Gunnison	WATERSHED: East River	WATER DIVISION: 4	DOW WATER CODE: 43113			
MAP(S): USGS:			GPS Zone 13 323394			
USFS:			4309682			

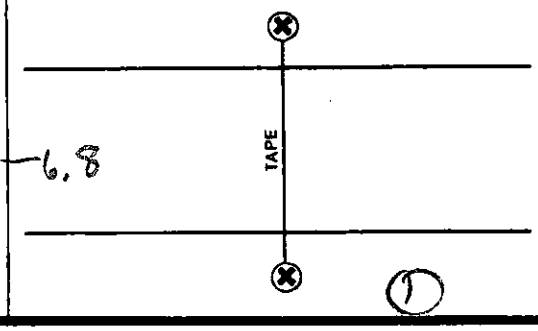
SUPPLEMENTAL DATA

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: gravel to 6" cobbles		PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.25 / 5.25
② WS Upstream	46.7	5.00
③ WS Downstream	28.5	5.52
SLOPE	0.52 / 75.2 = .007	

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:

mayfly, caddisfly, stonefly

COMMENTS

pH: 6.62
Cond: 52.8
Temp: 10.7° C
Salinity: 0

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River | CROSS-SECTION NO: 2 | DATE: 6-7-12 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: ____ ft | TIME: 2:10

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		2.62								
G	4.6		3.60								
	5.6		4.88								
W	6.8		5.25								
	8		5.55	0.3				0.93			
	10		5.85	0.6				1.96			
	12		6.25	1.0				3.16			
	14		6.45	1.2				3.01			
	16		6.55	1.3				2.93			
	18		6.35	1.1				2.77			
	20		6.25	1.0				3.01			
	22		6.10	0.85				2.71			
	24		6.00	0.75				2.89			
	26		6.05	0.80				3.25			
	28		6.10	0.85				2.75			
	30		6.00	0.75				2.64			
	32		5.90	0.65				2.86			
	34		5.75	0.50				2.29			
	36		5.60	0.35				2.21			
	38		5.55	0.30				2.05			
	40		5.55	0.30				2.02			
	42		5.60	0.35				2.10			
	44		5.65	0.40				2.42			
	46		5.75	0.50				2.37			
	48		5.75	0.50				2.44			
W	49.8		5.25								
	49.9		5.02								
	51.7		4.72								
	59.4		4.71								
G	60.0		3.80								
LS	66.2		3.5								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	Upstream from BLM campground
XS NUMBER:	2
DATE:	7-Jun-12
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW NW
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
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:	0.007

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

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

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 2

DATA POINTS= 31

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	2.62			0.00		0.00	0.00	0.0%
1	G	4.60	3.60			0.00		0.00	0.00	0.0%
		5.60	4.88			0.00		0.00	0.00	0.0%
	W	6.80	5.25	0.00	0.00	0.00		0.00	0.00	0.0%
		8.00	5.55	0.30	0.93	1.24	0.30	0.48	0.45	0.6%
		10.00	5.85	0.60	1.96	2.02	0.60	1.20	2.35	3.1%
		12.00	6.25	1.00	3.16	2.04	1.00	2.00	6.32	8.2%
		14.00	6.45	1.20	3.01	2.01	1.20	2.40	7.22	9.4%
		16.00	6.55	1.30	2.93	2.00	1.30	2.60	7.62	9.9%
		18.00	6.35	1.10	2.77	2.01	1.10	2.20	6.09	7.9%
		20.00	6.25	1.00	3.01	2.00	1.00	2.00	6.02	7.8%
		22.00	6.10	0.85	2.71	2.01	0.85	1.70	4.61	6.0%
		24.00	6.00	0.75	2.89	2.00	0.75	1.50	4.34	5.6%
		26.00	6.05	0.80	3.25	2.00	0.80	1.60	5.20	6.8%
		28.00	6.10	0.85	2.75	2.00	0.85	1.70	4.68	6.1%
		30.00	6.00	0.75	2.64	2.00	0.75	1.50	3.96	5.1%
		32.00	5.90	0.65	2.86	2.00	0.65	1.30	3.72	4.8%
		34.00	5.75	0.50	2.29	2.01	0.50	1.00	2.29	3.0%
		36.00	5.60	0.35	2.21	2.01	0.35	0.70	1.55	2.0%
		38.00	5.55	0.30	2.05	2.00	0.30	0.60	1.23	1.6%
		40.00	5.55	0.30	2.02	2.00	0.30	0.60	1.21	1.6%
		42.00	5.60	0.35	2.10	2.00	0.35	0.70	1.47	1.9%
		44.00	5.65	0.40	2.42	2.00	0.40	0.80	1.94	2.5%
		46.00	5.75	0.50	2.37	2.00	0.50	1.00	2.37	3.1%
		48.00	5.75	0.50	2.44	2.00	0.50	0.95	2.32	3.0%
	W	49.80	5.25	0.00	0.00	1.87		0.00	0.00	0.0%
		49.90	5.02			0.00		0.00	0.00	0.0%
		57.70	4.72			0.00		0.00	0.00	0.0%
		59.40	4.71			0.00		0.00	0.00	0.0%
1	G	60.00	3.80			0.00		0.00	0.00	0.0%
	LS	66.20	3.51			0.00		0.00	0.00	0.0%
	TOTALS ----------					43.22	1.3 (Max.)	28.53	76.94	100.0%

Manning's n = 0.0349
Hydraulic Radius= 0.66008074

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	28.53	28.53	0.0%
5.00	28.53	39.40	38.1%
5.02	28.53	38.52	35.0%
5.04	28.53	37.64	31.9%
5.06	28.53	36.77	28.9%
5.08	28.53	35.89	25.8%
5.10	28.53	35.02	22.8%
5.12	28.53	34.15	19.7%
5.14	28.53	33.28	16.7%
5.16	28.53	32.42	13.6%
5.18	28.53	31.55	10.6%
5.20	28.53	30.69	7.6%
5.21	28.53	30.25	6.0%
5.22	28.53	29.82	4.5%
5.23	28.53	29.39	3.0%
5.24	28.53	28.96	1.5%
5.25	28.53	28.53	0.0%
5.26	28.53	28.10	-1.5%
5.27	28.53	27.67	-3.0%
5.28	28.53	27.24	-4.5%
5.29	28.53	26.82	-6.0%
5.30	28.53	26.39	-7.5%
5.32	28.53	25.54	-10.5%
5.34	28.53	24.69	-13.5%
5.36	28.53	23.85	-16.4%
5.38	28.53	23.00	-19.4%
5.40	28.53	22.17	-22.3%
5.42	28.53	21.33	-25.2%
5.44	28.53	20.50	-28.2%
5.46	28.53	19.67	-31.1%
5.48	28.53	18.84	-34.0%
5.50	28.53	18.02	-36.8%

WATERLINE AT ZERO
AREA ERROR = 5.250

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
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	3.80	55.24	1.87	2.75	103.16	56.69	100.0%	1.82	547.01	5.30
	4.25	54.60	1.44	2.30	78.45	55.58	98.0%	1.41	351.13	4.48
	4.30	54.52	1.39	2.25	75.72	55.46	97.8%	1.37	331.51	4.38
	4.35	54.45	1.34	2.20	73.00	55.34	97.6%	1.32	312.33	4.28
	4.40	54.38	1.29	2.15	70.27	55.21	97.4%	1.27	293.61	4.18
	4.45	54.31	1.24	2.10	67.56	55.09	97.2%	1.23	275.34	4.08
	4.50	54.24	1.20	2.05	64.84	54.97	97.0%	1.18	257.54	3.97
	4.55	54.16	1.15	2.00	62.13	54.84	96.7%	1.13	240.21	3.87
	4.60	54.09	1.10	1.95	59.43	54.72	96.5%	1.09	223.36	3.76
	4.65	54.02	1.05	1.90	56.72	54.60	96.3%	1.04	207.00	3.65
	4.70	53.95	1.00	1.85	54.03	54.47	96.1%	0.99	191.13	3.54
	4.75	51.42	1.00	1.80	51.40	51.92	91.6%	0.99	181.64	3.53
	4.80	50.08	0.98	1.75	48.86	50.55	89.2%	0.97	169.93	3.48
	4.85	48.74	0.95	1.70	46.39	49.19	86.8%	0.94	158.72	3.42
	4.90	47.35	0.93	1.65	43.99	47.78	84.3%	0.92	148.09	3.37
	4.95	45.89	0.91	1.60	41.66	46.31	81.7%	0.90	138.09	3.31
	5.00	44.43	0.89	1.55	39.40	44.84	79.1%	0.88	128.58	3.26
	5.05	43.74	0.85	1.50	37.20	44.12	77.8%	0.84	118.13	3.18
	5.10	43.55	0.80	1.45	35.02	43.89	77.4%	0.80	107.17	3.06
	5.15	43.37	0.76	1.40	32.85	43.67	77.0%	0.75	96.65	2.94
	5.20	43.18	0.71	1.35	30.68	43.45	76.6%	0.71	86.57	2.82
WL	5.25	43.00	0.66	1.30	28.53	43.22	76.2%	0.66	76.94	2.70
	5.30	42.62	0.62	1.25	26.39	42.83	75.5%	0.62	67.98	2.58
	5.35	42.24	0.57	1.20	24.27	42.44	74.8%	0.57	59.48	2.45
	5.40	41.86	0.53	1.15	22.17	42.04	74.2%	0.53	51.46	2.32
	5.45	41.48	0.48	1.10	20.08	41.65	73.5%	0.48	43.93	2.19
	5.50	41.10	0.44	1.05	18.02	41.26	72.8%	0.44	36.89	2.05
	5.55	38.72	0.41	1.00	15.97	38.86	68.6%	0.41	31.41	1.97
	5.60	34.21	0.41	0.95	14.15	34.34	60.6%	0.41	27.87	1.97
	5.65	31.03	0.40	0.90	12.52	31.15	54.9%	0.40	24.25	1.94
	5.70	28.85	0.38	0.85	11.02	28.95	51.1%	0.38	20.59	1.87
	5.75	24.67	0.39	0.80	9.63	24.76	43.7%	0.39	18.26	1.90
	5.80	23.67	0.36	0.75	8.42	23.75	41.9%	0.35	15.02	1.78
	5.85	22.67	0.32	0.70	7.27	22.75	40.1%	0.32	12.08	1.66
	5.90	21.75	0.28	0.65	6.16	21.82	38.5%	0.28	9.42	1.53
	5.95	20.50	0.25	0.60	5.10	20.57	36.3%	0.25	7.16	1.40
	6.00	19.25	0.21	0.55	4.11	19.31	34.1%	0.21	5.20	1.27
	6.05	15.00	0.22	0.50	3.25	15.05	26.6%	0.22	4.16	1.28
	6.10	10.75	0.24	0.45	2.61	10.80	19.0%	0.24	3.59	1.38
	6.15	9.83	0.21	0.40	2.09	9.87	17.4%	0.21	2.64	1.26
	6.20	8.92	0.18	0.35	1.62	8.95	15.8%	0.18	1.85	1.14
	6.25	8.00	0.15	0.30	1.20	8.02	14.2%	0.15	1.20	1.00
	6.30	6.50	0.13	0.25	0.84	6.52	11.5%	0.13	0.76	0.91
	6.35	5.00	0.11	0.20	0.55	5.02	8.8%	0.11	0.45	0.81
	6.40	4.00	0.08	0.15	0.32	4.01	7.1%	0.08	0.22	0.67
	6.45	3.00	0.05	0.10	0.15	3.01	5.3%	0.05	0.07	0.48
	6.50	1.50	0.02	0.05	0.04	1.50	2.7%	0.02	0.01	0.30

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	76.94	cfs
CALCULATED FLOW (Qc)=	76.94	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.25	ft
CALCULATED WATERLINE (WLc)=	5.25	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.30	ft
MAX CALCULATED DEPTH (Dc)=	1.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	2.70	ft/sec
MANNING'S N=	0.035	
SLOPE=	0.007	ft/ft
.4 * Qm =	30.8	cfs
2.5 * Qm=	192.4	cfs

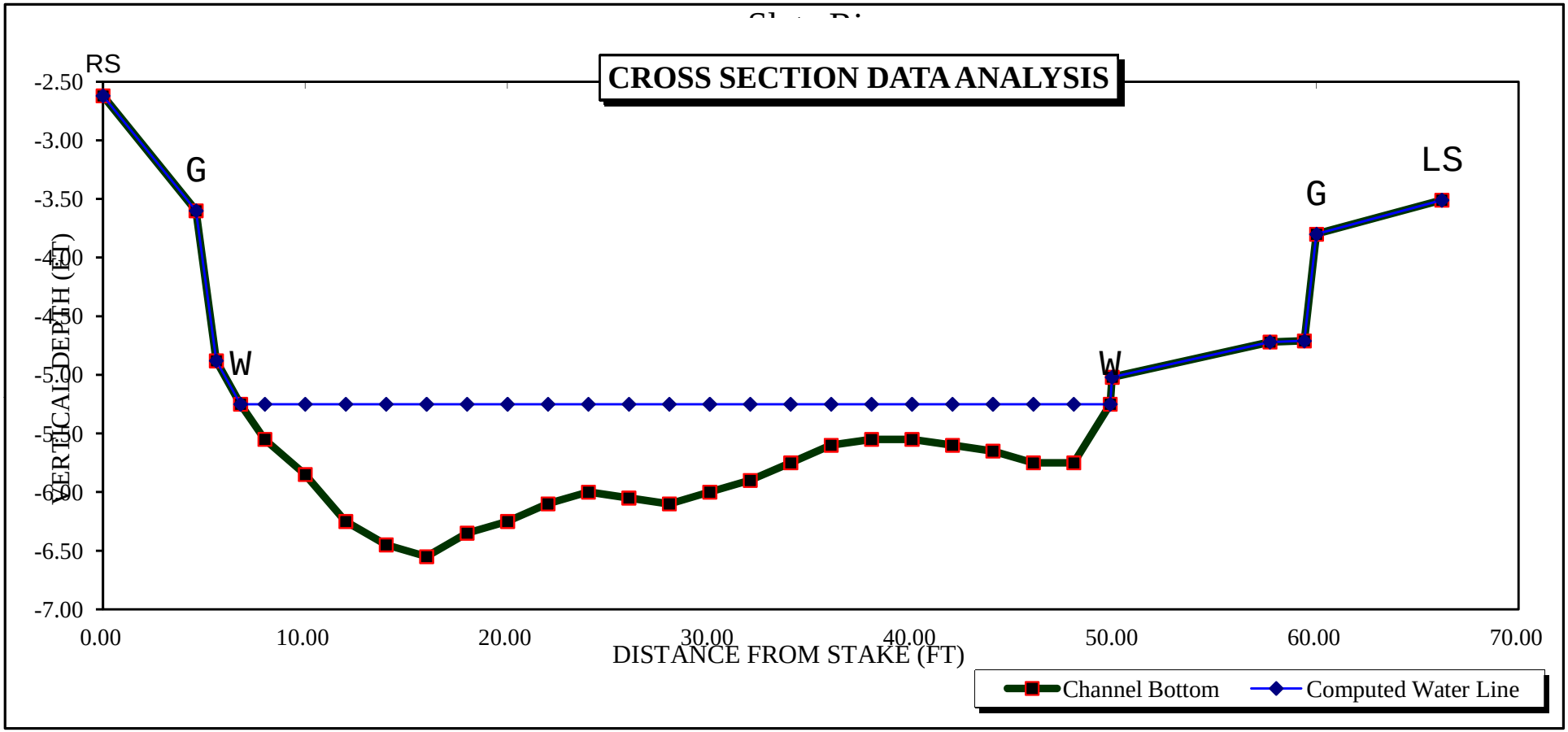
RECOMMENDED INSTREAM FLOW:
=============================

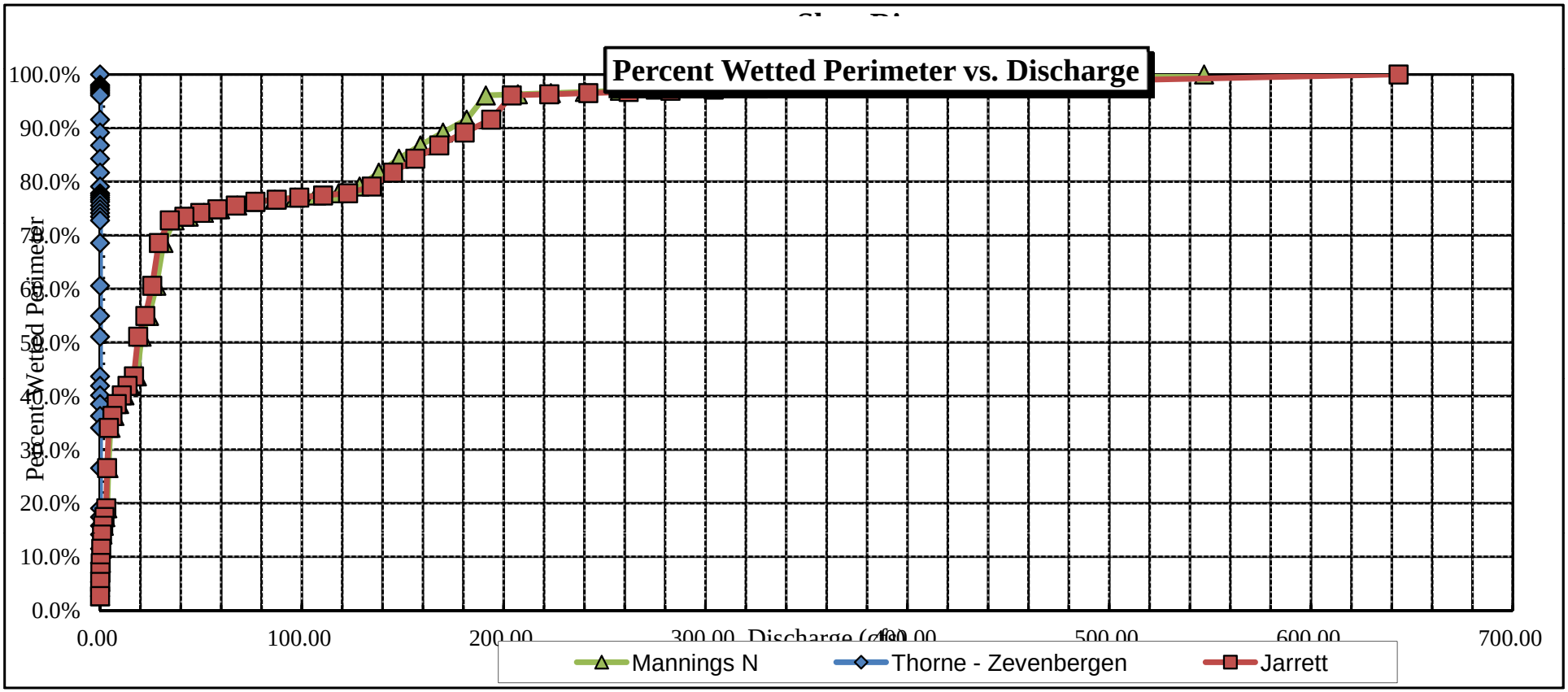
FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

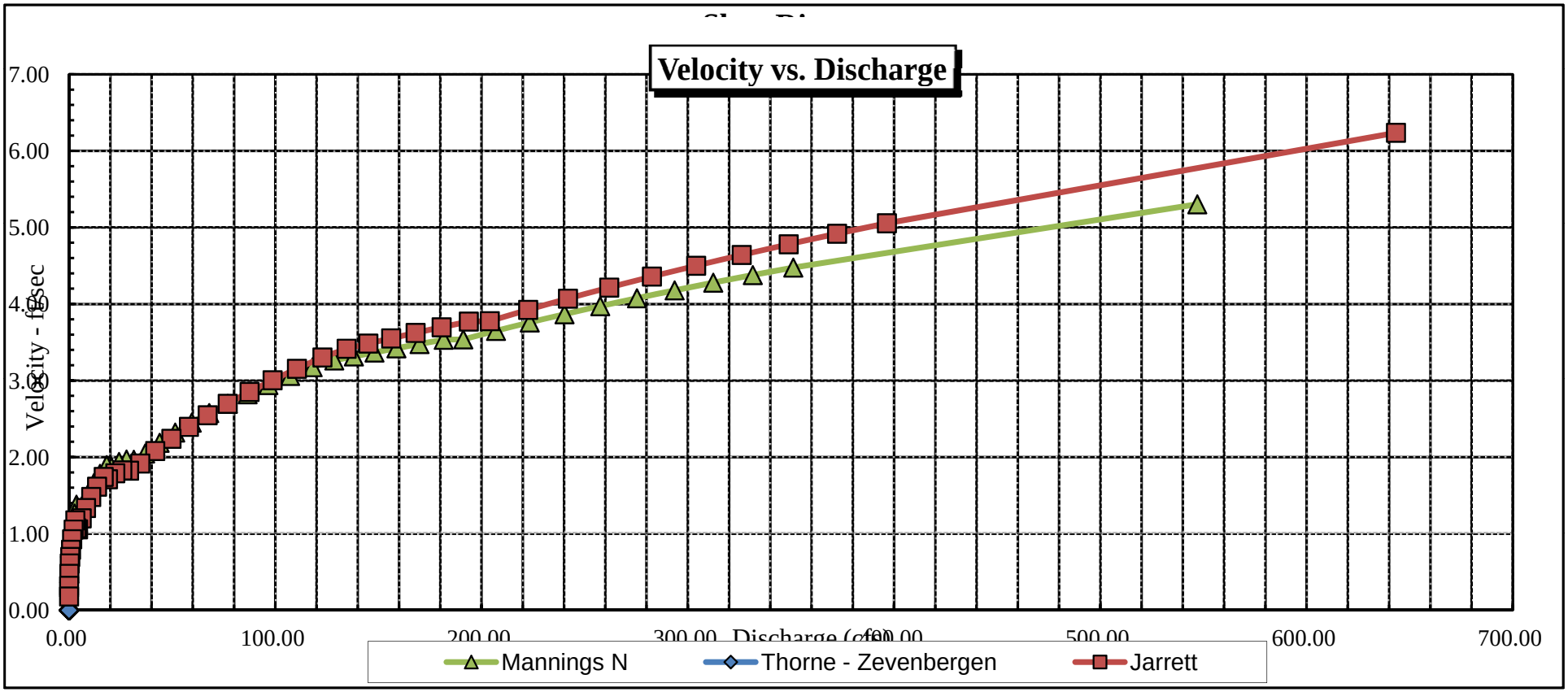
RATIONALE FOR RECOMMENDATION:
=============================

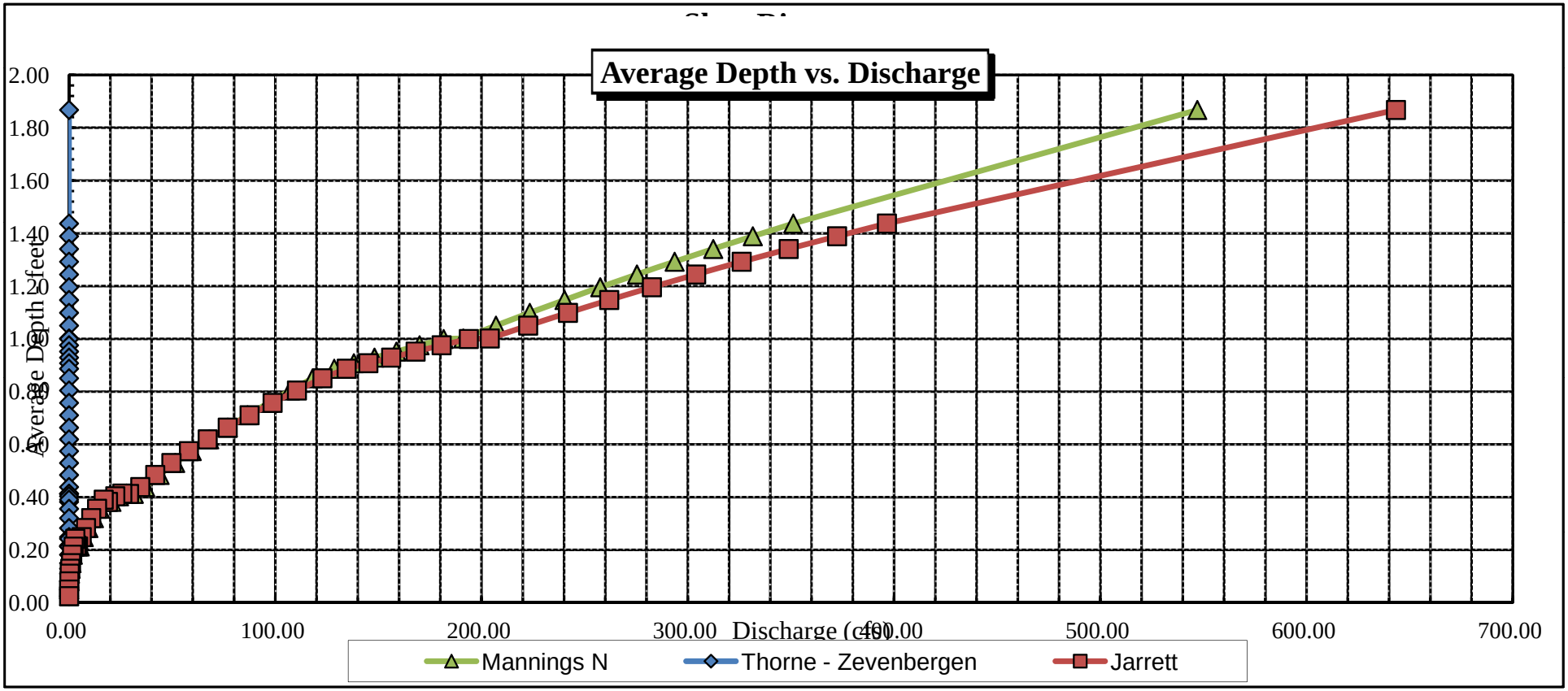
RECOMMENDATION BY: ………………...………..…................................ AGENCY...……………………......…....…...…….…...... DATE:......…...…......……………

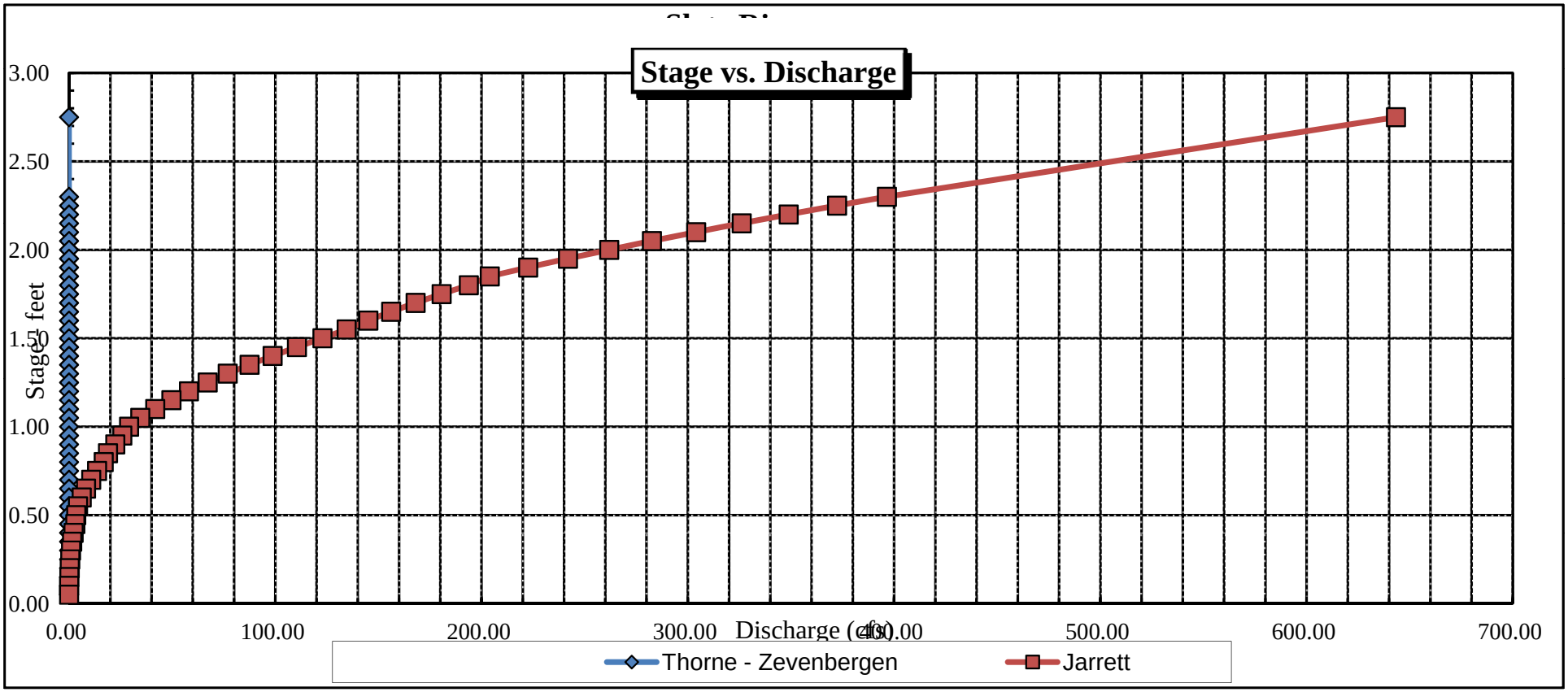
CWCB REVIEW BY: ..…………………………....………………………………………………...….............. DATE:.................…………….....…


CROSS SECTION DATA ANALYSIS
RS
G
W
W
G
LS
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
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
100.00
200.00
300.00
500.00
600.00
700.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
100.00
200.00
300.00
Discharge (cfs)
500.00
600.00
700.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth (feet)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: upstream from BLM campground						
DATE: 6-7-12	OBSERVERS: R. Smith, A. Breibart					
LEGAL DESCRIPTION	¼ SECTION: NW NW	SECTION: 20	TOWNSHIP: 13 N/S	RANGE: 86 E/W	PM: 6th	
COUNTY: Gunnison	WATERSHED:	WATER DIVISION: 4	DOW WATER CODE: 43113			
MAP(S): USGS:	GPS Zone 13S 323581					
USFS:	4309299					

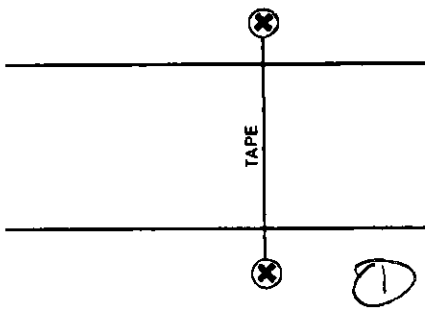
SUPPLEMENTAL DATA

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: gravel to 6" cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
Tape @ Stake LB	0.0	surveyed
Tape @ Stake RB	0.0	surveyed
1 WS @ Tape LB/RB	0.0	6.58 / 6.62
2 WS Upstream	84.5	6.20
3 WS Downstream	24.8	7.00
SLOPE	0.8 / 109.3 = .0073	

SKETCH



LEGEND: Stake, Station, Photo, Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly

COMMENTS

Cond = 52.8
Ph = 6.62
Temp = 10.7° C
Salinity = 0

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slate River	CROSS-SECTION NO.:	DATE: 6-7-12	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 12:40

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		3.58								
G	1.9		5.34								
	2.7		6.26								
W	2.8		6.60	Ø				Ø			
	4		7.0	0.4				Ø			
	6		7.7	1.1				2.02			
	8		7.55	0.95				1.82			
	10		7.30	0.70				1.67			
	12		7.20	0.60				1.80			
	14		7.15	0.55				1.49			
	16		7.20	0.60				3.45			
	18		7.30	0.70				2.26			
	20		7.35	0.75				3.46			
	22		7.45	0.85				2.31			
	24		7.50	0.90				3.51			
	26		7.50	0.90				3.73			
	28		7.45	0.85				1.54			
	30		7.50	0.90				3.08			
	32		7.40	0.80				2.99			
	34		7.40	0.80				2.97			
	36		7.35	0.75				2.96			
	38		7.30	0.70				2.97			
	40		7.00	0.40				3.65			
	42		7.20	0.60				2.37			
	44		7.15	0.55				1.08			
	46		7.40	0.80				1.00			
	48		6.80	0.20				0.83			
	50		6.85	0.25				0.11			
W	50.9		6.60	Ø				Ø			
	51.3		6.22								
	51.7		6.07								
G	52.2		5.41								
LS	55.9		5.30								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	Upstream from BLM campground
XS NUMBER:	1
DATE:	7-Jul-12
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW NW
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
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:	0.0073

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

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

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 1

DATA POINTS= 33

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	0.00	3.58			0.00		0.00	0.00	0.0%
1	G	1.90	5.34			0.00		0.00	0.00	0.0%
		2.70	6.26			0.00		0.00	0.00	0.0%
	W	2.80	6.60	0.00	0.00	0.00		0.00	0.00	0.0%
		4.00	7.00	0.40	0.00	1.26	0.40	0.64	0.00	0.0%
		6.00	7.70	1.10	2.02	2.12	1.10	2.20	4.44	5.6%
		8.00	7.55	0.95	1.82	2.01	0.95	1.90	3.46	4.4%
		10.00	7.30	0.70	1.67	2.02	0.70	1.40	2.34	3.0%
		12.00	7.20	0.60	1.80	2.00	0.60	1.20	2.16	2.7%
		14.00	7.15	0.55	1.49	2.00	0.55	1.10	1.64	2.1%
		16.00	7.20	0.60	3.45	2.00	0.60	1.20	4.14	5.3%
		18.00	7.30	0.70	2.26	2.00	0.70	1.40	3.16	4.0%
		20.00	7.35	0.75	3.46	2.00	0.75	1.50	5.19	6.6%
		22.00	7.45	0.85	2.31	2.00	0.85	1.70	3.93	5.0%
		24.00	7.50	0.90	3.51	2.00	0.90	1.80	6.32	8.0%
		26.00	7.50	0.90	3.73	2.00	0.90	1.80	6.71	8.5%
		28.00	7.45	0.85	1.54	2.00	0.85	1.70	2.62	3.3%
		30.00	7.50	0.90	3.08	2.00	0.90	1.80	5.54	7.0%
		32.00	7.40	0.80	2.99	2.00	0.80	1.60	4.78	6.1%
		34.00	7.40	0.80	2.97	2.00	0.80	1.60	4.75	6.0%
		36.00	7.35	0.75	2.96	2.00	0.75	1.50	4.44	5.6%
		38.00	7.30	0.70	2.97	2.00	0.70	1.40	4.16	5.3%
		40.00	7.00	0.40	3.65	2.02	0.40	0.80	2.92	3.7%
		42.00	7.20	0.60	2.37	2.01	0.60	1.20	2.84	3.6%
		44.00	7.15	0.55	1.08	2.00	0.55	1.10	1.19	1.5%
		46.00	7.40	0.80	1.00	2.02	0.80	1.60	1.60	2.0%
		48.00	6.80	0.20	0.83	2.09	0.20	0.40	0.33	0.4%
		50.00	6.85	0.25	0.11	2.00	0.25	0.36	0.04	0.1%
	W	50.90	6.60	0.00	0.00	0.93		0.00	0.00	0.0%
		51.30	6.22			0.00		0.00	0.00	0.0%
		51.70	6.07			0.00		0.00	0.00	0.0%
1	G	52.20	5.41			0.00		0.00	0.00	0.0%
	LS	55.90	5.30			0.00		0.00	0.00	0.0%
	TOTALS ----------					48.49	1.1 (Max.)	32.90	78.71	100.0%

Manning's n = 0.0410
Hydraulic Radius= 0.67852307

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	32.90	32.90	0.0%
6.35	32.90	44.97	36.7%
6.37	32.90	44.00	33.7%
6.39	32.90	43.03	30.8%
6.41	32.90	42.07	27.9%
6.43	32.90	41.10	24.9%
6.45	32.90	40.13	22.0%
6.47	32.90	39.17	19.0%
6.49	32.90	38.20	16.1%
6.51	32.90	37.24	13.2%
6.53	32.90	36.27	10.2%
6.55	32.90	35.31	7.3%
6.56	32.90	34.83	5.9%
6.57	32.90	34.35	4.4%
6.58	32.90	33.87	2.9%
6.59	32.90	33.38	1.5%
6.60	32.90	32.90	0.0%
6.61	32.90	32.42	-1.5%
6.62	32.90	31.94	-2.9%
6.63	32.90	31.46	-4.4%
6.64	32.90	30.98	-5.8%
6.65	32.90	30.51	-7.3%
6.67	32.90	29.55	-10.2%
6.69	32.90	28.60	-13.1%
6.71	32.90	27.65	-16.0%
6.73	32.90	26.71	-18.8%
6.75	32.90	25.76	-21.7%
6.77	32.90	24.82	-24.6%
6.79	32.90	23.88	-27.4%
6.81	32.90	22.95	-30.2%
6.83	32.90	22.03	-33.0%
6.85	32.90	21.14	-35.8%

WATERLINE AT ZERO
AREA ERROR = 6.600

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 1

Constant Manning's n

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.41	50.24	1.82	2.29	91.42	51.78	100.0%	1.77	413.74	4.53
	5.60	49.93	1.64	2.10	81.90	51.29	99.1%	1.60	346.66	4.23
	5.65	49.85	1.59	2.05	79.41	51.16	98.8%	1.55	329.80	4.15
	5.70	49.77	1.55	2.00	76.92	51.03	98.6%	1.51	313.27	4.07
	5.75	49.69	1.50	1.95	74.43	50.90	98.3%	1.46	297.07	3.99
	5.80	49.60	1.45	1.90	71.95	50.77	98.1%	1.42	281.22	3.91
	5.85	49.52	1.40	1.85	69.47	50.64	97.8%	1.37	265.71	3.82
	5.90	49.44	1.36	1.80	66.99	50.51	97.6%	1.33	250.55	3.74
	5.95	49.36	1.31	1.75	64.52	50.39	97.3%	1.28	235.75	3.65
	6.00	49.28	1.26	1.70	62.06	50.26	97.1%	1.23	221.30	3.57
	6.05	49.20	1.21	1.65	59.60	50.13	96.8%	1.19	207.22	3.48
	6.10	49.06	1.16	1.60	57.14	49.95	96.5%	1.14	193.63	3.39
	6.15	48.88	1.12	1.55	54.69	49.74	96.1%	1.10	180.50	3.30
	6.20	48.71	1.07	1.50	52.25	49.53	95.7%	1.05	167.75	3.21
	6.25	48.58	1.03	1.45	49.82	49.37	95.3%	1.01	155.29	3.12
	6.30	48.50	0.98	1.40	47.39	49.24	95.1%	0.96	143.14	3.02
	6.35	48.44	0.93	1.35	44.97	49.11	94.9%	0.92	131.37	2.92
	6.40	48.37	0.88	1.30	42.55	48.99	94.6%	0.87	120.00	2.82
	6.45	48.30	0.83	1.25	40.13	48.87	94.4%	0.82	109.04	2.72
	6.50	48.23	0.78	1.20	37.72	48.74	94.1%	0.77	98.50	2.61
	6.55	48.17	0.73	1.15	35.31	48.62	93.9%	0.73	88.39	2.50
WL	6.60	48.10	0.68	1.10	32.90	48.49	93.7%	0.68	78.71	2.39
	6.65	47.77	0.64	1.05	30.51	48.15	93.0%	0.63	69.72	2.29
	6.70	47.44	0.59	1.00	28.13	47.80	92.3%	0.59	61.18	2.18
	6.75	47.11	0.55	0.95	25.76	47.46	91.7%	0.54	53.11	2.06
	6.80	46.78	0.50	0.90	23.41	47.11	91.0%	0.50	45.52	1.94
	6.85	44.28	0.48	0.85	21.14	44.59	86.1%	0.47	39.81	1.88
	6.90	43.97	0.43	0.80	18.93	44.26	85.5%	0.43	33.30	1.76
	6.95	43.65	0.38	0.75	16.74	43.93	84.8%	0.38	27.26	1.63
	7.00	43.33	0.34	0.70	14.57	43.60	84.2%	0.33	21.73	1.49
	7.05	42.19	0.29	0.65	12.43	42.43	81.9%	0.29	16.98	1.37
	7.10	41.05	0.25	0.60	10.35	41.27	79.7%	0.25	12.75	1.23
	7.15	39.90	0.21	0.55	8.32	40.10	77.4%	0.21	9.04	1.09
	7.20	32.36	0.20	0.50	6.52	32.53	62.8%	0.20	6.91	1.06
	7.25	29.32	0.17	0.45	4.98	29.46	56.9%	0.17	4.71	0.95
	7.30	26.28	0.14	0.40	3.59	26.40	51.0%	0.14	2.94	0.82
	7.35	21.17	0.11	0.35	2.40	21.26	41.1%	0.11	1.74	0.72
	7.40	15.06	0.10	0.30	1.44	15.13	29.2%	0.10	0.93	0.65
	7.45	12.52	0.06	0.25	0.75	12.57	24.3%	0.06	0.36	0.47
	7.50	2.97	0.11	0.20	0.32	3.01	5.8%	0.11	0.22	0.69
	7.55	2.43	0.07	0.15	0.18	2.46	4.7%	0.07	0.10	0.55
	7.60	1.62	0.05	0.10	0.08	1.64	3.2%	0.05	0.03	0.42
	7.65	0.81	0.02	0.05	0.02	0.82	1.6%	0.02	0.01	0.26

STREAM NAME: Slate River
XS LOCATION: Upstream from BLM campground
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	78.71	cfs
CALCULATED FLOW (Qc)=	78.71	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	6.60	ft
CALCULATED WATERLINE (WLc)=	6.60	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.10	ft
MAX CALCULATED DEPTH (Dc)=	1.10	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	2.39	ft/sec
MANNING'S N=	0.041	
SLOPE=	0.0073	ft/ft
.4 * Qm =	31.5	cfs
2.5 * Qm=	196.8	cfs

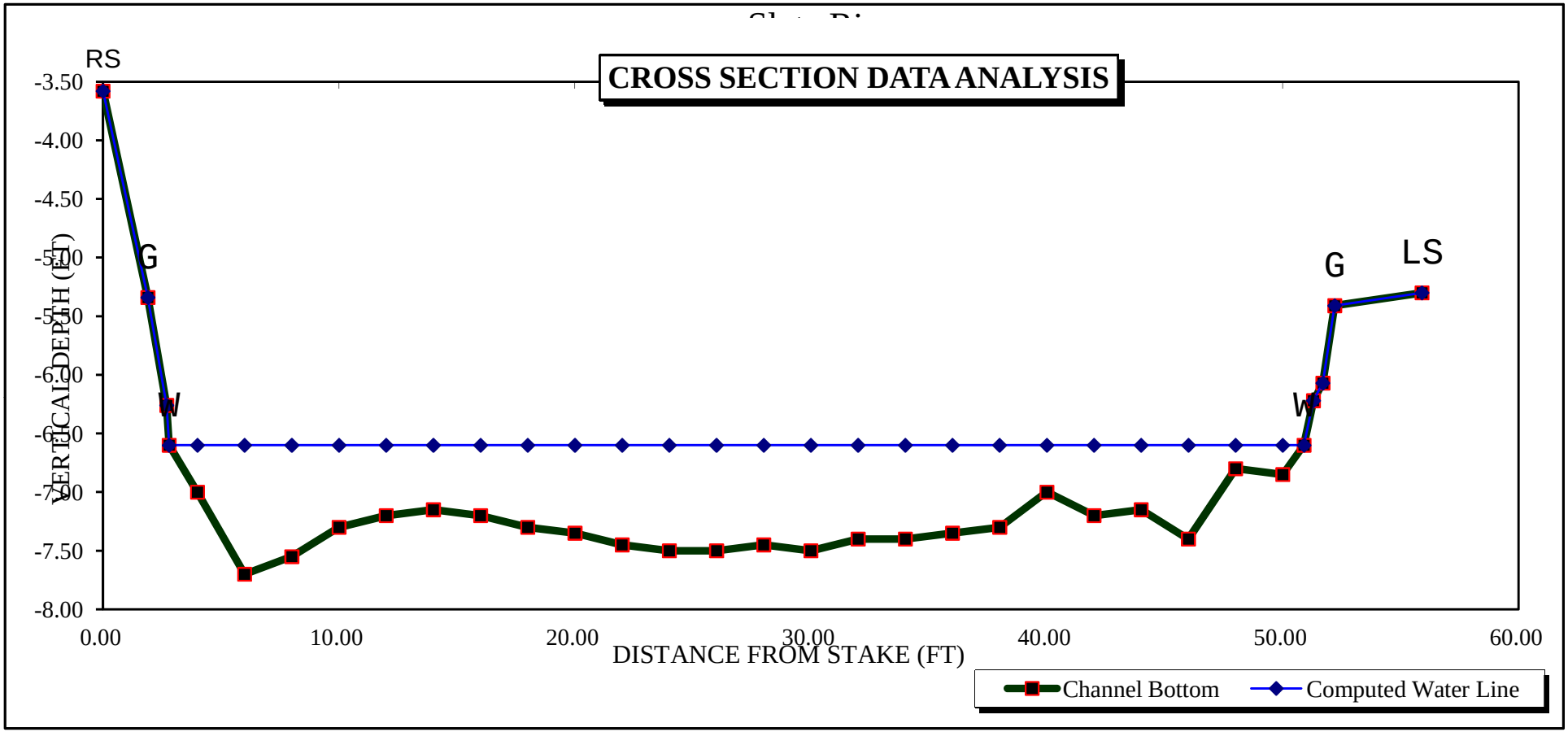
RECOMMENDED INSTREAM FLOW:
=============================

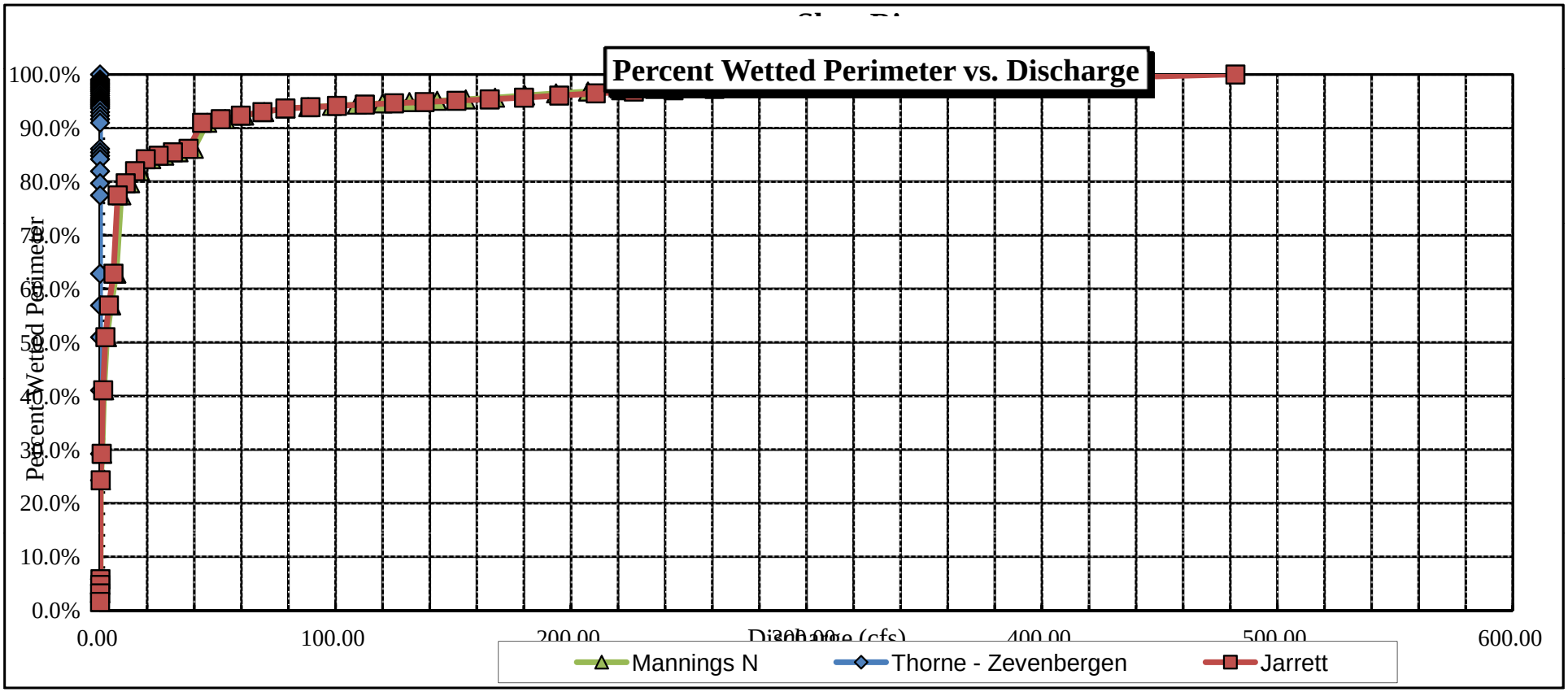
FLOW (CFS)	PERIOD
___________	___________
___________	___________
___________	___________
___________	___________

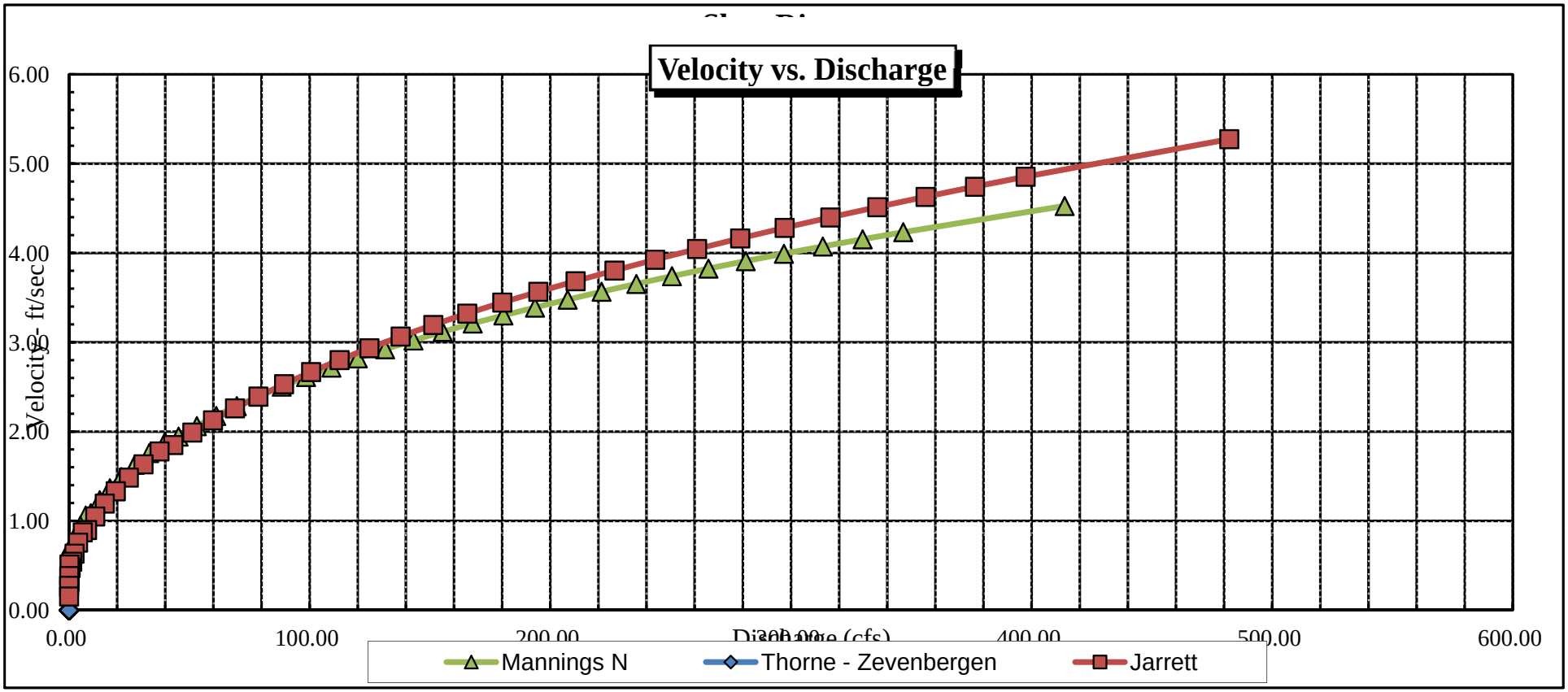
RATIONALE FOR RECOMMENDATION:
=============================

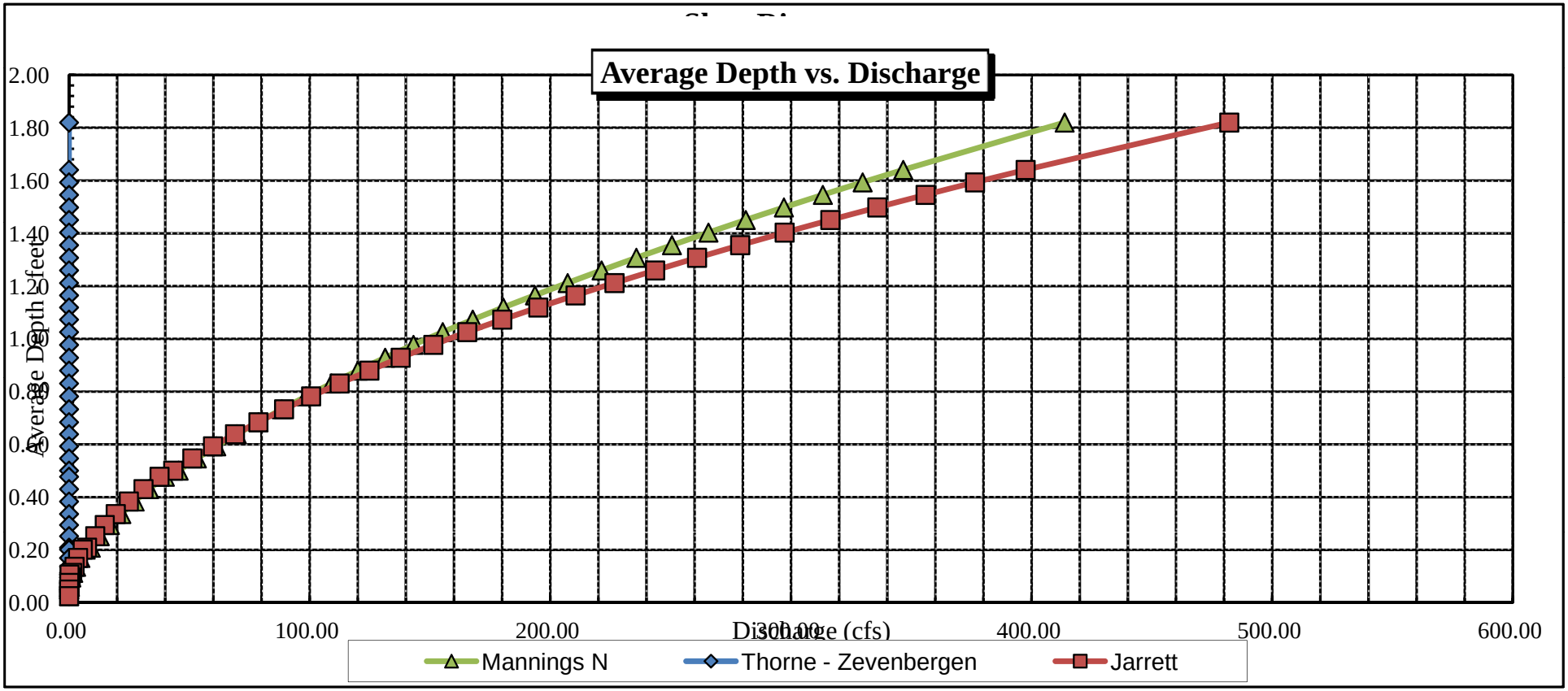
RECOMMENDATION BY: ………………………………………… AGENCY……………………………………… DATE:………………………

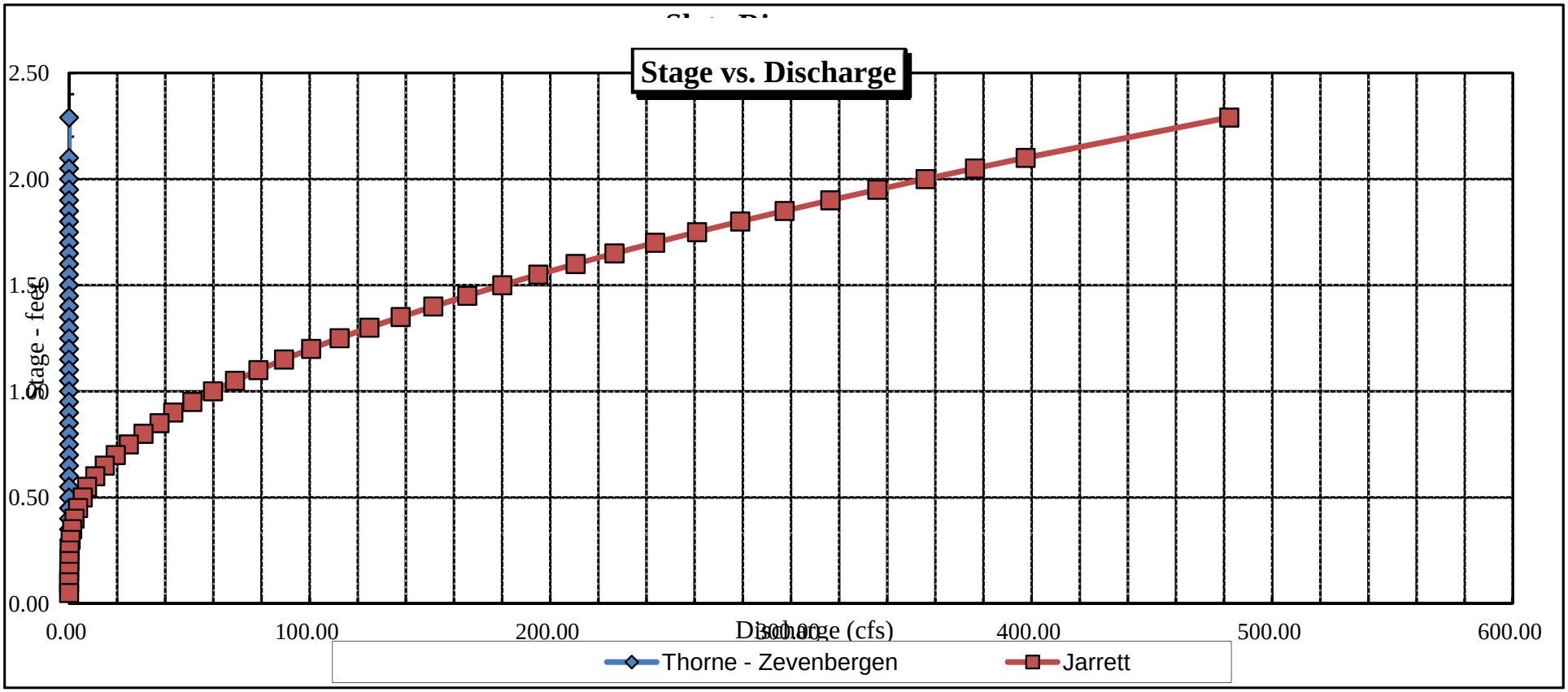
CWCB REVIEW BY: ……………………………………………………………………………………………… DATE:………………………


CROSS SECTION DATA ANALYSIS
RS
G
W
G
LS
W
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
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
100.00
200.00
400.00
500.00
600.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
100.00
200.00
400.00
500.00
600.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Average Depth (feet)
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Slate River	CROSS-SECTION NO.: 4
CROSS-SECTION LOCATION: on CB Land Trust parcel downstream from pedestrian bridge	
DATE: 9-29-11	OBSERVERS: R. Smith, A. Bradbooth
LEGAL DESCRIPTION: ¼ SECTION: NW SE; SECTION: 20; TOWNSHIP: 13 N/S (S); RANGE: 86 E/W (W); PM: Sixth	
COUNTY: Gunnison; WATERSHED: East River	WATER DIVISION: 4; DOW WATER CODE: 43113
MAP(S): USGS: GPS Zone 13 324062	USFS: 4308528

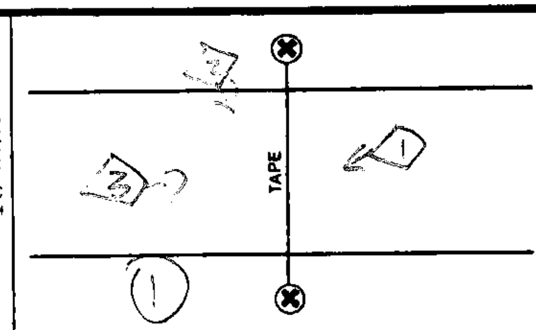
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES (circled) / 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: 2 to 6" cobbles	PHOTOGRAPHS TAKEN: YES (circled) / 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	5.06 / 5.10
(2) WS Upstream	48.05	4.98
(3) WS Downstream	32.85	~~5.08~~ 5.10
SLOPE	0.12 / 80.9 = .0014	

SKETCH



LEGEND: Stake ⊗ Station (1) Photo ◇→ Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO (NO circled) | DISTANCE ELECTROFISHED: ___ ft | FISH CAUGHT: YES/NO | WATER CHEMISTRY SAMPLED: YES (circled)/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, stonefly

COMMENTS

Ph = 7.38

Temp = 10.4°C

Cond = 141

Sal = 0.1

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Slade River | CROSS-SECTION NO: 4 | DATE: 9-29-11 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: _____ ft | TIME: 3:45 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/G	0.0		3.18								
	2.0		3.82								
	4.0		4.72								
LW	5.4		5.26								
	6.0		5.15	0.1				0.28			
	7.5		5.60	0.55				0.63			
	8.5		5.85	0.80				0.11			
	9.5		5.8	0.75				1.90			
	10.5		5.75	0.70				2.00			
	11.5		5.75	0.70				2.10			
	12.5		5.75	0.70				1.78			
	13.5		5.7	0.65				1.74			
	14.5		5.7	0.65				1.76			
	16		5.65	0.60				1.43			
	17.5		5.55	0.50				1.27			
	19		5.55	0.50				1.22			
	20.5		5.5	0.45				1.05			
	22		5.45	0.40				0.62			
	23.5		5.35	0.30				0.34			
	25		5.25	0.20				0.36			
	26.5		5.2	0.15				0			
	28		5.15	0.10				0			
	29.5		5.10	0.05				0			
RW	30.5		5.10								
	35.0		4.58								
	40.0		4.58								
	50.0		3.58								
RS/G	55.0		3.26								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Slate River
XS LOCATION:	on CB Land Trust near ped bridge
XS NUMBER:	4
DATE:	29-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NW SE
SECTION:	20
TWP:	13S
RANGE:	86W
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	East River
DIVISION:	4
DOW CODE:	43113
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:	0.0014

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

ASSIGNED TO: ….....…….....DATE.....

STREAM NAME: Slate River
XS LOCATION: on CB Land Trust near ped bridge
XS NUMBER: 4

DATA POINTS= 29

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 LS & G	0.00	3.48			0.00		0.00	0.00	0.0%
	2.00	3.82			0.00		0.00	0.00	0.0%
	4.00	4.22			0.00		0.00	0.00	0.0%
W	5.40	5.06	0.00	0.00	0.00		0.00	0.00	0.0%
	6.00	5.15	0.10	0.28	0.61	0.10	0.11	0.03	0.2%
	7.50	5.60	0.55	0.63	1.57	0.55	0.69	0.43	3.2%
	8.50	5.85	0.80	0.71	1.03	0.80	0.80	0.57	4.1%
	9.50	5.80	0.75	1.90	1.00	0.75	0.75	1.43	10.4%
	10.50	5.75	0.70	2.00	1.00	0.70	0.70	1.40	10.2%
	11.50	5.75	0.70	2.10	1.00	0.70	0.70	1.47	10.7%
	12.50	5.75	0.70	1.78	1.00	0.70	0.70	1.25	9.1%
	13.50	5.70	0.65	1.74	1.00	0.65	0.65	1.13	8.2%
	14.50	5.70	0.65	1.76	1.00	0.65	0.81	1.43	10.4%
	16.00	5.65	0.60	1.43	1.50	0.60	0.90	1.29	9.4%
	17.50	5.55	0.50	1.27	1.50	0.50	0.75	0.95	6.9%
	19.00	5.55	0.50	1.22	1.50	0.50	0.75	0.92	6.7%
	20.50	5.50	0.45	1.05	1.50	0.45	0.68	0.71	5.2%
	22.00	5.45	0.40	0.62	1.50	0.40	0.60	0.37	2.7%
	23.50	5.35	0.30	0.54	1.50	0.30	0.45	0.24	1.8%
	25.00	5.25	0.20	0.36	1.50	0.20	0.30	0.11	0.8%
	26.50	5.20	0.15	0.00	1.50	0.15	0.23	0.00	0.0%
	28.00	5.15	0.10	0.00	1.50	0.10	0.15	0.00	0.0%
	29.50	5.10	0.05	0.00	1.50	0.05	0.05	0.00	0.0%
W	30.00	5.10	0.00	0.00	0.50		0.00	0.00	0.0%
	35.00	4.68			0.00		0.00	0.00	0.0%
	40.00	4.58			0.00		0.00	0.00	0.0%
	49.00	4.28			0.00		0.00	0.00	0.0%
	53.00	3.58			0.00		0.00	0.00	0.0%
1 RS & G	55.00	3.26			0.00		0.00	0.00	0.0%
TOTALS ----------					24.72	0.8 (Max.)	10.76	13.72	100.0%

Manning's n = 0.0250
Hydraulic Radius= 0.43503287

STREAM NAME: Slate River
XS LOCATION: on CB Land Trust near ped bridge
XS NUMBER: 4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	10.76	10.04	-6.7%
4.83	10.76	16.66	54.9%
4.85	10.76	16.10	49.7%
4.87	10.76	15.54	44.5%
4.89	10.76	14.99	39.4%
4.91	10.76	14.45	34.3%
4.93	10.76	13.91	29.3%
4.95	10.76	13.37	24.4%
4.97	10.76	12.85	19.4%
4.99	10.76	12.32	14.6%
5.01	10.76	11.80	9.8%
5.03	10.76	11.29	5.0%
5.04	10.76	11.04	2.6%
5.05	10.76	10.79	0.3%
5.06	10.76	10.53	-2.1%
5.07	10.76	10.28	-4.4%
5.08	10.76	10.04	-6.7%
5.09	10.76	9.79	-9.0%
5.10	10.76	9.55	-11.2%
5.11	10.76	9.31	-13.4%
5.12	10.76	9.08	-15.6%
5.13	10.76	8.85	-17.7%
5.15	10.76	8.40	-21.9%
5.17	10.76	7.97	-25.9%
5.19	10.76	7.55	-29.8%
5.21	10.76	7.14	-33.6%
5.23	10.76	6.75	-37.3%
5.25	10.76	6.37	-40.8%
5.27	10.76	6.00	-44.2%
5.29	10.76	5.63	-47.6%
5.31	10.76	5.28	-50.9%
5.33	10.76	4.93	-54.1%

WATERLINE AT ZERO
AREA ERROR = 5.051

STREAM NAME: Slate River
XS LOCATION: on CB Land Trust near ped bridge
XS NUMBER: 4 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	3.48	53.63	1.41	2.37	75.62	54.14	100.0%	1.40	209.93	2.78
	4.05	47.15	0.99	1.80	46.88	47.57	87.9%	0.99	103.16	2.20
	4.10	46.62	0.96	1.75	44.54	47.02	86.9%	0.95	95.44	2.14
	4.15	46.08	0.92	1.70	42.22	46.48	85.8%	0.91	87.99	2.08
	4.20	45.54	0.88	1.65	39.93	45.93	84.8%	0.87	80.81	2.02
	4.25	45.11	0.83	1.60	37.67	45.48	84.0%	0.83	73.79	1.96
	4.30	44.23	0.80	1.55	35.42	44.58	82.3%	0.79	67.52	1.91
	4.35	42.64	0.78	1.50	33.25	42.99	79.4%	0.77	62.26	1.87
	4.40	41.06	0.76	1.45	31.16	41.39	76.4%	0.75	57.29	1.84
	4.45	39.48	0.74	1.40	29.15	39.79	73.5%	0.73	52.62	1.81
	4.50	37.89	0.72	1.35	27.21	38.19	70.5%	0.71	48.23	1.77
	4.55	36.31	0.70	1.30	25.36	36.59	67.6%	0.69	44.11	1.74
	4.60	34.30	0.69	1.25	23.59	34.57	63.9%	0.68	40.61	1.72
	4.65	31.72	0.69	1.20	21.93	31.97	59.1%	0.69	37.91	1.73
	4.70	29.95	0.68	1.15	20.40	30.18	55.8%	0.68	34.92	1.71
	4.75	29.27	0.65	1.10	18.92	29.49	54.5%	0.64	31.28	1.65
	4.80	28.59	0.61	1.05	17.48	28.79	53.2%	0.61	27.84	1.59
	4.85	27.91	0.58	1.00	16.07	28.10	51.9%	0.57	24.59	1.53
	4.90	27.23	0.54	0.95	14.69	27.41	50.6%	0.54	21.53	1.47
	4.95	26.55	0.50	0.90	13.34	26.71	49.3%	0.50	18.66	1.40
	5.00	25.87	0.47	0.85	12.03	26.02	48.1%	0.46	15.99	1.33
WL	5.05	25.20	0.43	0.80	10.75	25.32	46.8%	0.42	13.50	1.26
	5.10	23.79	0.40	0.75	9.52	23.91	44.2%	0.40	11.44	1.20
	5.15	21.96	0.38	0.70	8.37	22.07	40.8%	0.38	9.75	1.16
	5.20	20.29	0.36	0.65	7.32	20.40	37.7%	0.36	8.21	1.12
	5.25	18.64	0.34	0.60	6.34	18.74	34.6%	0.34	6.85	1.08
	5.30	17.73	0.31	0.55	5.43	17.82	32.9%	0.31	5.47	1.01
	5.35	16.81	0.27	0.50	4.57	16.89	31.2%	0.27	4.25	0.93
	5.40	15.89	0.24	0.45	3.75	15.97	29.5%	0.24	3.18	0.85
	5.45	14.96	0.20	0.40	2.98	15.02	27.7%	0.20	2.25	0.76
	5.50	13.29	0.17	0.35	2.28	13.35	24.7%	0.17	1.55	0.68
	5.55	10.14	0.16	0.30	1.65	10.19	18.8%	0.16	1.09	0.66
	5.60	9.23	0.13	0.25	1.17	9.26	17.1%	0.13	0.65	0.56
	5.65	8.26	0.09	0.20	0.73	8.29	15.3%	0.09	0.32	0.44
	5.70	5.57	0.07	0.15	0.36	5.59	10.3%	0.06	0.13	0.36
	5.75	2.37	0.05	0.10	0.12	2.39	4.4%	0.05	0.03	0.30
	5.80	1.17	0.02	0.05	0.03	1.18	2.2%	0.02	0.01	0.19

STREAM NAME: Slate River
XS LOCATION: on CB Land Trust near ped bridge
XS NUMBER: 4

SUMMARY SHEET

MEASURED FLOW (Qm)=	13.72	cfs
CALCULATED FLOW (Qc)=	13.50	cfs
(Qm-Qc)/Qm * 100 =	1.6	%
MEASURED WATERLINE (WLm)=	5.08	ft
CALCULATED WATERLINE (WLc)=	5.05	ft
(WLm-WLc)/WLm * 100 =	0.6	%
MAX MEASURED DEPTH (Dm)=	0.80	ft
MAX CALCULATED DEPTH (Dc)=	0.80	ft
(Dm-Dc)/Dm * 100	0.2	%
MEAN VELOCITY=	1.26	ft/sec
MANNING'S N=	0.025	
SLOPE=	0.0014	ft/ft
.4 * Qm =	5.5	cfs
2.5 * Qm=	34.3	cfs

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

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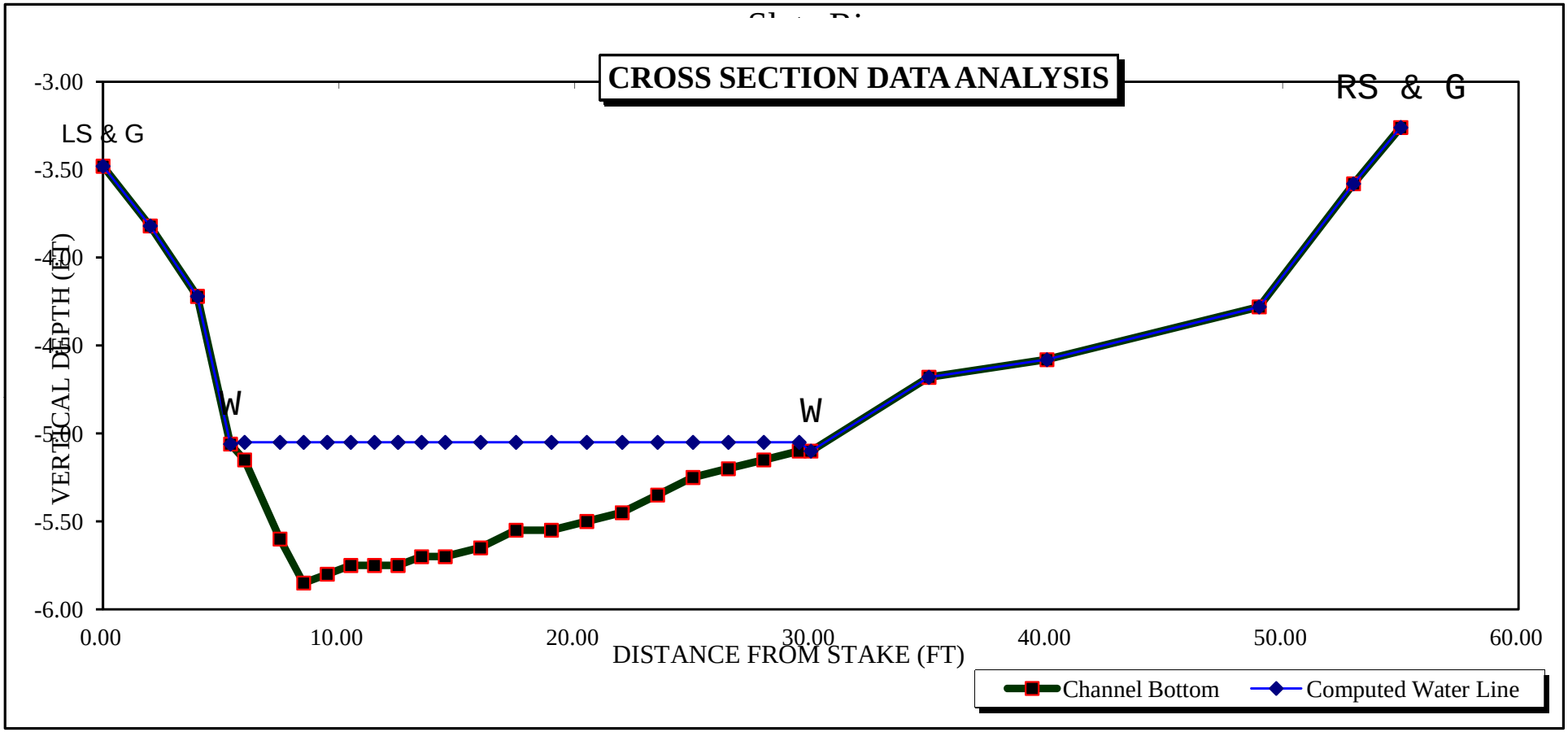
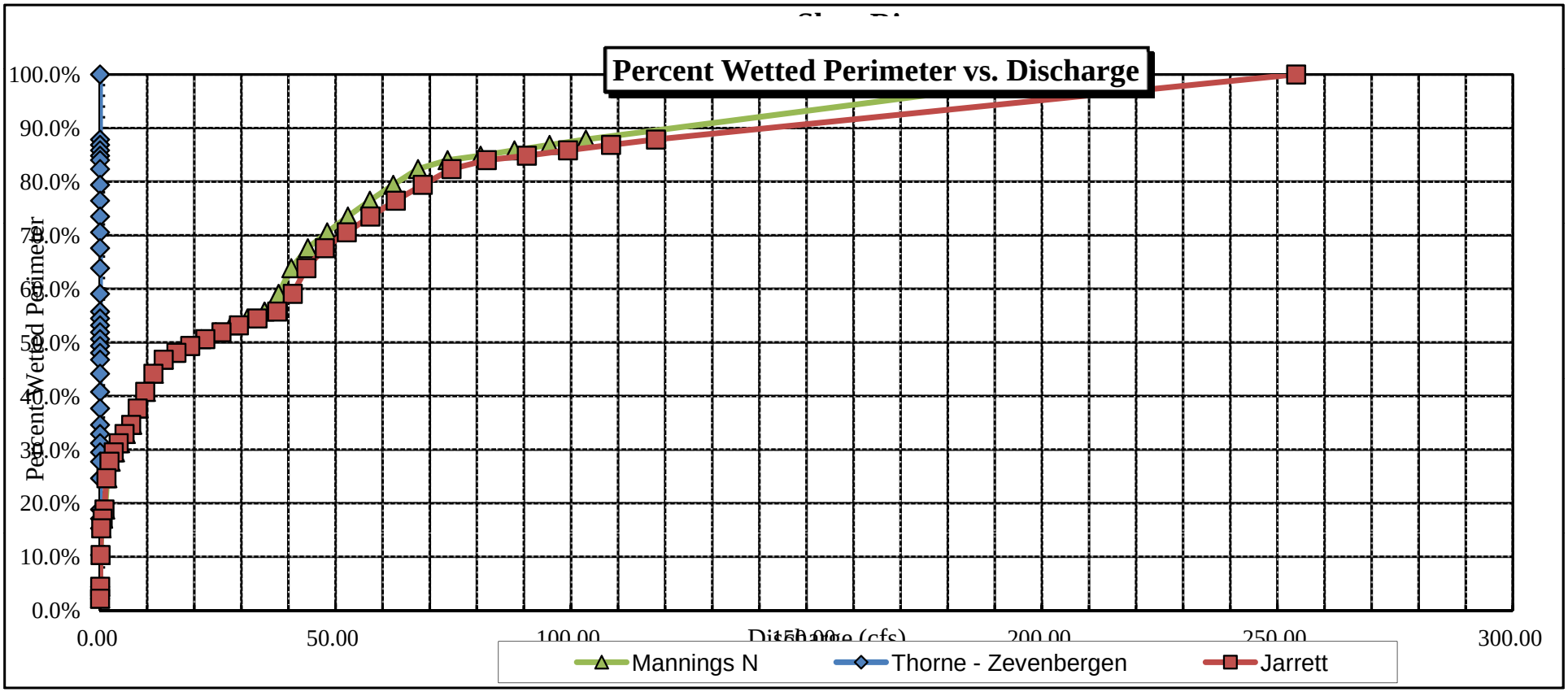
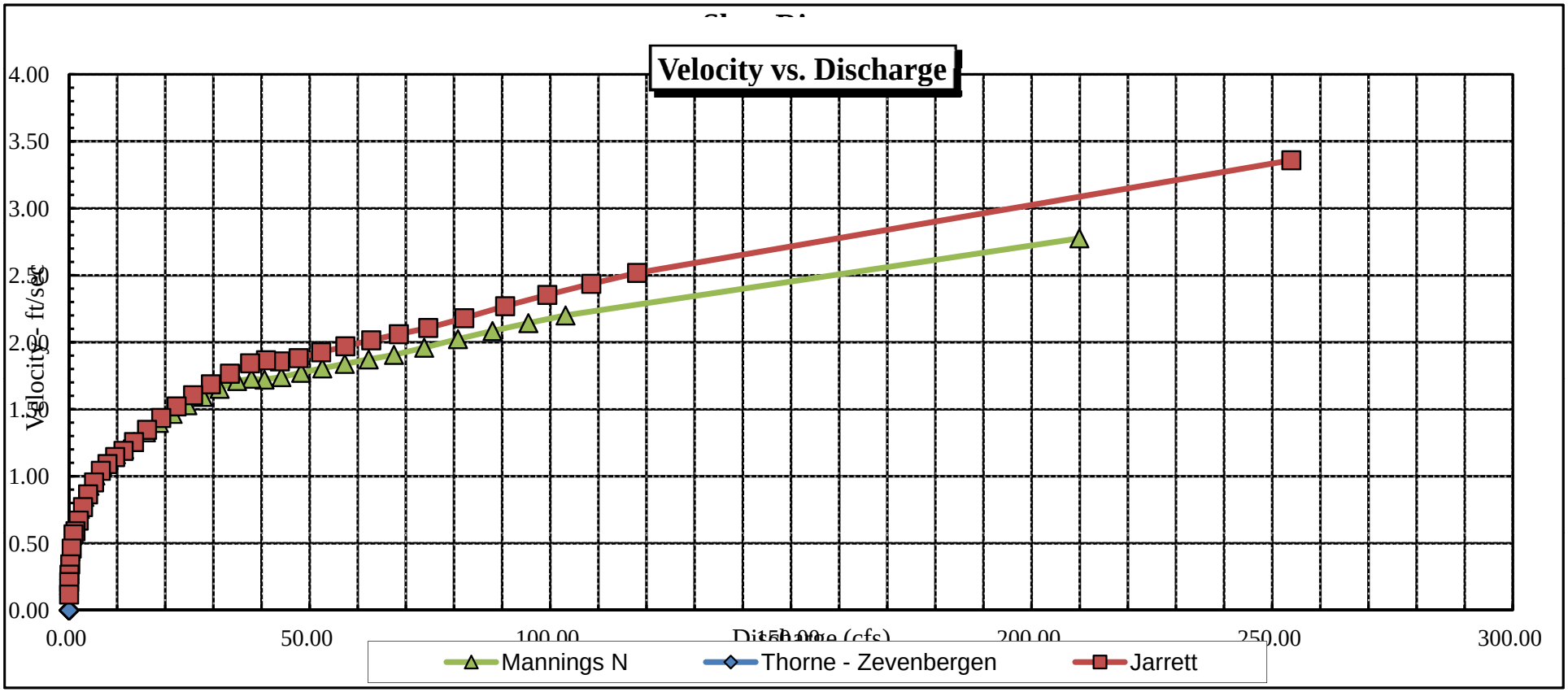
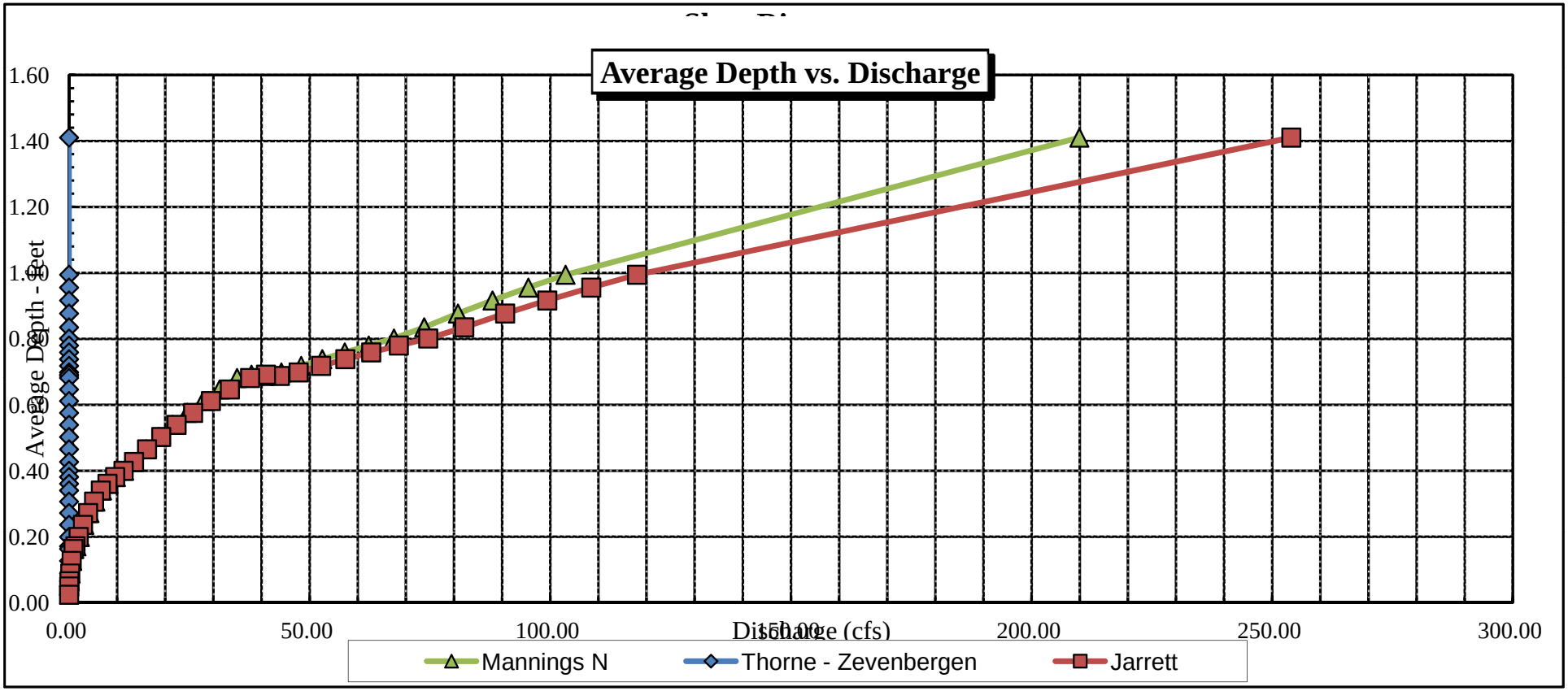
RECOMMENDATION BY: ………………………………………… AGENCY………………………………………… DATE:………………………

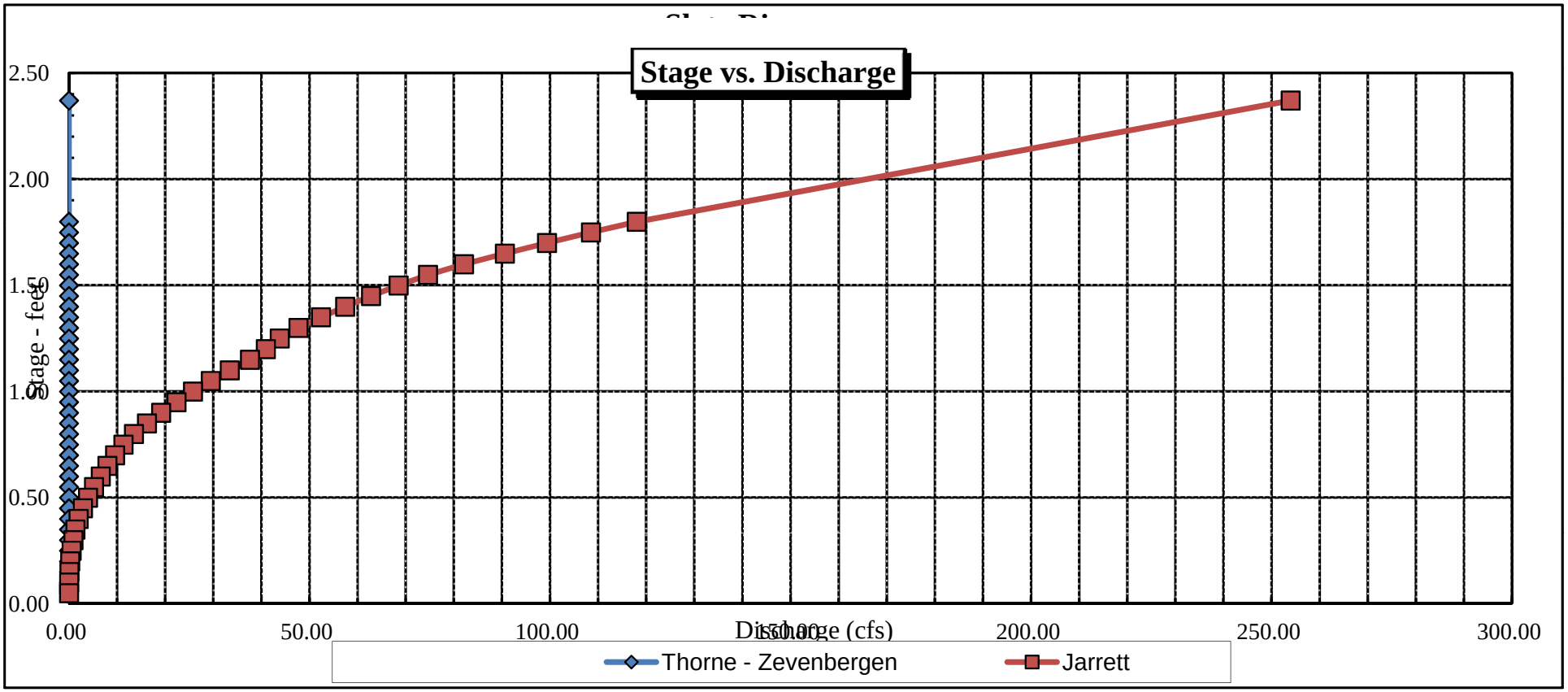
CWCB REVIEW BY: ……………………………………………………………………………… DATE:………………………


CROSS SECTION DATA ANALYSIS
LS & G
RS & G
W
W
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
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
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Average Depth - Feet
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett