United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7093
www.blm.gov/co

TAKE PRIDE IN AMERICA

In Reply Refer To:
7250 (CO-932)

DEC 1 1 2009

Ms. Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right for the upper Animas River, located in Water Division 7.

Location and Land Status: The Animas River starts in the San Juan Mountains east of Silverton and flows downstream to the Durango area. This recommendation covers two stream reaches located upstream from Silverton. The upper reach begins at the confluence with Minnie Gulch and extends to the confluence with Cunningham Creek. The lower reach begins at the confluence with Cunningham Creek and extends downstream to the confluence with Arrastra Creek.

In the upper reach, approximately 25 percent of the 2.25-mile reach is located on federal lands managed by the BLM, while the remaining 75 percent is located on private lands. In the lower reach, approximately 50% of the 2.25-mile reach is located on federal lands managed by the BLM, while the remaining 50% is located on private lands.

Biological Summary: These segments of the Animas River are moderate gradient streams with moderate to large substrate size, often punctuated by large boulders within the stream channel. Many portions of the stream channel have been affected by historic mining that moved bedload materials. Natural hydrologic processes since the mining activity ceased have created a natural stream channel, but some portions of the river are still highly braided and lack good width to depth ratios.

Water quality in the stream segment is affected by heavy metals from both natural sources and historic mining activities within the watershed. Minnie Gulch, Maggie Gulch, and Cunningham Creek contribute water to the river that has lower concentrations of heavy metals, so water quality improves as you move downstream through the two reaches.

Fish surveys have documented naturally reproducing populations of brook trout in both stream

reaches. Brook trout are the trout species that are most tolerant of heavy metal loads, but they indicate that the stream has sufficient macroinvertebrates to provide for fish forage, and that the stream has basic ecologic functions. Brook trout are not found either immediately above or below these two reaches, indicating that heavy metal loads in those locations are too high for fish habitat. The two recommended reaches provide an important connectivity between good fish habitat found in Minnie Gulch, Maggie Gulch, and Cunningham Creek. The Colorado Water Conservation Board (CWCB) has previously appropriated instream flow water rights on all three of these important tributaries, based upon recommendations from the BLM and the Colorado Division of Wildlife.

The riparian community consists primarily of willows and potentilla. As you move downstream and the water quality improves, the riparian community is more vigorous and has succeeded in converting the stream from a braided system to a channelized environment that is more favorable to fish populations.

R2Cross Analysis. Upper Segment - BLM collected the following R2Cross data from the creek:

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	07/28/2004	37.55	15.0-93.9	15.62	Out of range
BLM	10/20/2004	18.10	7.2-45.3	Out of range	11.37
BLM	10/20/2004	13.81	5.5-34.5	8.80	6.80

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

> 12.2 cubic feet per second is recommended during the high temperature period from May 1 through October 31. This recommendation is derived by averaging the results of the data sets. The recommendation is driven by the depth criteria. Given the wide creek channel in riffle habitats, 12.2 cfs is required to meet the depth criteria and provide sufficient physical habitat that is usable by the fish population.
>
> 9.1 cubic feet second is recommended for the period from November 1 to April 30. This recommendation is derived by averaging the results of the data sets. This recommendation is driven by the wetted perimeter criteria, and should provide adequate flow through pools and prevent complete icing of riffles during winter to insure successful overwintering by the fish population.

Lower Segment - The BLM collected the following R2Cross data from the creek:

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	07/28/2004	39.80	15.9-99.5	31.73	Out of range
BLM	10/20/2004	39.33	15.7-98.3	16.32	Out of range
BLM	10/20/2004	39.08	15.6-97.7	22.69	Out of range
BLM	10/23/2008	24.63	9.9-61.6	22.43	13.92
BLM	10/23/2008	22.68	9.1-56.7	32.17	12.23

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Water Availability: The BLM has identified a handful of decreed stream diversions located upstream from the proposed stream reaches. Further analysis would be required to determine in what seasons these diversions are operated and whether the decreed uses are consumptive:

Hematite Gulch Hydro – 6 cfs, conditional
Burrows Creek Diversion – 1 cfs, conditional
Mineral Point Ditch – 11 cfs, absolute
Hematite Creek Pipeline – 0.5 cfs, absolute
Highland Mary Pipeline – 8 cfs, absolute
Pride of the West Pipeline – 0.5 cfs, absolute
Cole Ranch Animas Diversion – 0.5 cfs, absolute
Cole Ranch Minnie Diversion - 2.5 cfs, absolute
Hewett Diversion – 0.233 cfs, absolute

For water availability analysis, the BLM recommends using the Animas River gage at Howardsville (USGS 09357500). This gage is located in the middle of the two recommended stream reaches and had a long period of record from 1935 to 1982. The gage record indicates that recommended flow rates are available during most hydrologic conditions.

Relationship to Management Plans: The BLM land use plan that covers this management unit is currently under revision. Under the new plan, many historical management actions are expected to continue. For example, the BLM will continue to cooperate with the Upper Animas Stakeholders Group to implement projects within the watershed that are designed to minimize acid mine drainage. The BLM will continue to provide recreation access along this stream segment for informal camping, hiking, and fishing. The river corridor will also continue to be managed as part of the Alpine Loop Scenic byway. If further water quality improvements result in additional stream reaches of the Animas being able to support fish populations, the BLM may bring forth additional instream flow recommendations at that time.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2009. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

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

Sincerely,

Linda Anañia

Linda Anañia,
Deputy State Director, Natural Resources and Fire

cc: Mark Stiles, San Juan Public Lands Center
Matt Janowiak, Columbine Field Office
Kelly Palmer, San Juan Public Lands Center
Shauna Jensen, Dolores Field Office

DRAFT INSTREAM FLOW RECOMMENDATION

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Deputy State Director
Resources and Fire

cc: Mark Stiles, San Juan Public Lands Center
Matt Janowiak, Columbine Field Office
Kelly Palmer, San Juan Public Lands Center
Shauna Jensen, Dolores Field Office

APPENDIX 6A

FISHERIES REPORT

Current and Historical Review of Animas Watershed Fisheries

Prepared for
Animas River Stakeholders Group
July 2000

A Collaborative Preparation by:

William Simon, Animas Watershed Coordinator
Barb Horn, Colorado Division of Wildlife
David Wegner, EMI, Inc.

6.1.2 Upper Animas River, Minnie Gulch to Cement Creek in Silverton (Segment 3a)

Trout populations in this section of the Upper Animas River are dominated by brook and rainbow trout (when stocked) with an isolated capture of a native cutthroat trout. Trout samplings are summarized by year and life stage in Table 6.3.

Table 6.3 Upper Animas River, below Minnie Gulch (Segment 3a). Trout population dynamics for 1976-1998.

Species Age	1976 Smith	1984 Western Aquatics	1992 CDPHE	1994 Cadmus Group	1996 CDOW	1997 CDOW	1998 CDOW
Rainbow							
Larval	0		0			0	
YOY	0	NFC	0	NFC	NFC	0	NFC
Juvenile	0		0			0	
Adult	4		12			1	
Brook							
Larval		0	0	0		0	0
YOY	NFC	0	9	4	NFC	0	179[1]
Juvenile		0	37	0		1	73
Adult		4 (+4 seen)	45	10 (seen)		0	87
Cutthroat							
Larval							1
YOY	NFC	NFC	NFC	NFC	NFC	NFC	0
Juvenile							0
Adult							0

[1]Sampled at A45: upstream of P & G Mill tailing pond above Howardsville

In terms of actual numbers of trout captured in this area, brook trout predominate. This is in part attributed to the availability of beaver pond habitat in side channels above Silverton and the brook trout's ability to withstand higher metal concentrations, and habitat less suitable for other trout species. The rainbow trout sampled in 1992 were likely remnants of the CDOW stocking efforts and likely do not reflect natural reproduction of that species in the upper Animas River.

A study by the Department of Interior (unknown author, 1968) reported one fish captured through three electroshocking efforts. The report suggested the section may support very low numbers of trout on a "put and take" (the fish are put in for the purpose of being caught by fisherman before they would over winter) basis if population of bottom organisms were not limited by toxic metals. In 1976 Smith (1976) referred to this section of the Animas to be "essentially dead". Conditions apparently have substantially improved over the years. Data collected by CDOH (1992), Japhet (1998), and Brantliner (1998) indicate that brook trout are not only

present but are now self sustaining in the mainstem Animas River above Silverton (Table 6.5). Rainbow trout are no longer being stocked and therefore have not recently been captured.

SUMMARIES OF RECENT FISH SURVEYS FOLLOWS:

6.1.2.1 SMITH, 1976. Samples collected with electrofishing by Norwin Smith in 1976 (Silverton to Animas Forks) found a total of four adult rainbow trout with an average length of 8.2 inches. Smith concluded that this segment would essentially be devoid of life (fish) if it weren't for stocking. These observed fish were likely stocked fish from the 1976 summer planting when a total of 3,180 rainbow trout, with an average size of 8.9 inches, were planted in this segment of the river. Tributary sample results are as follows:

Segment 2 tributaries:

- Burrows Creek - no fish collected
- Horseshoe Creek - no fish collected
- Cinnamon Creek - no fish collected
- Picayne Gulch - no fish collected
- Animas River, South Fork - no fish collected

Segment 3 tributaries:

- Minnie Gulch (2 sites) - cutthroat (23) - estimated 8.2 lbs./acre and 8.6lbs/acre biomass
- Maggie Gulch - no fish collected
- Stony Gulch - no fish collected
- Cunningham Creek (3 sites) - brook trout (13), rainbow trout (1) - 58 fish total with an estimated 8.6lbs/acre biomass
- Arrastra Creek - no fish collected

6.1.2.2 CDOW, 1987. In 1987 personnel with the CDOW sampled Maggie Gulch and Cunningham Creek above Silverton. Six fish were sampled in Maggie Gulch yielding an estimated biomass for brook trout of 9.4 lbs./acre and cutthroat trout of 22.9 lbs./acre (Horn, 1988). Cunningham Gulch yielded sixteen brook trout (39.2 lbs./acre) and one cutthroat trout. It was concluded by Woodling (1988) that limited natural reproduction of brook trout was occurring in Cunningham Creek, predominately associated with beaver pond habitats in the lower reaches. Both researchers concluded that habitat improvements could be made and water quality improvements in Cunningham would result in higher fish productivity.

6.1.2.3 Colorado Department of Health, 1992. Samples collected with electrofishing by the Colorado Department of Health in 1992 identified mostly brook trout at three locations above Silverton, sites A68, A55, A53, A40, and A45. This survey yielded biomass estimates of 32.3, 6.3,11.4, 15.2, and 16.3 lbs. per acre respectfully (combined brook and rainbow trout). In 1992 CDOW stocked the upper Animas River with cacheable size rainbow trout in July prior to the sampling effort, thus affecting the rainbow sampling results. Results of this survey are presented in Table 6.5.

6.1.2.4 Cadmus Group, 1994. Adult Trout Sampling. In mid-July of 1994 the Cadmus group sampled four locations for adult trout using a timed backpack electofishing method. The results of this sampling event are presented in Table 6.4.

Table 6.4 1994 Adult Trout Electoshocking Results: Captured or Sighted

HAR1	Animas River 1 mile below confluence with Maggie Gulch	20 brook trout
HAR2	Animas River immediately upstream of the USGS gage at Howardsville extending upstream to below the Howardsville bridge	2 brook trout
HAR3	Animas River 1.5 to 2.0 miles below USGS gage	2 brook trout
HAR 4	Immediately upstream of Lakawanna bridge	3 brook trout

The Cadmus group was surprised to find that the Animas between Howardsville and Maggie gulch contained a brook trout fishery. They concluded that results suggest that "brook trout are capable of limited, but sustainable recruitment and maintenance". They also noted that a lack of brown, cutthroat, and rainbow trout suggests physical or chemical limitations to these species.

6.1.2.5 Colorado Division of Wildlife, 1998. The most quantitative sampling done to date on the upper Animas River occurred in 1992 (CDOH, 1992) and 1998 (Japhet, 1998). These sampling efforts were conducted in the area above Cataract Gulch and P & G Mill tailings ponds (Howardsville, site A45) in a riffle section located adjacent to a series of beaver dam pools. In 1998, the predominant species collected in the sampled 1000' stretch using streambank multi-pass generator assisted electrofishing, were small brook trout (average 3.8 inches in length) and one native trout (1.5 inches in length). The biomass of the brook trout sampled was calculated to be 20.9 lbs. per acre which is at the low end of the spectrum for a high elevation fishery. Table 6.5 provides quantification of the results of these two sampling events plus others as listed.

Table 6.5 Combined CDOH (1992) and CDOW (1998) Fish Sampling Results, Segment 3a

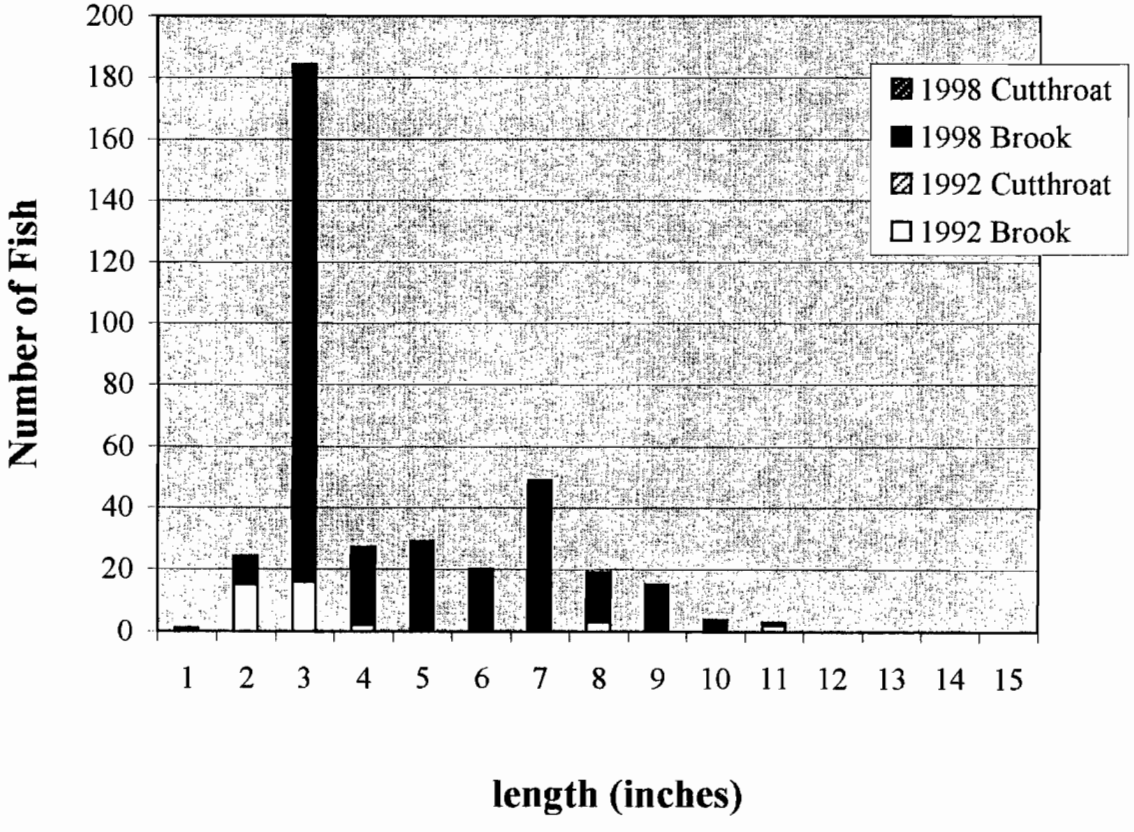
Site ID	Date	Brook # and (lbs/acre)	Rainbow # and (lbs/acre)	Cut-throat # and (lbs/acre)	Location
A40a	1992	28 (15.2)			above Maggie Gulch
A45	*1992*	***41 (16.3)****			*above P&G Mill*
A45	*1998 CDOW*	***333(20.9)****		*1.0*	*above Cataract Creek (above P&G Mill)*
A53	1992	15(7.6)			below P&G tailings
A53a	1992	18 (11.4)			below Cunningham
A55a	1992	21.0 (4.9)	1.0	1.0 (.2)	above Arrastra Gulch

A68	1992	34.2 (6.2)	36.8		above 14th street

*Although the numbers of individuals is accurate the biomass might not be calculated in the same fashion possibly explaining the huge increase in numbers in 1998 but small increase in biomass.

The length frequency distribution of the trout captured in 1992 is compared to those captured in 1998 in Figure 6.1 below.

Figure 6.1 Brook & Cutthroat Trout Length-Frequency
Animas River above Howardsville Mill Tailings (A45)



6.1.2.6 Cadmus Group, 1994, Fry Sampling. The Cadmus Group collected samples with a 15 foot, one-sixteenth inch mesh seine and a dipnet at 16 locations. Only seven trout fry were collected. Results are presented in Table 6.6.

Table 6.6 Cadmus Group Upper Animas River Fry Sampling Results, May 23 & 24, 1994.

Site	Location	Results
AFS1	Animas River, immediately downstream of Lackawanna bridge	1 - post larval fry
AFS2	Animas River 100 yds. below Howardsville bridge	No collection
AFS3	Animas River 0.25 miles below Howardsville bridge	No collection
AFS4	Animas River side tributary from beaver pond, 0.5 miles below Howardsville bridge	No collection
AFS5	Cunningham Creek upstream of confluence with Animas River	3 - fry
AFS6	Lowermost beaver pond on Cunningham Creek above confluence with Animas River	No collection
AFS7	Northern side channel of Cunningham Creek 100 yards above confluence with Animas River	No collection
AFS8	Cunningham Creek 50 yards above confluence with Animas River	No collection
HAR2	Animas River immediately upstream of the USGS gage at Howardsville extending upstream to below the Howardsville bridge	No collection
HAR3	Animas River 1.5 to 2.0 miles below USGS gage	No collection
AFS9	Animas River upstream of Howardsville bridge and 5.0 miles above Cement Creek confluence	No collection
AFS10	Animas River 5.3 miles above Cement Creek confluence, .3 miles above AFS9 (same site as CDOH (1992) and CDOW (1998) site.	3 - fry collected
AFS11	Animas River 100 yards upstream of Maggie Gulch, 6 miles above Cement Creek confluence	No collection
HAR1	Animas River 1 mile below confluence with Maggie Gulch	No collection
AFS12	Animas River 5.5 miles above Cement Creek confluence (just below Maggie Gulch)	No collection

AFS13	Animas river 100 yards downstream of gaging station (A72), 1.6 miles below Cement Crk, 50 yds. Below railroad bridge	No collection

They did note "many fish in pond" near Howardsville but were unable to identify or quantify the species present (these beaver ponds are known to contain numerous brook trout).

6.1.2.7 Brantlinger, 1998, Upper Animas Fry Sampling

Fry collections from backpack electroshocking in the Upper Basin in 1998 by Brantlinger indicates that the brook trout are dominating the fish assemblage and that natural reproduction is occurring at several sites. Table 6.7 summarizes this data.

Table 6.7 Brantlinger's fry electrofishing results from the Upper Animas River, 1998.

Date	Location	# of fry captured
9/8/98	Animas River above Minnie Gulch (Segment 2)	None
9/8/98	Animas River above Arrastra Creek (Segment 3a) 100' 2 pass	None caught, 2 observed
9/8/98	Animas River above Boulder Creek (Segment 3a) 100' 3 pass	4 brook trout
9/9/98	Animas River above Cunningham Creek (Segment 3a) 100'- 4 pass	27 brook trout
9/10/98	Animas River above Maggie Gulch (Segment 2) 3 pass 100'	24 brook trout
9/8/98	Animas River above 14th Street Bridge (Segment 3a) 100' 2 pass	20 brook trout fry 3 brook trout adult
9/8/98	South Mineral Creek (Segment 9a) 100' one pass	24 brook trout fry
9/?/98	Arastra Gulch (spot locations)	No fish taken

The Upper Animas River, below Minnie gulch and above the confluence with Cement and Mineral Creeks, reflects a riverine ecosystem that has been naturally and anthropogenically impacted by elevated levels of metals and minimal habitat resulting in low productivity. Historic stocking of catchable rainbow trout had seasonally augmented a resident brook trout population. Recent data indicates that brook trout have been able to increase their population and biomass, particularly above Howardsville.

6.1.3 Cement and Mineral Creeks (Segments 7, 8,9a, 9b).

Limited surveys of the fishery in Cement and Mineral Creeks have been conducted although those plus observations of many are probably enough to conclude a lack of fish. The earliest documented sampling effort occurred in Cement Creek in 1984. Western

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Animas River - Cunningham to Arrastra							CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Approx. 750' upstream from powerline crossing							
DATE: 10-23-08	OBSERVERS: J. Seechan, K. Palmer, R. Smith						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 11	TOWNSHIP: 41 (N)/S	RANGE: 7 E/(W)	PM: N.M.		
COUNTY: San Juan	WATERSHED: Animas	WATER DIVISION: 7	DOW WATER CODE: 38011				
MAP(S): USGS: Howardsville 7.5'				270969			
USFS:				4190376			

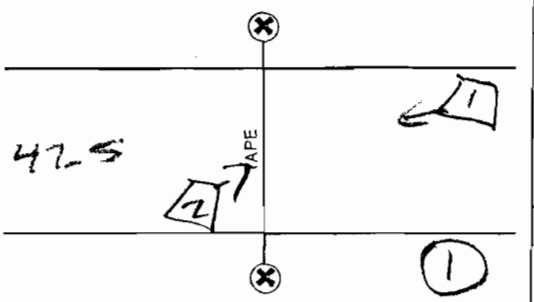
SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0 6.6	4.70/4.72
(2) WS Upstream	48.1	4.20
(3) WS Downstream	17.1	4.45
SLOPE	0.75/65.21 = 0.012	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

Ph = 8.2
Temp = 3° C
TDS = 310

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Animas River | CROSS-SECTION NO.: 1 | DATE: 10-23-08 | SHEET ___ OF ___

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

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	4.6		2.80								
	5.3		3.95								
W	6.6		4.70								
	7		4.8	.10				0.03			
	8		4.8	.10				0.50			
	9		4.9	.20				0.62			
	11		5.4	.70				1.52			
	13		5.2	.50				2.01			
	15		5.35	.65				2.11			
	17		5.60	.90				0.99			
R	18		5.30	.60				1.81			
	21		5.40	.70				1.02			
	23		5.20	.50				1.77			
	25		5.05	.35				1.64			
	27		5.30	.60				1.50			
	29		5.40	.70				1.02			
R	31		4.80	.10				0.52			
R	33		4.80	.10				0.35			
	35		5.30	.50				1.50			
	37		5.30	.60				1.52			
	39		5.00	.30				.94			
	41		4.85	.15				.21			
	42		4.75	.05				0			
	44		4.80	.10				.06			
	45		4.95	.25				0			
W	47.5		4.72								
	50.9		4.26								
RS/G	54.2		2.82								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Animas River | CROSS-SECTION NO: 2

CROSS-SECTION LOCATION: 500 ft downstream from powerline

DATE: 10/20/04 | OBSERVERS: R. Smith, S. Jensen, J. Gunn

LEGAL DESCRIPTION: ¼ SECTION: NW | SECTION: 11 | TOWNSHIP: 41 (N)S | RANGE: 7 E/(W) | PM: N.M.

COUNTY: San Juan | WATERSHED: Animas | WATER DIVISION: 7 | DOW WATER CODE:

MAP(S): USGS: Howardsville 7.5' 13 S 0270450 4186500 | USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES / NO) | METER TYPE: Marsh McBirney

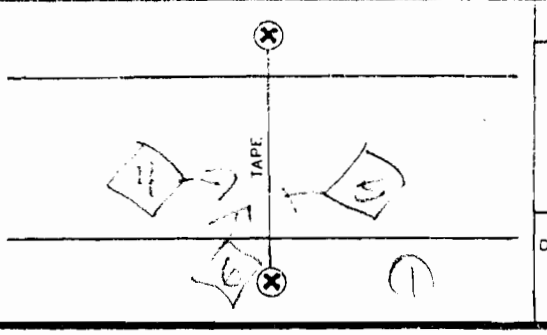
METER NUMBER: | DATE RATED: | CALIB/SPIN: _____ sec | TAPE WEIGHT: surveyed _____ lbs/foot | TAPE TENSION: surveyed _____ lbs

CHANNEL BED MATERIAL SIZE RANGE: 3" cobbles to 2-foot boulders | PHOTOGRAPHS TAKEN: (YES/NO) | NUMBER OF PHOTOGRAPHS: 5

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	8.418 / 8.419
2 WS Upstream	100	7.89
3 WS Downstream	100	9.80
SLOPE	1.91 / 200.0 = 0.00955	

SKETCH



AQUATIC SAMPLING SUMMARY

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

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:
mayfly, caddisfly, stonefly

COMMENTS

pH 8.1
TDS 200
Temp 3.5°C

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Animas River | CROSS-SECTION NO: | DATE: 10/20/04 | SHEET __ OF __

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: 0.6 ft | TIME: 9:25am

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		6.28								
G	4		6.86								
	7		7.07								
W	8		8.48								
	10		8.75	.25				0			
	12		8.81	.3				0.52			
	14		9.47	.95				0.75			
	16		9.42	1.0				1.92			
	18		9.61	1.1				1.83			
	20		9.31	.85				1.66			
TOR	22		8.61	.15				1.83			
	24		9.33	.9				1.81			
	26		9.13	.65				2.25			
	27		9.50	.95				1.30			
	28		9.24	.70				1.08			
	29		9.05	.60				2.21			
	30		9.39	.90				2.00			
	31		9.53	1.1				1.52			
	32		9.13	0.6				1.52			
	34		9.42	0.95				1.42			
	36		9.36	0.90				2.57			
	38		8.93	0.45				1.98			
	40		9.47	0.90				0.72			
	42		9.26	0.80				0.97			
	44		9.02	0.50				0.36			
TOR	46		8.40	~~0~~				~~0~~			
W	47		8.49	~~0~~				~~0~~			
G	49.2		6.40								
RS	50.9		5.59								
TOTALS:											

End of Measurement | Time: 9:50 | Gage Reading: 0.6 ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Animas River - between Cunningham & Arrastra | CROSS-SECTION NO: 1

CROSS-SECTION LOCATION: 800' upstream from power line

DATE: 10-20-04 | OBSERVERS: R Smith, S. Jensen, C. Gunn

LEGAL DESCRIPTION: ¼ SECTION: NW | SECTION: 11 | TOWNSHIP: 41 (N)/S | RANGE: 7E (W) | PM: N.M.

COUNTY: San Juan | WATERSHED: Animas | WATER DIVISION: 7 | DOW WATER CODE: 38011

MAP(S): USGS: Howardsville 7.5' 13S 0271285 4193118

USFS:

SUPPLEMENTAL DATA

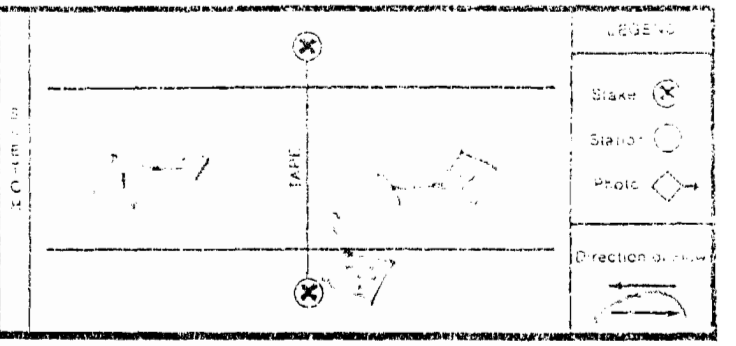
SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO | METER TYPE: Marsh McBirney

METER NUMBER: | DATE RATED: | CALIB/SPIN ____ sec | TAPE WEIGHT: surveyed ____ lbs/foot | TAPE TENSION: surveyed ____ lbs

CHANNEL BED MATERIAL SIZE RANGE: 3" cobbles to 2' 400# boulders | PHOTOGRAPHS TAKEN: (YES)/NO | NUMBER OF PHOTOGRAPHS: 3

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape & Stake LB	0.0	surveyed
⊗ Tape & Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	1.76/12.00
② WS Upstream	100.0	11.10
③ WS Downstream	100.0	13.60
SLOPE	2.50 / 200.0 ft = .0125	



AQUATIC SAMPLING SUMMARY

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

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

mayfly, caddisfly, stonefly

COMMENTS

Temp: 3°C Ph: 8.1 TDS: 210

DISCHARGE/CROSS SECTIO NOTES

STREAM NAME: Animas River | CROSS-SECTION NO: 1 | DATE: 10-30-04 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT? | EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: 0.6 ft | TIME: 9:45 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 (ft²)	Discharge (cfs)
LS	0.0		9.78								
G	4.5		10.36								
	6.0		11.10								
W	7.6		11.95	Ø							
	9.0		12.58	0.6				1.19			
	11.0		12.85	0.8				1.17			
	13.0		12.94	1.0				2.27			
	15.0		12.92	0.9				2.03			
	17.0		12.30	0.3				2.13			
	19.0		12.84	0.8				2.02			
	21.0		12.33	0.45				0.81			
	23.0		12.60	0.60				1.53			
	25.0		12.81	0.80				2.23			
	27.0		12.99	1.00				1.09			
	29.0		13.18	1.10				1.52			
	31.0		12.83	0.75				1.56			
	33.0		12.24	0.25				1.24			
	35.0		12.64	0.60				1.37			
	37.0		12.46	0.50				1.00			
RS	39.0		12.00	Ø				Ø			
	41.0		12.68	0.60				1.52			
	43.0		12.80	0.80				1.03			
	45.0		12.91	1.00				0.59			
	47.0		12.78	0.80				0.77			
	49.0		12.48	0.40				0.82			
W	50.6		12.00	Ø							
	52.5		11.04								
G	54.0		10.51								
RS	55.4		9.86								
TOTALS:											

End of Measurement | Time: 9:55 | Gage Reading: 0.6 ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Animas River - Cunningham to Aztec Ck. | CROSS-SECTION NO.: 4

CROSS-SECTION LOCATION: approx. 800' upstream of powerline

DATE: 7/29/04 | OBSERVERS: R. Smith, S. Jensen

LEGAL DESCRIPTION | ¼ SECTION: NW | SECTION: 11 | TOWNSHIP: 31 (N)S | RANGE: 7 E(W) | PM: N.M.

COUNTY: San Juan | WATERSHED: Animas | WATER DIVISION: 7 | DOW WATER CODE: 38011

MAP(S) USGS: Howardsville 135 027 1027

USFS: UTM 4190190 9612 ft

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES / NO) | METER TYPE: Marsh McBirney

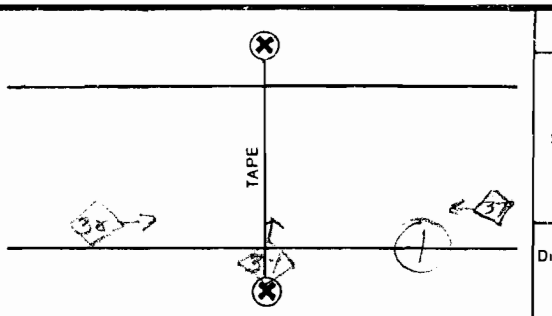
METER NUMBER: | DATE RATED: | CALIB/SPIN: ____ sec | TAPE WEIGHT: surveyed ____ lbs/foot | TAPE TENSION: surveyed ____ lbs

CHANNEL BED MATERIAL SIZE RANGE: 4" cobbles - 2' boulders | PHOTOGRAPHS TAKEN: (YES/NO) | NUMBER OF PHOTOGRAPHS: 3

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	3.92, 3.78
② WS Upstream	52.0	3.22
③ WS Downstream	103.0	5.73
SLOPE	2.51'/155.0 = 0.01	

SKETCH



AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly

COMMENTS

TDS = 140
Ph = 7.9
Temp = 11°C

SCHARGE/CROSS SECTION NOT

STREAM NAME: Illinois River | CROSS-SECTION NO: 4 | DATE: 7-29-04 | SHEET __ OF __

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: 0.6 ft | TIME: 12:00 noon

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)
S	0.0		2.12								
G	5.1		2.40								
W	5.4		3.92	Ø				Ø			
	10.0		4.56	0.6				0.92			
	12.0		4.78	0.9				2.44			
	14.0		4.86	0.7				1.55			
	16.0		4.54	0.7				3.06			
	18.0		4.70	0.7				2.20			
	20.0		5.18	1.20				1.90			
	22.0		5.01	1.2				2.21			
	24.0		4.54	0.65				1.48			
	26.0		4.96	1.0				2.04			
	28.0		5.12	0.95				2.41			
	30.0		5.24	1.35				2.04			
	32.0		4.70	0.8				1.91			
	34.0		4.92	1.0				1.28			
	36.0		4.78	0.80				1.70			
	38.0		4.68	0.80				2.11			
	40.0		4.44	0.55				0.26			
	42.0		4.86	0.70				2.04			
	44.0		5.01	0.90				1.37			
	46.0		5.06	1.15				1.09			
	48.0		4.90	.85				1.04			
	50.0		4.83	0.80				1.34			
W	52.0		3.98	Ø				Ø			
G	55.1		2.20								
RS	59.6		0.0								
TOTALS:											

End of Measurement | Time: 12:30 | Gage Reading: 0.6 ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Animas River - Cunningham to Arrastra						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: 250 Ft. upstream from powerline crossing						
DATE: 10-23-08	OBSERVERS: J. Seecham, K. Palmer, R. Smith					
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 11	TOWNSHIP: 41 (N)/S	RANGE: 7E (W)	PM: N.M.	
COUNTY: San Juan	WATERSHED: Animas	WATER DIVISION: 7	DOW WATER CODE: 38011			
MAP(S): USGS: Howardsville 7.5'						
USFS:						

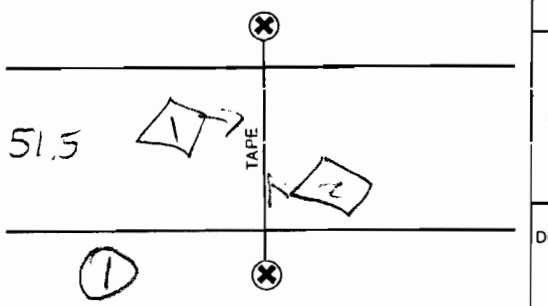
SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	12.0 - 5.20 / 5.20
(2) WS Upstream	32.3	4.80
(3) WS Downstream	28.41	5.61
SLOPE	0.81 / 60.7 = 0.0133	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

TDS = 310
pH = 8.2
Temp = 3°C

FORM #ISF-FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Animas River | CROSS-SECTION NO.: 2 | DATE: 10-23-08 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: _____ ft | TIME: 11:15

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	6.0		3.43								
	6.6		3.95								
	9.0		4.00								
	11.3		4.61								
W	12.0		5.20								
	15.0		5.35	0.15				0			
	16.0		5.40	0.20				0.52			
	18.0		5.55	0.35				0.57			
	20.0		5.75	0.55				1.05			
	22.0		5.90	0.70				1.27			
	24.0		5.85	0.65				2.11			
	26.0		5.75	0.55				2.48			
	28.0		5.80	0.60				0.65			
	30.0		5.75	0.55				1.55			
Behind Rock	32.0		6.55	1.05				0.11			
	34.0		5.60	0.40				1.59			
Behind Rx	36.0		5.70	0.50				0.16			
Top Rock	38.0		5.60	0.40				1.95			
	40.0		5.90	0.75				2.00			
	42.0		5.90	0.70				1.69			
	44.0		6.00	0.85				1.29			
	46.0		5.85	0.65				1.46			
	48.0		5.75	0.55				0.40			
	50.0		5.45	0.25				0.16			
W	51.5		5.20								
	53.0		4.68								
	54.0		4.25								
RS/G	55.2		3.50								
TOTALS:											

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

Data Input & Proofing

STREAM NAME:	Animas River-between Cunningham and Arrastra
XS LOCATION:	800' upstream from powerline
XS NUMBER:	1
DATE:	10/20/04
OBSERVERS:	R. Smith, S. Jensen, C. Gunn
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	N.M.P.M.
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville 7.5
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.0125 ft / ft

CHECKED BY:.....DATE.....

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

Total Data Points = 29

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	LS	0.00	9.78			0.00	0.00	0.00
1	G	4.50	10.56			0.00	0.00	0.00
		6.00	11.10			0.00	0.00	0.00
	W	7.60	11.95	0.00		0.00	0.00	0.00
		9	12.58	0.60	0.79	1.02	0.81	11.98
		11.00	12.85	0.80	1.17	1.60	1.87	12.05
		13	12.94	1.00	2.27	2.00	4.54	11.94
		15	12.92	0.90	2.03	1.80	3.65	12.02
		17	12.30	0.30	2.13	0.60	1.28	12.00
		19	12.84	0.80	2.02	1.60	3.23	12.04
		21	12.38	0.45	0.81	0.90	0.73	11.93
		23	12.60	0.60	1.53	1.20	1.84	12.00
		25	12.84	0.80	2.23	1.60	3.57	12.04
		27	12.99	1.00	1.09	2.00	2.18	11.99
		29	13.18	1.10	1.53	2.20	3.37	12.08
		31	12.83	0.75	1.56	1.50	2.34	12.08
		33	12.24	0.25	1.07	0.50	0.54	11.99
		35	12.64	0.60	1.39	1.20	1.67	12.04
		37	12.46	0.50	1.00	1.00	1.00	11.96
	R	39	12.00	0.00	0.00	0.00	0.00	0.00
		41	12.68	0.60	1.52	1.20	1.82	12.08
		43	12.80	0.80	1.03	1.60	1.65	12.00
		45	12.94	1.00	0.59	2.00	1.18	11.94
		47	12.78	0.80	0.77	1.60	1.23	11.98
		49	12.48	0.40	0.82	0.72	0.59	12.08
	W	50.6	12.00	0.00		0.00	0.00	0.00
		52.5	11.04			0.00	0.00	0.00
1	G	54	10.51			0.00	0.00	0.00
	RS	55.4	9.86			0.00	0.00	0.00
					Totals	27.84	39.08	

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

LOCATION INFORMATION

STREAM NAME:	Animas River-between Cunningham and Arrastra
XS LOCATION:	800' upstream from powerline
XS NUMBER:	1
DATE:	20-Oct-04
OBSERVERS:	R. Smith, S. Jensen, C. Gunn
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	N.M.P.M.
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville 7.5
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.0125

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

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

STREAM NAME: Animas River-between Cunningham and Arrastra
XS LOCATION: 800' upstream from powerline
XS NUMBER: 1

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
	LS	0.00	9.78			0.00		0.00	0.00	0.0%
1	G	4.50	10.56			0.00		0.00	0.00	0.0%
		6.00	11.10			0.00		0.00	0.00	0.0%
	W	7.60	11.95	0.00		0.00		0.00	0.00	0.0%
		9.00	12.58	0.60	0.79	1.54	0.60	1.02	0.81	2.1%
		11.00	12.85	0.80	1.17	2.02	0.80	1.60	1.87	4.8%
		13.00	12.94	1.00	2.27	2.00	1.00	2.00	4.54	11.6%
		15.00	12.92	0.90	2.03	2.00	0.90	1.80	3.65	9.4%
		17.00	12.30	0.30	2.13	2.09	0.30	0.60	1.28	3.3%
		19.00	12.84	0.80	2.02	2.07	0.80	1.60	3.23	8.3%
		21.00	12.38	0.45	0.81	2.05	0.45	0.90	0.73	1.9%
		23.00	12.60	0.60	1.53	2.01	0.60	1.20	1.84	4.7%
		25.00	12.84	0.80	2.23	2.01	0.80	1.60	3.57	9.1%
		27.00	12.99	1.00	1.09	2.01	1.00	2.00	2.18	5.6%
		29.00	13.18	1.10	1.53	2.01	1.10	2.20	3.37	8.6%
		31.00	12.83	0.75	1.56	2.03	0.75	1.50	2.34	6.0%
		33.00	12.24	0.25	1.07	2.09	0.25	0.50	0.54	1.4%
		35.00	12.64	0.60	1.39	2.04	0.60	1.20	1.67	4.3%
		37.00	12.46	0.50	1.00	2.01	0.50	1.00	1.00	2.6%
	R	39.00	12.00	0.00	0.00	2.05		0.00	0.00	0.0%
		41.00	12.68	0.60	1.52	2.11	0.60	1.20	1.82	4.7%
		43.00	12.80	0.80	1.03	2.00	0.80	1.60	1.65	4.2%
		45.00	12.94	1.00	0.59	2.00	1.00	2.00	1.18	3.0%
		47.00	12.78	0.80	0.77	2.01	0.80	1.60	1.23	3.2%
		49.00	12.48	0.40	0.82	2.02	0.40	0.72	0.59	1.5%
	W	50.60	12.00	0.00		1.67		0.00	0.00	0.0%
		52.50	11.04			0.00		0.00	0.00	0.0%
	G	54.00	10.51			0.00		0.00	0.00	0.0%
	RS	55.40	9.86			0.00		0.00	0.00	0.0%
	TOTALS ----------					43.85	1.1 (Max.)	27.84	39.08	100.0%

Manning's n = 0.0874
Hydraulic Radius= 0.634892981

STREAM NAME: Animas River-between Cunningham and Arrastra
XS LOCATION: 800' upstream from powerline
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	27.84	28.24	1.4%
11.75	27.84	39.08	40.4%
11.77	27.84	38.21	37.2%
11.79	27.84	37.33	34.1%
11.81	27.84	36.46	31.0%
11.83	27.84	35.59	27.8%
11.85	27.84	34.72	24.7%
11.87	27.84	33.85	21.6%
11.89	27.84	32.98	18.5%
11.91	27.84	32.11	15.4%
11.93	27.84	31.25	12.2%
11.95	27.84	30.39	9.2%
11.96	27.84	29.96	7.6%
11.97	27.84	29.53	6.1%
11.98	27.84	29.10	4.5%
11.99	27.84	28.67	3.0%
12.00	27.84	28.24	1.4%
12.01	27.84	27.81	-0.1%
12.02	27.84	27.38	-1.6%
12.03	27.84	26.96	-3.2%
12.04	27.84	26.53	-4.7%
12.05	27.84	26.11	-6.2%
12.07	27.84	25.27	-9.2%
12.09	27.84	24.43	-12.2%
12.11	27.84	23.60	-15.2%
12.13	27.84	22.77	-18.2%
12.15	27.84	21.95	-21.2%
12.17	27.84	21.13	-24.1%
12.19	27.84	20.32	-27.0%
12.21	27.84	19.51	-29.9%
12.23	27.84	18.71	-32.8%
12.25	27.84	17.92	-35.6%

WATERLINE AT ZERO
AREA ERROR = 12.009

STREAM NAME: Animas River-between Cunningham and Arrastra
XS LOCATION: 800' upstream from powerline
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	10.56	49.36	1.91	2.62	94.25	50.83	100.0%	1.85	270.35	2.87
	11.01	46.84	1.55	2.17	72.64	48.15	94.7%	1.51	181.58	2.50
	11.06	46.57	1.51	2.12	70.31	47.87	94.2%	1.47	172.64	2.46
	11.11	46.35	1.47	2.07	67.99	47.62	93.7%	1.43	163.81	2.41
	11.16	46.15	1.42	2.02	65.67	47.40	93.3%	1.39	155.10	2.36
	11.21	45.96	1.38	1.97	63.37	47.18	92.8%	1.34	146.59	2.31
	11.26	45.77	1.33	1.92	61.08	46.96	92.4%	1.30	138.28	2.26
	11.31	45.57	1.29	1.87	58.79	46.75	92.0%	1.26	130.17	2.21
	11.36	45.38	1.25	1.82	56.52	46.53	91.5%	1.21	122.27	2.16
	11.41	45.19	1.20	1.77	54.26	46.31	91.1%	1.17	114.58	2.11
	11.46	44.99	1.16	1.72	52.00	46.09	90.7%	1.13	107.09	2.06
	11.51	44.80	1.11	1.67	49.76	45.88	90.3%	1.08	99.81	2.01
	11.56	44.61	1.07	1.62	47.52	45.66	89.8%	1.04	92.74	1.95
	11.61	44.41	1.02	1.57	45.30	45.44	89.4%	1.00	85.89	1.90
	11.66	44.22	0.97	1.52	43.08	45.22	89.0%	0.95	79.25	1.84
	11.71	44.03	0.93	1.47	40.87	45.01	88.6%	0.91	72.84	1.78
	11.76	43.84	0.88	1.42	38.68	44.79	88.1%	0.86	66.65	1.72
	11.81	43.64	0.84	1.37	36.49	44.57	87.7%	0.82	60.68	1.66
	11.86	43.45	0.79	1.32	34.31	44.36	87.3%	0.77	54.95	1.60
	11.91	43.26	0.74	1.27	32.15	44.14	86.8%	0.73	49.44	1.54
	11.96	43.06	0.70	1.22	29.99	43.92	86.4%	0.68	44.18	1.47
WL	12.01	42.77	0.65	1.17	27.84	43.60	85.8%	0.64	39.23	1.41
	12.06	42.13	0.61	1.12	25.72	42.93	84.5%	0.60	34.73	1.35
	12.11	41.49	0.57	1.07	23.63	42.25	83.1%	0.56	30.47	1.29
	12.16	40.84	0.53	1.02	21.57	41.58	81.8%	0.52	26.46	1.23
	12.21	40.20	0.49	0.97	19.54	40.91	80.5%	0.48	22.69	1.16
	12.26	39.40	0.45	0.92	17.55	40.07	78.8%	0.44	19.24	1.10
	12.31	38.27	0.41	0.87	15.61	38.89	76.5%	0.40	16.14	1.03
	12.36	36.86	0.37	0.82	13.73	37.43	73.6%	0.37	13.37	0.97
	12.41	35.06	0.34	0.77	11.93	35.56	70.0%	0.34	10.94	0.92
	12.46	32.99	0.31	0.72	10.23	33.42	65.8%	0.31	8.82	0.86
	12.51	30.47	0.28	0.67	8.64	30.84	60.7%	0.28	7.03	0.81
	12.56	27.88	0.26	0.62	7.18	28.20	55.5%	0.25	5.48	0.76
	12.61	25.15	0.23	0.57	5.85	25.41	50.0%	0.23	4.18	0.71
	12.66	22.66	0.21	0.52	4.66	22.87	45.0%	0.20	3.07	0.66
	12.71	20.26	0.18	0.47	3.58	20.42	40.2%	0.18	2.14	0.60
	12.76	17.57	0.15	0.42	2.64	17.70	34.8%	0.15	1.41	0.53
	12.81	14.73	0.12	0.37	1.83	14.82	29.2%	0.12	0.86	0.47
	12.86	11.73	0.10	0.32	1.17	11.79	23.2%	0.10	0.47	0.41
	12.91	8.16	0.08	0.27	0.67	8.20	16.1%	0.08	0.24	0.36
	12.96	3.67	0.11	0.22	0.40	3.70	7.3%	0.11	0.17	0.43
	13.01	2.77	0.09	0.17	0.24	2.80	5.5%	0.08	0.09	0.37
	13.06	1.96	0.06	0.12	0.12	1.98	3.9%	0.06	0.03	0.29
	13.11	1.15	0.04	0.07	0.04	1.16	2.3%	0.04	0.01	0.20
	13.16	0.34	0.01	0.02	0.00	0.34	0.7%	0.01	0.00	0.09

dep[illegible] 0.49 ft.

1. $0.49\bar{V} = 22.69$ cfs
2. 50% wetted perimeter = 4.18 cfs
3. 1 ft/sec $\bar{V}$

0.97	13.37	0.03	X	= 1.39 + 13.37 = 14.76 cfs
1.00	x			
1.03	16.14	0.06	2.77	

STREAM NAME: Animas River-between Cunningham and Arrastra
XS LOCATION: 800' upstream from powerline
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	39.08	cfs
CALCULATED FLOW (Qc)=	39.23	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	12.00	ft
CALCULATED WATERLINE (WLc)=	12.01	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	1.10	ft
MAX CALCULATED DEPTH (Dc)=	1.17	ft
(Dm-Dc)/Dm * 100	-6.4	%
MEAN VELOCITY=	1.41	ft/sec
MANNING'S N=	0.087	
SLOPE=	0.0125	ft/ft
.4 * Qm =	15.6	cfs
2.5 * Qm=	97.7	cfs

RECOMMENDED INSTREAM FLOW:

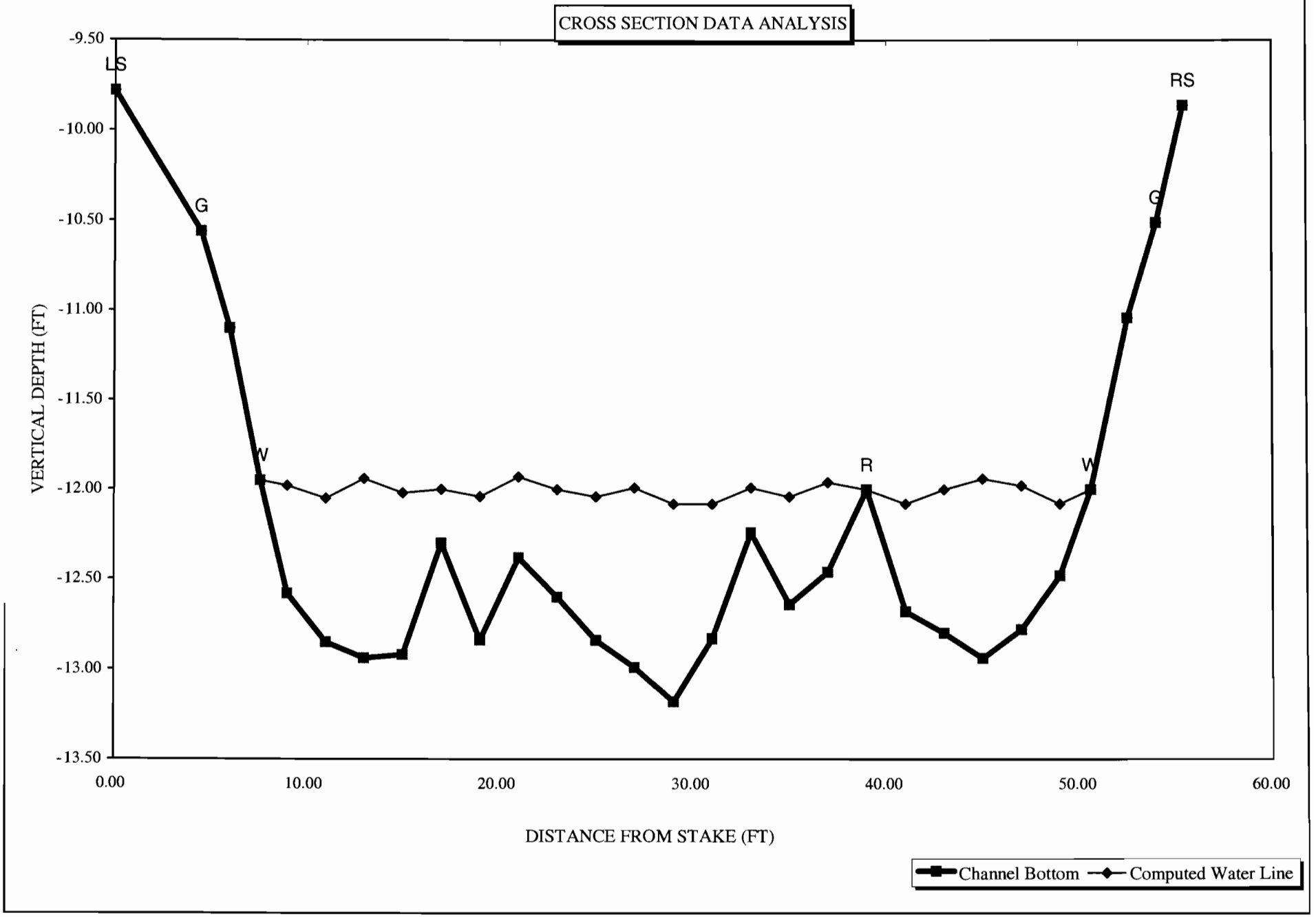
FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

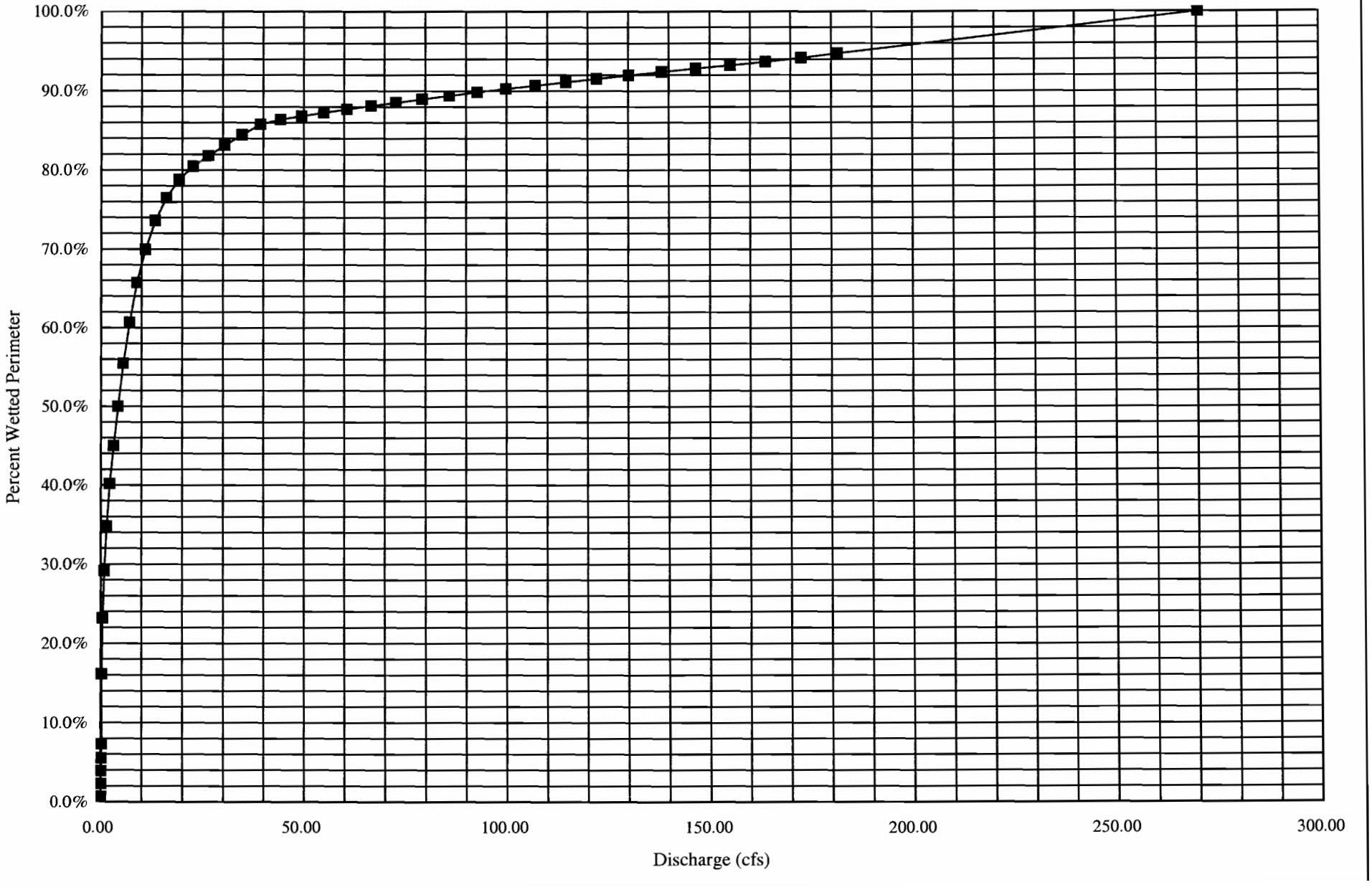
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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

Animas River-between Cunningham and Arrastra



Percent Wetted Perimeter vs. Discharge



Data Input & Proofing

STREAM NAME:	Animas River Cunningham to Arrastra
XS LOCATION:	approx. 800' upstream of powerline
XS NUMBER:	4
DATE:	7/29/04
OBSERVERS:	R. Smith, S. Jensen
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	NM
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.01 ft / ft

CHECKED BY:.....DATE.....

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

Total Data Points = 27

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	LS	0.00	2.12			0.00	0.00	0.00
1	GL	5.10	2.40			0.00	0.00	0.00
	WL	8.40	3.92	0.00	0.00	0.00	0.00	0.00
		10.00	4.46	0.60	0.92	1.08	0.99	3.86
		12.00	4.78	0.90	2.44	1.80	4.39	3.88
		14.00	4.86	0.70	1.55	1.40	2.17	4.16
		16.00	4.54	0.70	3.06	1.40	4.28	3.84
		18.00	4.70	0.70	2.20	1.40	3.08	4.00
		20.00	5.18	1.20	1.90	2.40	4.56	3.98
		22.00	5.01	1.20	2.21	2.40	5.30	3.81
		24.00	4.57	0.65	1.48	1.30	1.92	3.92
		26.00	4.96	1.00	2.04	2.00	4.08	3.96
		28.00	5.12	0.95	2.41	1.90	4.58	4.17
		30.00	5.24	1.35	2.04	2.70	5.51	3.89
		32.00	4.70	0.80	1.91	1.60	3.06	3.90
		34.00	4.92	1.00	1.28	2.00	2.56	3.92
		36.00	4.78	0.80	1.70	1.60	2.72	3.98
		38.00	4.68	0.80	2.11	1.60	3.38	3.88
		40.00	4.44	0.55	0.26	1.10	0.29	3.89
		42.00	4.86	0.70	2.04	1.40	2.86	4.16
		44.00	5.01	0.90	1.37	1.80	2.47	4.11
		46.00	5.06	1.15	1.09	2.30	2.51	3.91
		48.00	4.90	0.85	1.04	1.70	1.77	4.05
		50.00	4.83	0.80	1.34	1.60	2.14	4.03
	WL	52.00	3.98	0.00	0.00	0.00	0.00	0.00
1	GL	55.70	2.20			0.00	0.00	0.00
	RS	59.60	0.00			0.00	0.00	0.00
	Totals					36.48	64.61	

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

LOCATION INFORMATION

STREAM NAME:	Animas River Cunningham to Arrastra
XS LOCATION:	approx. 800' upstream of powerline
XS NUMBER:	4
DATE:	29-Jul-04
OBSERVERS:	R. Smith, S. Jensen
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	NM
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville
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:	0.01

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

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

STREAM NAME: Animas River Cunningham to Arrastra
XS LOCATION: approx. 800' upstream of powerline
XS NUMBER: 4

DATA POINTS= 27

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	2.12			0.00		0.00	0.00	0.0%
1 GL	5.10	2.40			0.00		0.00	0.00	0.0%
WL	8.40	3.92	0.00	0.00	0.00		0.00	0.00	0.0%
	10.00	4.46	0.60	0.92	1.69	0.60	1.08	0.99	1.5%
	12.00	4.78	0.90	2.44	2.03	0.90	1.80	4.39	6.8%
	14.00	4.86	0.70	1.55	2.00	0.70	1.40	2.17	3.4%
	16.00	4.54	0.70	3.06	2.03	0.70	1.40	4.28	6.6%
	18.00	4.70	0.70	2.20	2.01	0.70	1.40	3.08	4.8%
	20.00	5.18	1.20	1.90	2.06	1.20	2.40	4.56	7.1%
	22.00	5.01	1.20	2.21	2.01	1.20	2.40	5.30	8.2%
	24.00	4.57	0.65	1.48	2.05	0.65	1.30	1.92	3.0%
	26.00	4.96	1.00	2.04	2.04	1.00	2.00	4.08	6.3%
	28.00	5.12	0.95	2.41	2.01	0.95	1.90	4.58	7.1%
	30.00	5.24	1.35	2.04	2.00	1.35	2.70	5.51	8.5%
	32.00	4.70	0.80	1.91	2.07	0.80	1.60	3.06	4.7%
	34.00	4.92	1.00	1.28	2.01	1.00	2.00	2.56	4.0%
	36.00	4.78	0.80	1.70	2.00	0.80	1.60	2.72	4.2%
	38.00	4.68	0.80	2.11	2.00	0.80	1.60	3.38	5.2%
	40.00	4.44	0.55	0.26	2.01	0.55	1.10	0.29	0.4%
	42.00	4.86	0.70	2.04	2.04	0.70	1.40	2.86	4.4%
	44.00	5.01	0.90	1.37	2.01	0.90	1.80	2.47	3.8%
	46.00	5.06	1.15	1.09	2.00	1.15	2.30	2.51	3.9%
	48.00	4.90	0.85	1.04	2.01	0.85	1.70	1.77	2.7%
	50.00	4.83	0.80	1.34	2.00	0.80	1.60	2.14	3.3%
WL	52.00	3.98	0.00	0.00	2.17		0.00	0.00	0.0%
GL	55.70	2.20			0.00		0.00	0.00	0.0%
RS	59.60	0.00			0.00		0.00	0.00	0.0%
TOTALS ----------					44.24	1.35 (Max.)	36.48	64.61	100.0%

Manning's n = 0.0738
Hydraulic Radius= 0.824536123

STREAM NAME: Animas River Cunningham to Arrastra
XS LOCATION: approx. 800' upstream of powerline
XS NUMBER: 4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	36.48	37.21	2.0%
3.70	36.48	48.24	32.2%
3.72	36.48	47.35	29.8%
3.74	36.48	46.46	27.3%
3.76	36.48	45.57	24.9%
3.78	36.48	44.68	22.5%
3.80	36.48	43.79	20.0%
3.82	36.48	42.91	17.6%
3.84	36.48	42.03	15.2%
3.86	36.48	41.15	12.8%
3.88	36.48	40.27	10.4%
3.90	36.48	39.39	8.0%
3.91	36.48	38.95	6.8%
3.92	36.48	38.52	5.6%
3.93	36.48	38.08	4.4%
3.94	36.48	37.64	3.2%
3.95	36.48	37.21	2.0%
3.96	36.48	36.77	0.8%
3.97	36.48	36.34	-0.4%
3.98	36.48	35.90	-1.6%
3.99	36.48	35.47	-2.8%
4.00	36.48	35.03	-4.0%
4.02	36.48	34.17	-6.3%
4.04	36.48	33.31	-8.7%
4.06	36.48	32.45	-11.1%
4.08	36.48	31.59	-13.4%
4.10	36.48	30.73	-15.8%
4.12	36.48	29.88	-18.1%
4.14	36.48	29.02	-20.4%
4.16	36.48	28.17	-22.8%
4.18	36.48	27.32	-25.1%
4.20	36.48	26.48	-27.4%

WATERLINE AT ZERO
AREA ERROR = 3.967

STREAM NAME: Animas River Cunningham to Arrastra
XS LOCATION: approx. 800' upstream of powerline
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	2.40	50.18	2.19	2.84	109.89	51.52	100.0%	2.13	366.78	3.34
	2.97	47.78	1.72	2.27	82.13	48.86	94.8%	1.68	233.89	2.85
	3.02	47.56	1.68	2.22	79.75	48.62	94.4%	1.64	223.40	2.80
	3.07	47.35	1.63	2.17	77.37	48.39	93.9%	1.60	213.12	2.75
	3.12	47.14	1.59	2.12	75.01	48.15	93.5%	1.56	203.05	2.71
	3.17	46.93	1.55	2.07	72.66	47.92	93.0%	1.52	193.18	2.66
	3.22	46.71	1.51	2.02	70.32	47.68	92.6%	1.47	183.52	2.61
	3.27	46.50	1.46	1.97	67.99	47.45	92.1%	1.43	174.06	2.56
	3.32	46.29	1.42	1.92	65.67	47.22	91.6%	1.39	164.82	2.51
	3.37	46.08	1.38	1.87	63.36	46.98	91.2%	1.35	155.79	2.46
	3.42	45.86	1.33	1.82	61.06	46.75	90.7%	1.31	146.98	2.41
	3.47	45.65	1.29	1.77	58.77	46.51	90.3%	1.26	138.38	2.35
	3.52	45.44	1.24	1.72	56.50	46.28	89.8%	1.22	130.00	2.30
	3.57	45.23	1.20	1.67	54.23	46.04	89.4%	1.18	121.83	2.25
	3.62	45.01	1.15	1.62	51.97	45.81	88.9%	1.13	113.89	2.19
	3.67	44.80	1.11	1.57	49.73	45.57	88.5%	1.09	106.17	2.14
	3.72	44.59	1.07	1.52	47.49	45.34	88.0%	1.05	98.68	2.08
	3.77	44.38	1.02	1.47	45.27	45.10	87.5%	1.00	91.41	2.02
	3.82	44.16	0.97	1.42	43.06	44.87	87.1%	0.96	84.38	1.96
	3.87	43.95	0.93	1.37	40.85	44.63	86.6%	0.92	77.58	1.90
	3.92	43.74	0.88	1.32	38.66	44.40	86.2%	0.87	71.01	1.84
WL	3.97	43.49	0.84	1.27	36.48	44.13	85.7%	0.83	64.73	1.77
	4.02	43.23	0.79	1.22	34.31	43.85	85.1%	0.78	58.69	1.71
	4.07	42.96	0.75	1.17	32.16	43.56	84.6%	0.74	52.91	1.65
	4.12	42.70	0.70	1.12	30.02	43.28	84.0%	0.69	47.37	1.58
	4.17	42.43	0.66	1.07	27.89	42.99	83.5%	0.65	42.09	1.51
	4.22	42.16	0.61	1.02	25.77	42.71	82.9%	0.60	37.07	1.44
	4.27	41.90	0.56	0.97	23.67	42.43	82.3%	0.56	32.32	1.37
	4.32	41.63	0.52	0.92	21.58	42.14	81.8%	0.51	27.83	1.29
	4.37	41.37	0.47	0.87	19.51	41.86	81.2%	0.47	23.62	1.21
	4.42	41.10	0.42	0.82	17.45	41.57	80.7%	0.42	19.70	1.13
	4.47	40.46	0.38	0.77	15.40	40.91	79.4%	0.38	16.18	1.05
	4.52	39.38	0.34	0.72	13.41	39.81	77.3%	0.34	13.07	0.98
	4.57	37.79	0.30	0.67	11.47	38.20	74.1%	0.30	10.36	0.90
	4.62	35.32	0.27	0.62	9.64	35.68	69.3%	0.27	8.12	0.84
	4.67	32.81	0.24	0.57	7.94	33.14	64.3%	0.24	6.17	0.78
	4.72	29.81	0.21	0.52	6.37	30.09	58.4%	0.21	4.56	0.72
	4.77	26.49	0.19	0.47	4.96	26.73	51.9%	0.19	3.25	0.66
	4.82	22.70	0.16	0.42	3.73	22.89	44.4%	0.16	2.24	0.60
	4.87	17.93	0.15	0.37	2.71	18.07	35.1%	0.15	1.54	0.57
	4.92	14.05	0.14	0.32	1.92	14.17	27.5%	0.14	1.02	0.53
	4.97	11.76	0.11	0.27	1.27	11.85	23.0%	0.11	0.58	0.45
	5.02	8.99	0.08	0.22	0.75	9.06	17.6%	0.08	0.29	0.38
	5.07	5.11	0.08	0.17	0.40	5.16	10.0%	0.08	0.15	0.37
	5.12	3.51	0.05	0.12	0.19	3.54	6.9%	0.05	0.05	0.28
	5.17	1.71	0.03	0.07	0.06	1.72	3.3%	0.03	0.01	0.21
	5.22	0.48	0.01	0.02	0.01	0.48	0.9%	0.01	0.00	0.10

1. 0.5 ft = 26.1 cfs

2. 60% WP = 5,0 cfs

3. 1 ft/sec
0.98 10.36
1.00 x
1.05 13.07
0.79 + 10.36 = 11.15 cfs

STREAM NAME: Animas River Cunningham to Arrastra
XS LOCATION: approx. 800' upstream of powerline
XS NUMBER: 4

SUMMARY SHEET

MEASURED FLOW (Qm)=	64.61	cfs
CALCULATED FLOW (Qc)=	64.73	cfs
(Qm-Qc)/Qm * 100 =	-0.2	%
MEASURED WATERLINE (WLm)=	3.95	ft
CALCULATED WATERLINE (WLc)=	3.97	ft
(WLm-WLc)/WLm * 100 =	-0.4	%
MAX MEASURED DEPTH (Dm)=	1.35	ft
MAX CALCULATED DEPTH (Dc)=	1.27	ft
(Dm-Dc)/Dm * 100	5.7	%
MEAN VELOCITY=	1.77	ft/sec
MANNING'S N=	0.074	
SLOPE=	0.01	ft/ft
.4 * Qm =	25.8	cfs
2.5 * Qm=	161.5	cfs

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

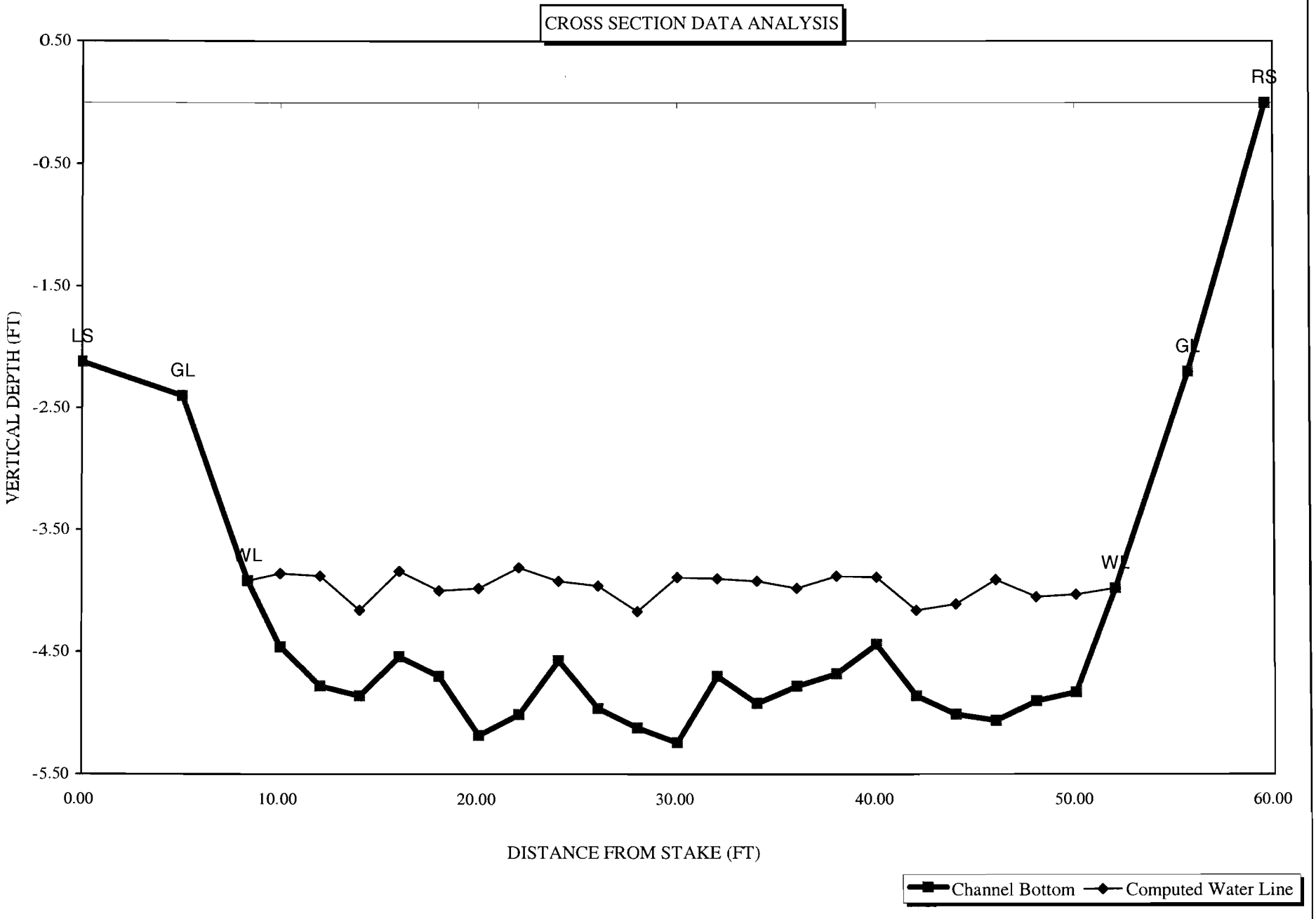
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

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

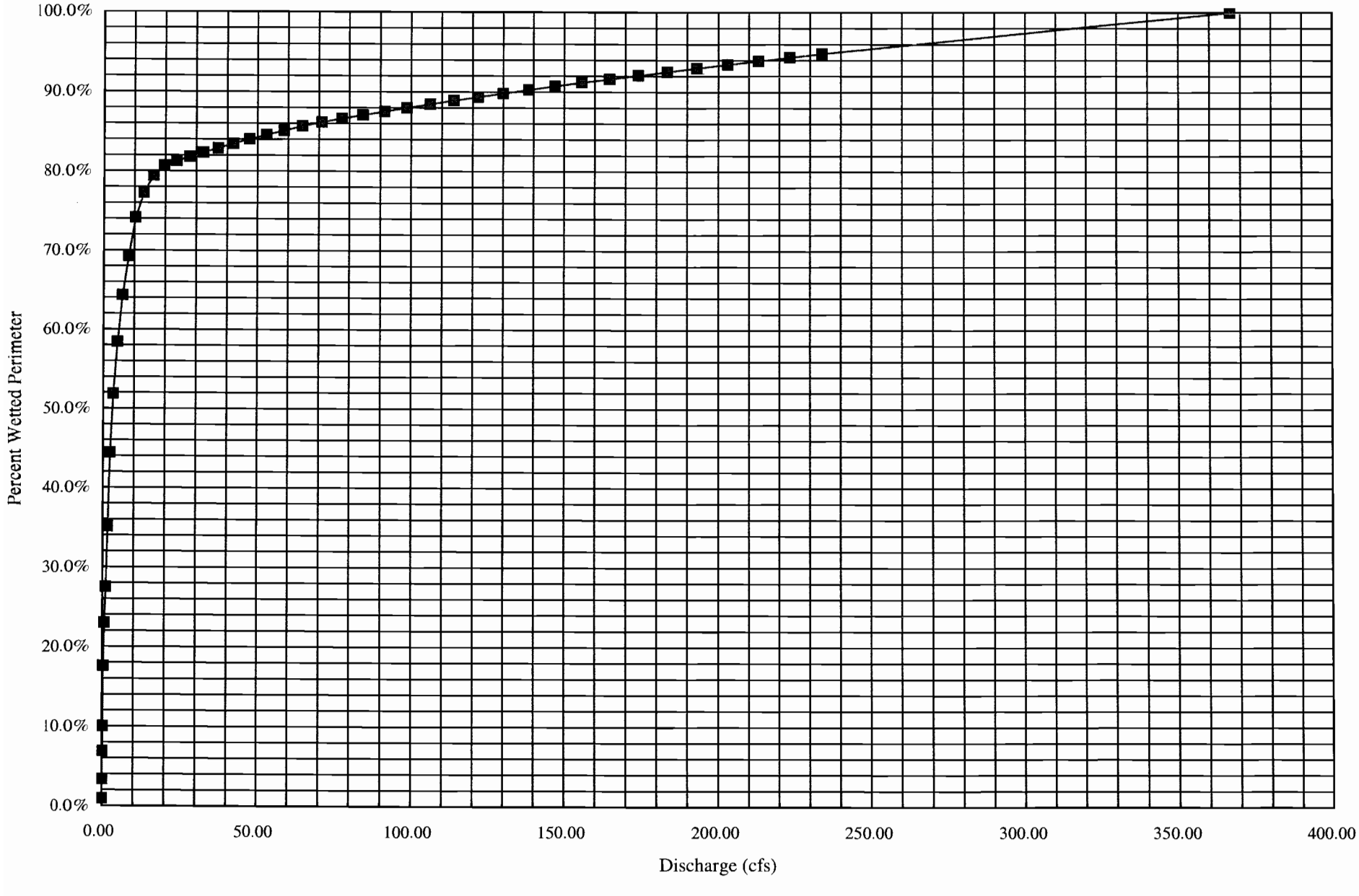
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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

Animas River Cunningham to Arrastra



Percent Wetted Perimeter vs. Discharge



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

LOCATION INFORMATION

STREAM NAME:	Animas River - Cunningham to Arrastra
XS LOCATION:	250 ft. upstream from powerline crossing
XS NUMBER:	2
DATE:	23-Oct-08
OBSERVERS:	R. Smith, K. Palmer, J. Seecham
1/4 SEC:	NW
SECTION:	11
TWP:	41N
RANGE:	7W
PM:	New Mexico
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.0133

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

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

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: 250 ft. upstream from powerline crossing
XS NUMBER: 2

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 LS & G	6.00	3.43			0.00		0.00	0.00	0.0%
	6.60	3.95			0.00		0.00	0.00	0.0%
	9.00	4.00			0.00		0.00	0.00	0.0%
	11.30	4.61			0.00		0.00	0.00	0.0%
W	12.00	5.20			0.00		0.00	0.00	0.0%
	15.00	5.35	0.15	0.00	3.00	0.15	0.30	0.00	0.0%
	16.00	5.40	0.20	0.52	1.00	0.20	0.30	0.16	0.6%
	18.00	5.55	0.35	0.57	2.01	0.35	0.70	0.40	1.6%
	20.00	5.75	0.55	1.05	2.01	0.55	1.10	1.16	4.7%
	22.00	5.90	0.70	1.27	2.01	0.70	1.40	1.78	7.2%
	24.00	5.85	0.65	2.11	2.00	0.65	1.30	2.74	11.1%
	26.00	5.75	0.55	2.48	2.00	0.55	1.10	2.73	11.1%
	28.00	5.80	0.60	0.65	2.00	0.60	1.20	0.78	3.2%
	30.00	5.75	0.55	1.55	2.00	0.55	1.10	1.71	6.9%
	32.00	6.35	1.05	0.11	2.09	1.05	2.10	0.23	0.9%
	34.00	5.60	0.40	1.59	2.14	0.40	0.80	1.27	5.2%
	36.00	5.70	0.50	0.16	2.00	0.50	1.00	0.16	0.6%
	38.00	5.60	0.40	1.95	2.00	0.40	0.80	1.56	6.3%
	40.00	5.90	0.75	2.00	2.02	0.75	1.50	3.00	12.2%
	42.00	5.90	0.70	1.69	2.00	0.70	1.40	2.37	9.6%
	44.00	6.00	0.85	1.29	2.00	0.85	1.70	2.19	8.9%
	46.00	5.85	0.65	1.46	2.01	0.65	1.30	1.90	7.7%
	48.00	5.75	0.55	0.40	2.00	0.55	1.10	0.44	1.8%
	50.00	5.45	0.25	0.16	2.02	0.25	0.44	0.07	0.3%
W	51.50	5.20			1.52		0.00	0.00	0.0%
	53.00	4.68			0.00		0.00	0.00	0.0%
	54.00	4.25			0.00		0.00	0.00	0.0%
1 RS & G	55.80	3.50			0.00		0.00	0.00	0.0%
TOTALS ----------					39.84	1.05 (Max.)	20.64	24.63	100.0%

Manning's n = 0.0926
Hydraulic Radius= 0.51806555

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: 250 ft. upstream from powerline crossing
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	20.64	20.64	0.0%
4.95	20.64	30.64	48.5%
4.97	20.64	29.83	44.5%
4.99	20.64	29.02	40.6%
5.01	20.64	28.22	36.7%
5.03	20.64	27.41	32.8%
5.05	20.64	26.61	28.9%
5.07	20.64	25.81	25.1%
5.09	20.64	25.01	21.2%
5.11	20.64	24.21	17.3%
5.13	20.64	23.41	13.4%
5.15	20.64	22.62	9.6%
5.16	20.64	22.22	7.7%
5.17	20.64	21.82	5.8%
5.18	20.64	21.43	3.8%
5.19	20.64	21.03	1.9%
5.20	20.64	20.64	0.0%
5.21	20.64	20.24	-1.9%
5.22	20.64	19.85	-3.8%
5.23	20.64	19.46	-5.7%
5.24	20.64	19.08	-7.6%
5.25	20.64	18.70	-9.4%
5.27	20.64	17.94	-13.1%
5.29	20.64	17.19	-16.7%
5.31	20.64	16.45	-20.3%
5.33	20.64	15.72	-23.8%
5.35	20.64	15.01	-27.3%
5.37	20.64	14.30	-30.7%
5.39	20.64	13.60	-34.1%
5.41	20.64	12.92	-37.4%
5.43	20.64	12.24	-40.7%
5.45	20.64	11.57	-44.0%

WATERLINE AT ZERO
AREA ERROR = 5.200

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: 250 ft. upstream from powerline crossing
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	3.50	49.72	1.92	2.85	95.68	50.84	100.0%	1.88	269.89	2.82
	4.20	44.37	1.40	2.15	62.33	45.16	88.8%	1.38	142.98	2.29
	4.25	44.06	1.36	2.10	60.12	44.83	88.2%	1.34	135.28	2.25
	4.30	43.75	1.32	2.05	57.92	44.51	87.5%	1.30	127.76	2.21
	4.35	43.45	1.28	2.00	55.74	44.19	86.9%	1.26	120.42	2.16
	4.40	43.14	1.24	1.95	53.58	43.87	86.3%	1.22	113.28	2.11
	4.45	42.84	1.20	1.90	51.43	43.55	85.6%	1.18	106.33	2.07
	4.50	42.53	1.16	1.85	49.29	43.22	85.0%	1.14	99.56	2.02
	4.55	42.23	1.12	1.80	47.17	42.90	84.4%	1.10	93.00	1.97
	4.60	41.92	1.08	1.75	45.07	42.58	83.7%	1.06	86.62	1.92
	4.65	41.72	1.03	1.70	42.98	42.35	83.3%	1.01	80.31	1.87
	4.70	41.54	0.98	1.65	40.90	42.14	82.9%	0.97	74.19	1.81
	4.75	41.33	0.94	1.60	38.82	41.91	82.4%	0.93	68.28	1.76
	4.80	41.13	0.89	1.55	36.76	41.68	82.0%	0.88	62.57	1.70
	4.85	40.92	0.85	1.50	34.71	41.45	81.5%	0.84	57.07	1.64
	4.90	40.72	0.80	1.45	32.67	41.22	81.1%	0.79	51.78	1.58
	4.95	40.52	0.76	1.40	30.64	40.99	80.6%	0.75	46.70	1.52
	5.00	40.31	0.71	1.35	28.62	40.76	80.2%	0.70	41.84	1.46
	5.05	40.11	0.66	1.30	26.61	40.53	79.7%	0.66	37.20	1.40
	5.10	39.91	0.62	1.25	24.61	40.30	79.3%	0.61	32.78	1.33
	5.15	39.70	0.57	1.20	22.62	40.07	78.8%	0.56	28.59	1.26
WL	5.20	39.50	0.52	1.15	20.64	39.84	78.3%	0.52	24.63	1.19
	5.25	38.20	0.49	1.10	18.70	38.53	75.8%	0.49	21.36	1.14
	5.30	36.90	0.46	1.05	16.82	37.22	73.2%	0.45	18.32	1.09
	5.35	35.60	0.42	1.00	15.01	35.92	70.6%	0.42	15.52	1.03
	5.40	34.30	0.39	0.95	13.26	34.61	68.1%	0.38	12.94	0.98
	5.45	33.33	0.35	0.90	11.57	33.64	66.2%	0.34	10.50	0.91
	5.50	32.33	0.31	0.85	9.93	32.64	64.2%	0.30	8.31	0.84
	5.55	31.33	0.27	0.80	8.33	31.63	62.2%	0.26	6.34	0.76
	5.60	30.50	0.22	0.75	6.79	30.79	60.6%	0.22	4.58	0.68
	5.65	27.20	0.20	0.70	5.35	27.47	54.0%	0.19	3.32	0.62
	5.70	23.90	0.17	0.65	4.07	24.15	47.5%	0.17	2.30	0.56
	5.75	22.60	0.13	0.60	2.91	22.83	44.9%	0.13	1.36	0.47
	5.80	15.30	0.13	0.55	1.96	15.50	30.5%	0.13	0.91	0.47
	5.85	12.00	0.11	0.50	1.28	12.18	24.0%	0.10	0.52	0.41
	5.90	6.03	0.13	0.45	0.77	6.19	12.2%	0.13	0.36	0.46
	5.95	4.07	0.13	0.40	0.52	4.20	8.3%	0.12	0.24	0.46
	6.00	2.10	0.18	0.35	0.37	2.21	4.4%	0.17	0.21	0.56
	6.05	1.80	0.15	0.30	0.27	1.90	3.7%	0.14	0.14	0.50
	6.10	1.50	0.13	0.25	0.19	1.58	3.1%	0.12	0.08	0.45
	6.15	1.20	0.10	0.20	0.12	1.27	2.5%	0.09	0.05	0.38
	6.20	0.90	0.08	0.15	0.07	0.95	1.9%	0.07	0.02	0.32
	6.25	0.60	0.05	0.10	0.03	0.63	1.2%	0.05	0.01	0.24
	6.30	0.30	0.03	0.05	0.01	0.32	0.6%	0.02	0.00	0.15
	6.35	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: 250 ft. upstream from powerline crossing
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	24.63	cfs
CALCULATED FLOW (Qc)=	24.63	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.20	ft
CALCULATED WATERLINE (WLc)=	5.20	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.05	ft
MAX CALCULATED DEPTH (Dc)=	1.15	ft
(Dm-Dc)/Dm * 100	-9.5	%
MEAN VELOCITY=	1.19	ft/sec
MANNING'S N=	0.093	
SLOPE=	0.0133	ft/ft
.4 * Qm =	9.9	cfs
2.5 * Qm=	61.6	cfs

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

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

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

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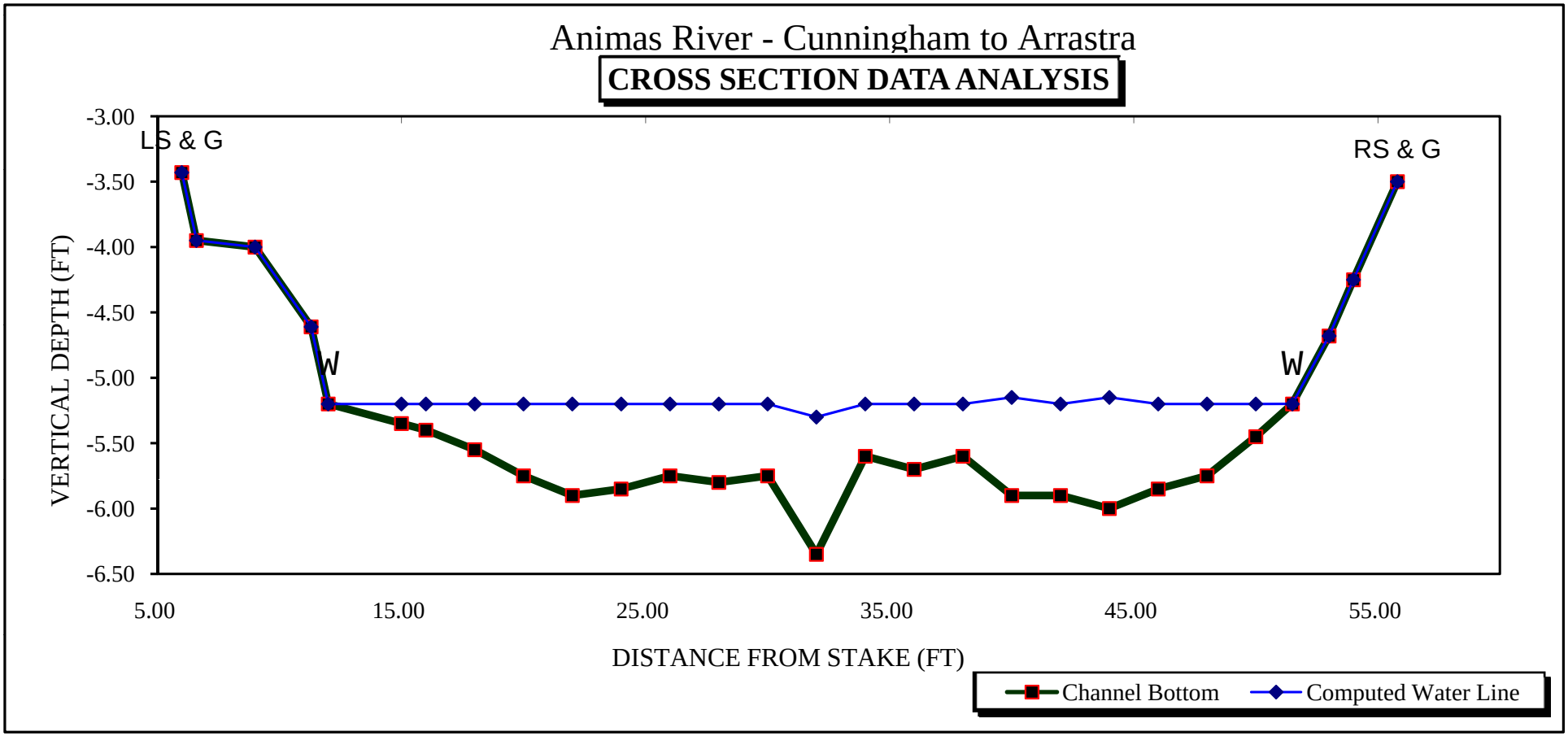
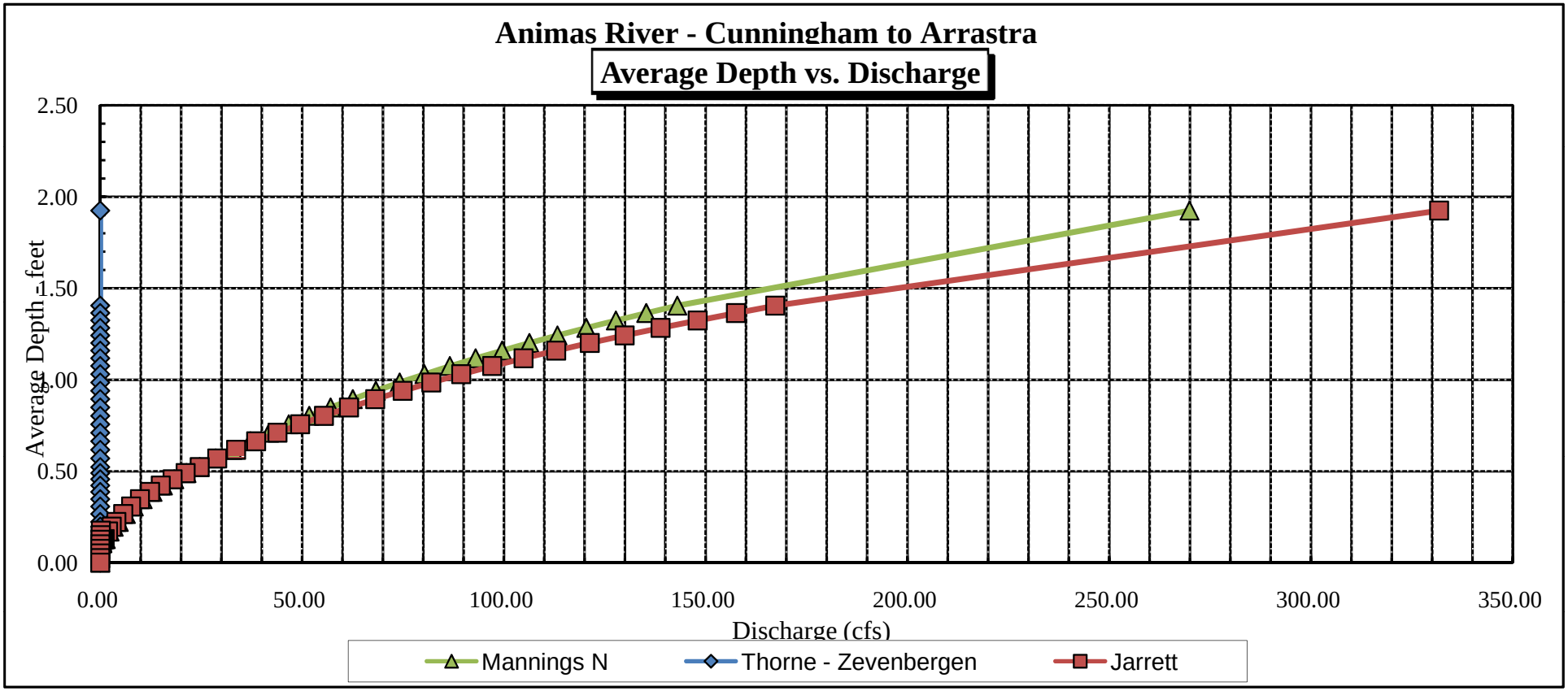
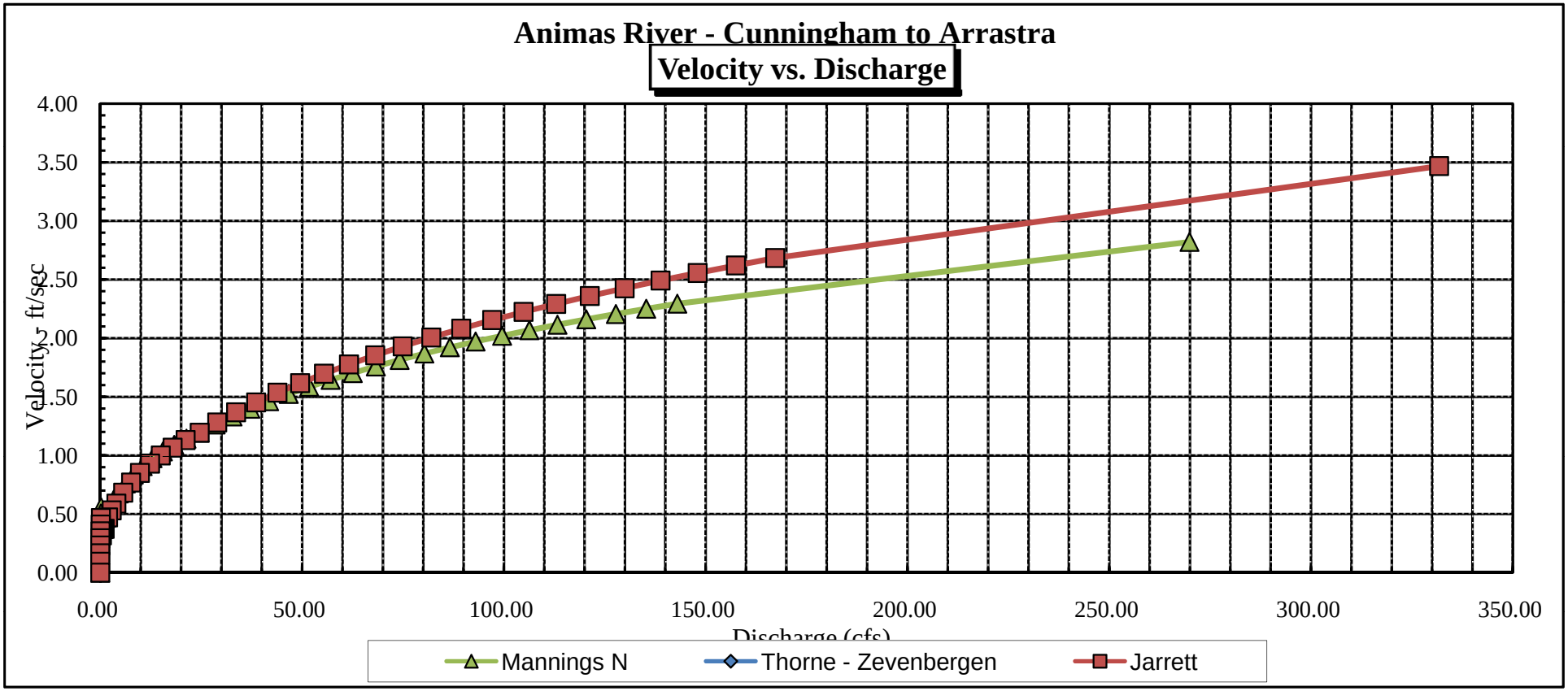
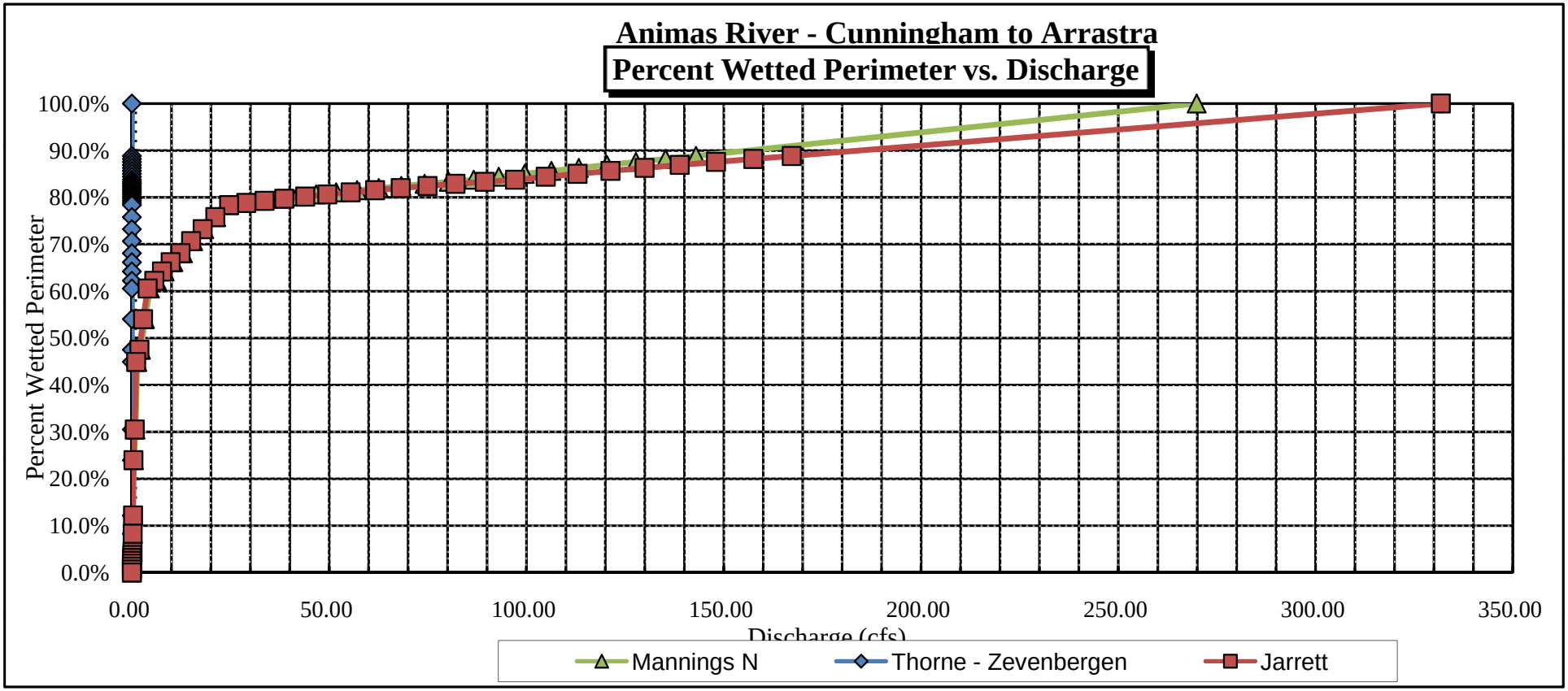
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

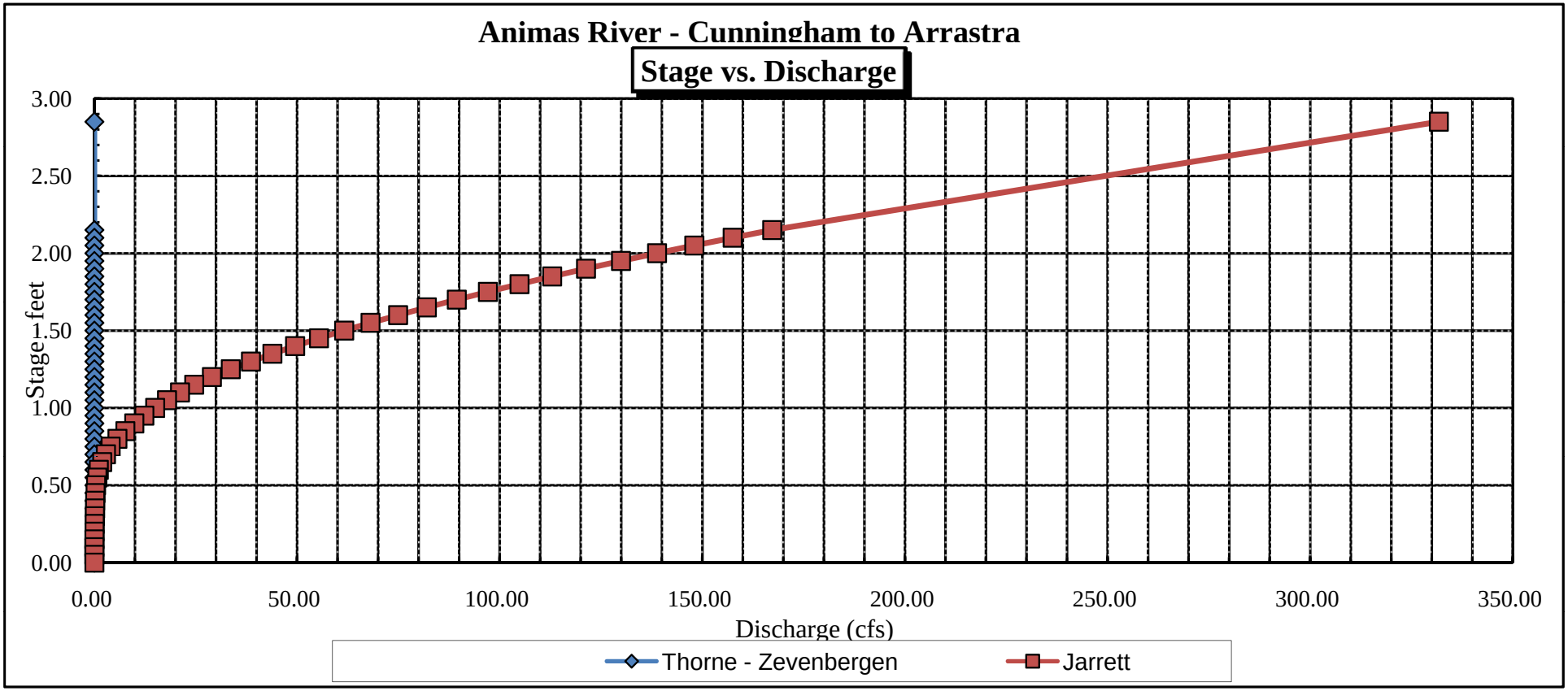
CWCB REVIEW BY: ..... DATE:.....


Animas River - Cunningham to Arrastra
CROSS SECTION DATA ANALYSIS
LS & G
RS & G
W
W
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
VERTICAL DEPTH (FT)
5.00
15.00
25.00
35.00
45.00
55.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Animas River - Cunningham to Arrastra
Average Depth vs. Discharge
Average Depth - feet
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
350.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
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
350.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
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
350.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
Stage vs. Discharge
Stage, feet
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
350.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	Animas River - Cunningham to Arrastra
XS LOCATION:	Approx. 750' upstream from powerline crossing
XS NUMBER:	1
DATE:	23-Oct-08
OBSERVERS:	R. Smith, K. Palmer, J. Seecham
1/4 SEC:	NW
SECTION:	11
TWP:	41N
RANGE:	7W
PM:	NM
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	38011
USGS MAP:	Howardsville 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.012

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

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

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: Approx. 750' upstream from powerline crossing
XS NUMBER: 1

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 LS & G	4.60	2.80			0.00		0.00	0.00	0.0%
	5.30	3.85			0.00		0.00	0.00	0.0%
W	6.60	4.70			0.00		0.00	0.00	0.0%
	7.00	4.80	0.10	0.03	0.41	0.10	0.07	0.00	0.0%
	8.00	4.80	0.10	0.50	1.00	0.10	0.10	0.05	0.2%
	9.00	4.90	0.20	0.62	1.00	0.20	0.30	0.19	0.8%
	11.00	5.40	0.70	1.52	2.06	0.70	1.40	2.13	9.4%
	13.00	5.20	0.50	2.01	2.01	0.50	1.00	2.01	8.9%
	15.00	5.35	0.65	2.11	2.01	0.65	1.30	2.74	12.1%
	17.00	5.60	0.90	0.99	2.02	0.90	1.35	1.34	5.9%
	18.00	5.30	0.60	1.81	1.04	0.60	1.20	2.17	9.6%
	21.00	5.40	0.70	1.02	3.00	0.70	1.75	1.79	7.9%
	23.00	5.20	0.50	1.77	2.01	0.50	1.00	1.77	7.8%
	25.00	5.05	0.35	1.64	2.01	0.35	0.70	1.15	5.1%
	27.00	5.30	0.60	1.50	2.02	0.60	1.20	1.80	7.9%
	29.00	5.40	0.70	1.02	2.00	0.70	1.40	1.43	6.3%
	31.00	4.80	0.10	0.52	2.09	0.10	0.20	0.10	0.5%
	33.00	4.80	0.10	0.35	2.00	0.10	0.20	0.07	0.3%
	35.00	5.20	0.50	1.50	2.04	0.50	1.00	1.50	6.6%
	37.00	5.30	0.60	1.52	2.00	0.60	1.20	1.82	8.0%
	39.00	5.00	0.30	0.94	2.02	0.30	0.60	0.56	2.5%
	41.00	4.85	0.15	0.21	2.01	0.15	0.23	0.05	0.2%
	42.00	4.75	0.05	0.00	1.00	0.05	0.08	0.00	0.0%
	44.00	4.80	0.10	0.06	2.00	0.10	0.15	0.01	0.0%
	45.00	4.95	0.25	0.00	1.01	0.25	0.44	0.00	0.0%
W	47.50	4.72			2.51		0.00	0.00	0.0%
	50.90	4.26			0.00		0.00	0.00	0.0%
1 RS & G	54.20	2.82			0.00		0.00	0.00	0.0%
TOTALS ----------					41.27	0.9 (Max.)	16.86	22.68	100.0%

Manning's n = 0.0666
Hydraulic Radius= 0.40842036

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: Approx. 750' upstream from powerline crossing
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	16.86	16.47	-2.3%
4.46	16.86	26.99	60.1%
4.48	16.86	26.13	55.0%
4.50	16.86	25.27	49.9%
4.52	16.86	24.42	44.8%
4.54	16.86	23.57	39.8%
4.56	16.86	22.72	34.8%
4.58	16.86	21.87	29.8%
4.60	16.86	21.03	24.8%
4.62	16.86	20.20	19.8%
4.64	16.86	19.36	14.9%
4.66	16.86	18.53	9.9%
4.67	16.86	18.12	7.5%
4.68	16.86	17.71	5.0%
4.69	16.86	17.30	2.6%
4.70	16.86	16.88	0.2%
4.71	16.86	16.47	-2.3%
4.72	16.86	16.07	-4.7%
4.73	16.86	15.66	-7.1%
4.74	16.86	15.25	-9.5%
4.75	16.86	14.85	-11.9%
4.76	16.86	14.45	-14.3%
4.78	16.86	13.67	-18.9%
4.80	16.86	12.91	-23.4%
4.82	16.86	12.24	-27.4%
4.84	16.86	11.58	-31.3%
4.86	16.86	10.95	-35.1%
4.88	16.86	10.33	-38.7%
4.90	16.86	9.73	-42.3%
4.92	16.86	9.15	-45.7%
4.94	16.86	8.59	-49.0%
4.96	16.86	8.04	-52.3%

WATERLINE AT ZERO
AREA ERROR = 4.701

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: Approx. 750' upstream from powerline crossing
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	2.82	49.59	2.10	2.78	104.07	51.10	100.0%	2.04	408.68	3.93
	3.70	46.98	1.31	1.90	61.55	47.84	93.6%	1.29	177.95	2.89
	3.75	46.83	1.26	1.85	59.21	47.65	93.3%	1.24	167.23	2.82
	3.80	46.69	1.22	1.80	56.87	47.47	92.9%	1.20	156.77	2.76
	3.85	46.54	1.17	1.75	54.54	47.28	92.5%	1.15	146.59	2.69
	3.90	46.35	1.13	1.70	52.22	47.06	92.1%	1.11	136.76	2.62
	3.95	46.15	1.08	1.65	49.90	46.85	91.7%	1.07	127.20	2.55
	4.00	45.96	1.04	1.60	47.60	46.63	91.3%	1.02	117.93	2.48
	4.05	45.77	0.99	1.55	45.31	46.42	90.8%	0.98	108.95	2.40
	4.10	45.58	0.94	1.50	43.02	46.20	90.4%	0.93	100.27	2.33
	4.15	45.39	0.90	1.45	40.75	45.98	90.0%	0.89	91.88	2.25
	4.20	45.20	0.85	1.40	38.48	45.77	89.6%	0.84	83.79	2.18
	4.25	45.01	0.80	1.35	36.23	45.55	89.1%	0.80	76.00	2.10
	4.30	44.61	0.76	1.30	33.99	45.13	88.3%	0.75	68.75	2.02
	4.35	44.16	0.72	1.25	31.77	44.67	87.4%	0.71	61.86	1.95
	4.40	43.72	0.68	1.20	29.57	44.20	86.5%	0.67	55.28	1.87
	4.45	43.27	0.63	1.15	27.40	43.74	85.6%	0.63	49.01	1.79
	4.50	42.83	0.59	1.10	25.24	43.28	84.7%	0.58	43.07	1.71
	4.55	42.38	0.55	1.05	23.11	42.81	83.8%	0.54	37.45	1.62
	4.60	41.93	0.50	1.00	21.01	42.35	82.9%	0.50	32.17	1.53
	4.65	41.49	0.46	0.95	18.92	41.88	82.0%	0.45	27.22	1.44
WL	4.70	41.04	0.41	0.90	16.86	41.42	81.1%	0.41	22.63	1.34
	4.75	40.33	0.37	0.85	14.82	40.70	79.6%	0.36	18.47	1.25
	4.80	34.10	0.38	0.80	12.89	34.46	67.4%	0.37	16.35	1.27
	4.85	31.80	0.35	0.75	11.24	32.14	62.9%	0.35	13.64	1.21
	4.90	29.35	0.33	0.70	9.71	29.66	58.0%	0.33	11.27	1.16
	4.95	27.20	0.31	0.65	8.30	27.48	53.8%	0.30	9.13	1.10
	5.00	25.92	0.27	0.60	6.97	26.18	51.2%	0.27	7.05	1.01
	5.05	24.96	0.23	0.55	5.70	25.20	49.3%	0.23	5.17	0.91
	5.10	22.94	0.20	0.50	4.50	23.15	45.3%	0.19	3.69	0.82
	5.15	20.92	0.16	0.45	3.40	21.11	41.3%	0.16	2.46	0.72
	5.20	18.88	0.13	0.40	2.41	19.04	37.3%	0.13	1.48	0.62
	5.25	15.12	0.10	0.35	1.56	15.25	29.8%	0.10	0.83	0.53
	5.30	11.34	0.08	0.30	0.90	11.44	22.4%	0.08	0.40	0.45
	5.35	6.64	0.07	0.25	0.45	6.72	13.1%	0.07	0.18	0.40
	5.40	2.26	0.10	0.20	0.23	2.30	4.5%	0.10	0.12	0.52
	5.45	1.69	0.07	0.15	0.13	1.72	3.4%	0.07	0.05	0.43
	5.50	1.13	0.05	0.10	0.06	1.15	2.2%	0.05	0.02	0.33
	5.55	0.56	0.02	0.05	0.01	0.57	1.1%	0.02	0.00	0.20

STREAM NAME: Animas River - Cunningham to Arrastra
XS LOCATION: Approx. 750' upstream from powerline crossing
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	22.68	cfs
CALCULATED FLOW (Qc)=	22.63	cfs
(Qm-Qc)/Qm * 100 =	0.2	%
MEASURED WATERLINE (WLm)=	4.71	ft
CALCULATED WATERLINE (WLc)=	4.70	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.90	ft
MAX CALCULATED DEPTH (Dc)=	0.90	ft
(Dm-Dc)/Dm * 100	0.1	%
MEAN VELOCITY=	1.34	ft/sec
MANNING'S N=	0.067	
SLOPE=	0.012	ft/ft
.4 * Qm =	9.1	cfs
2.5 * Qm=	56.7	cfs

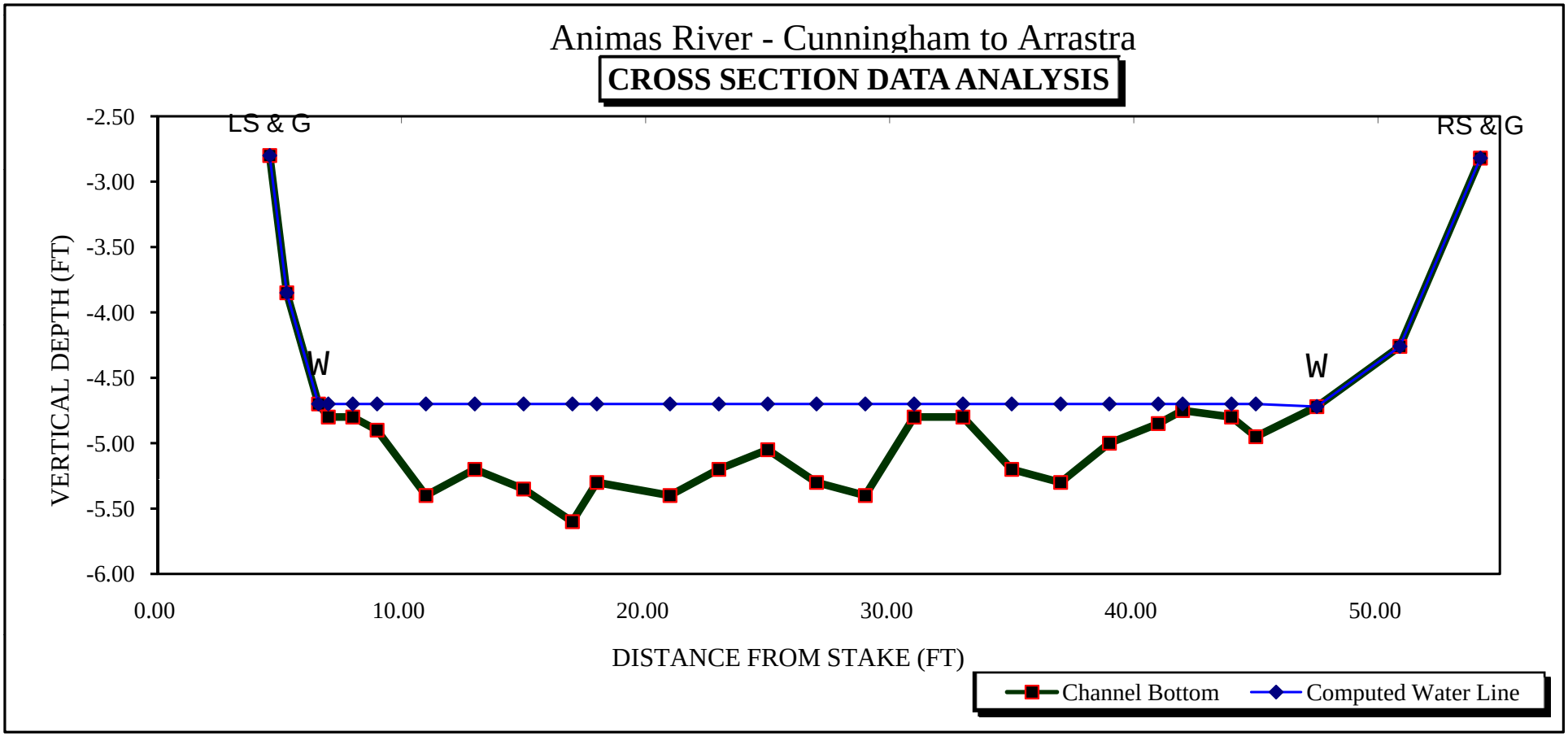
RECOMMENDED INSTREAM FLOW:
==========

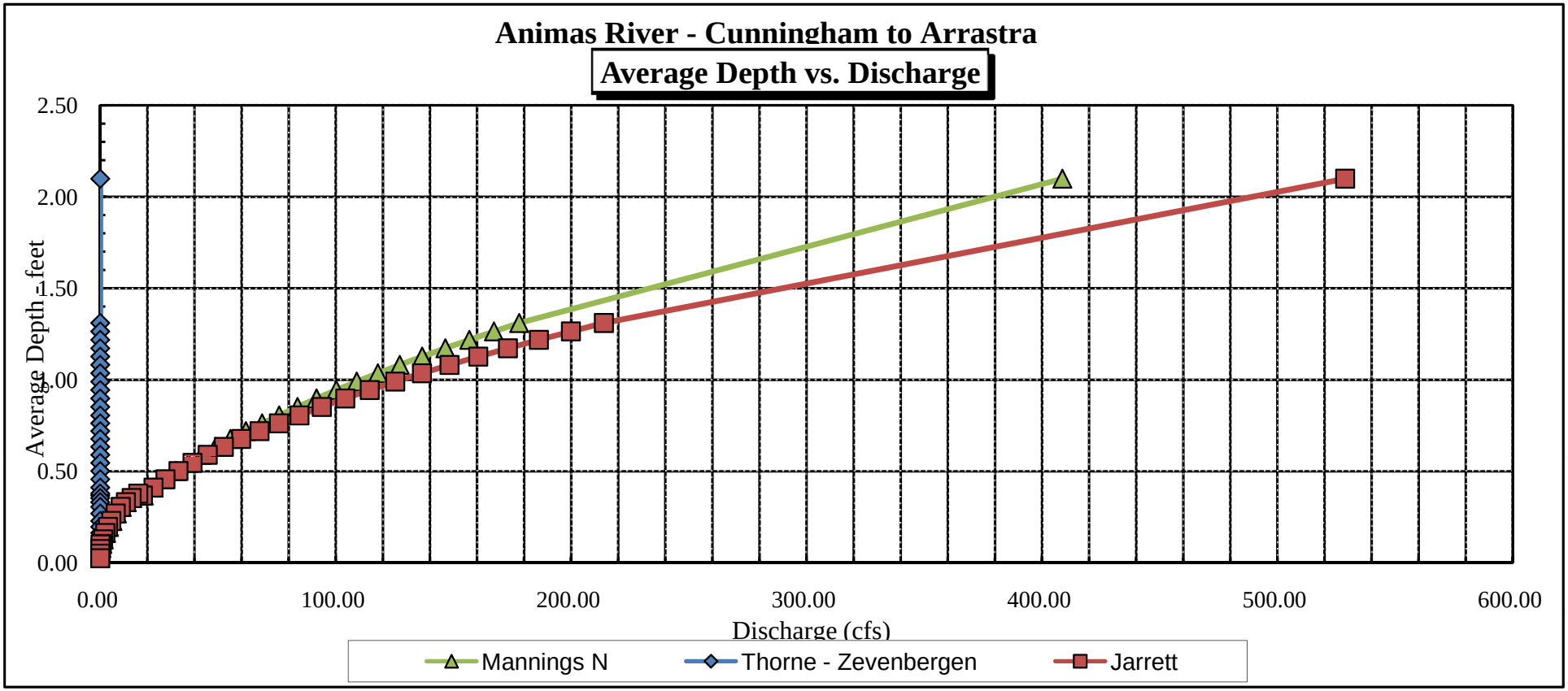
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

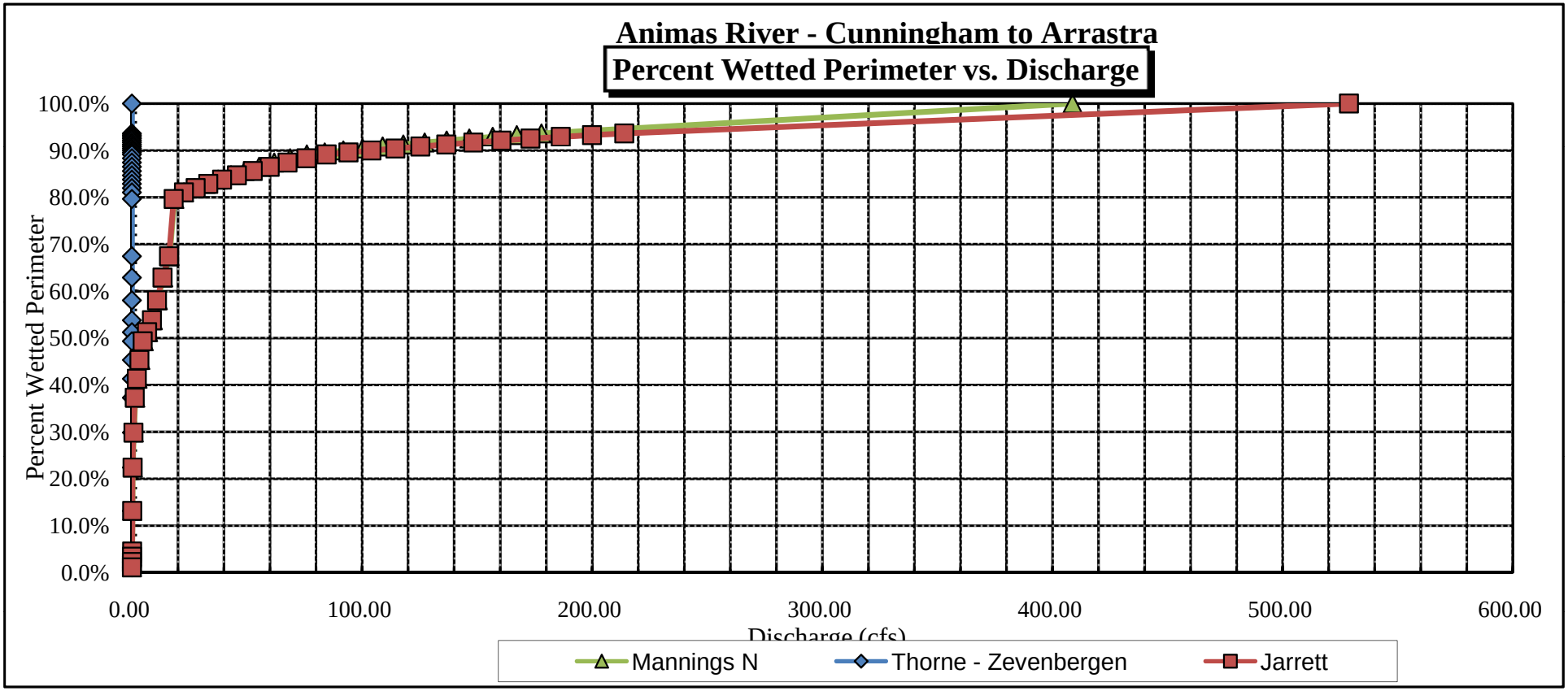
RATIONALE FOR RECOMMENDATION:
==========

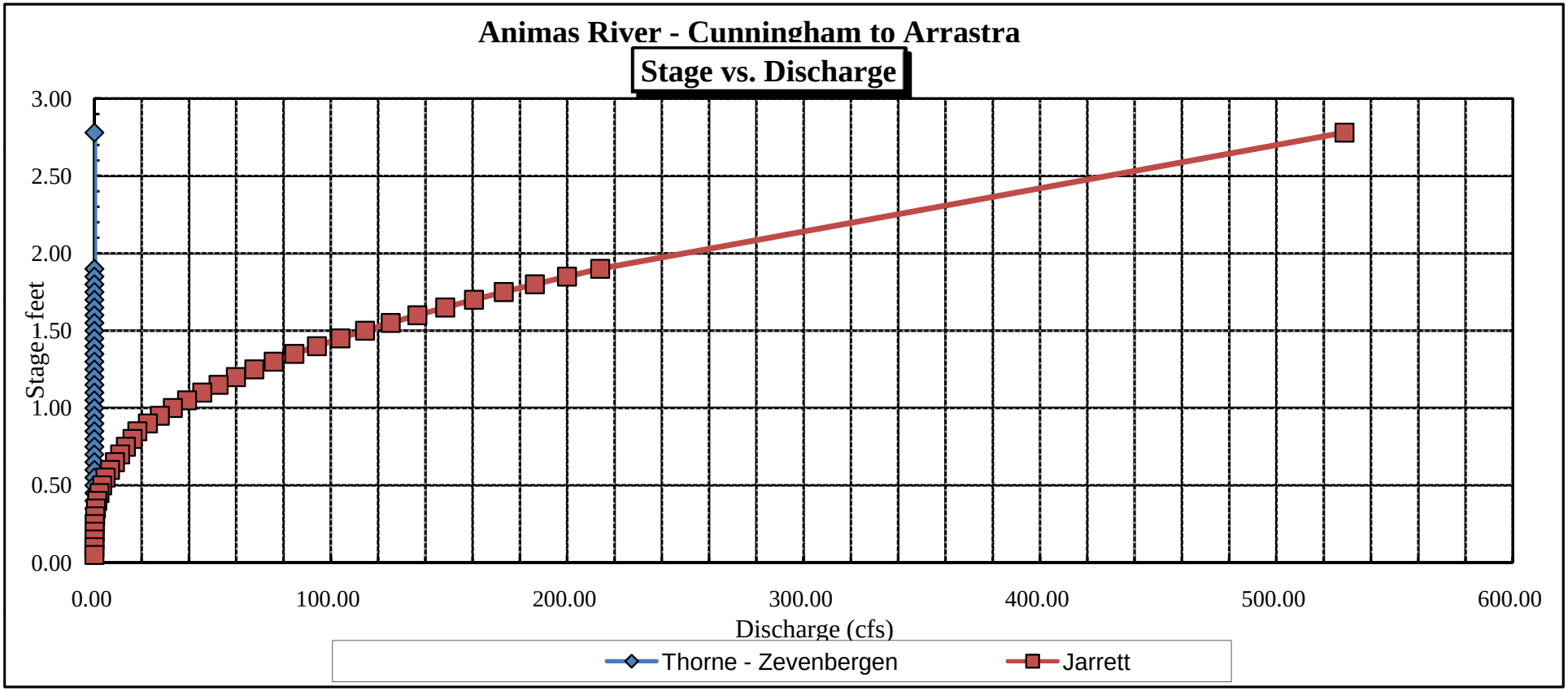
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

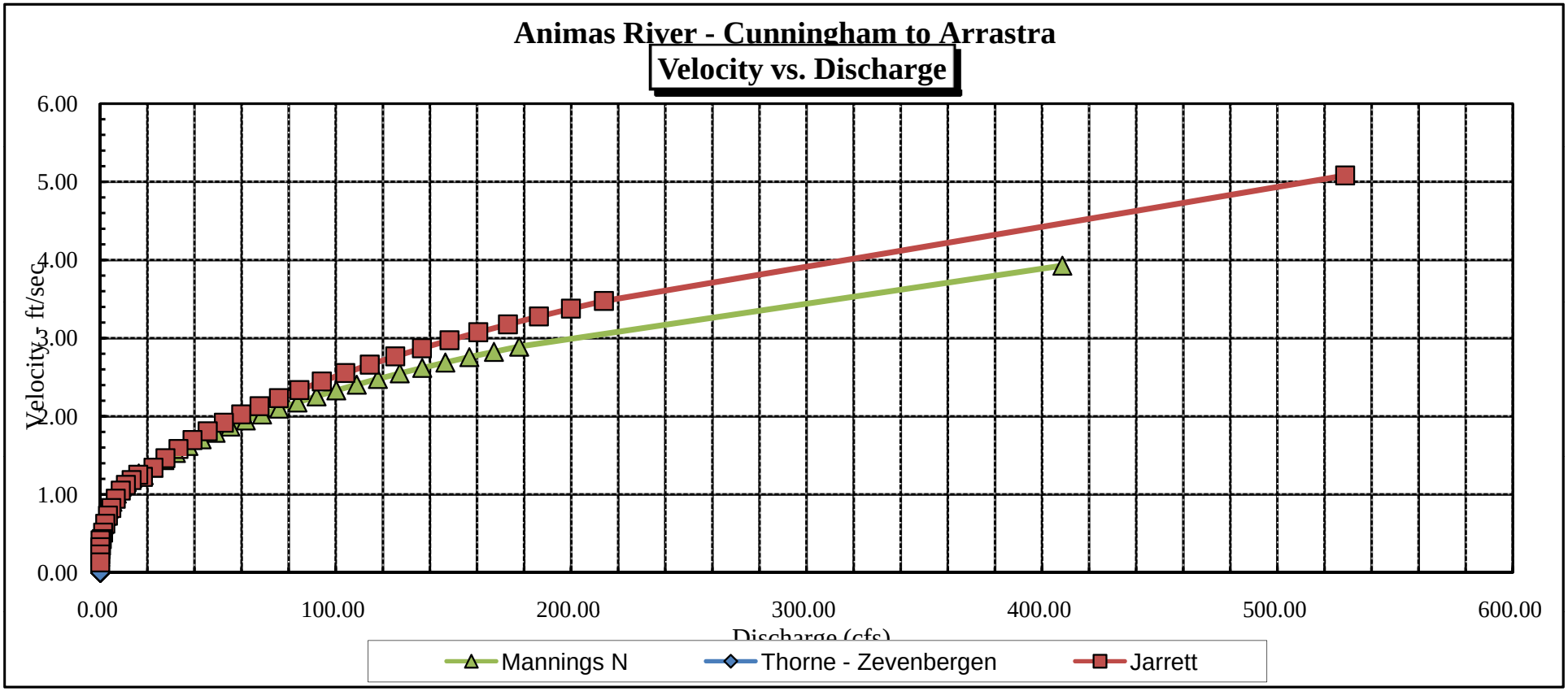
CWCB REVIEW BY: ..... DATE:.....


Animas River - Cunningham to Arrastra
CROSS SECTION DATA ANALYSIS
LS & G
RS & G
W
W
-2.50
-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
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Animas River - Cunningham to Arrastra
Average Depth vs. Discharge
Average Depth - feet
2.50
2.00
1.50
1.00
0.50
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
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
400.00
500.00
600.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
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
Discharge (cfs)
Thorne - Zevenbergen
Jarrett


Animas River - Cunningham to Arrastra
Velocity vs. Discharge
Velocity, ft/sec
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Animas River
XS LOCATION:	500' downstream from powerline
XS NUMBER:	2
DATE:	10/20/04
OBSERVERS:	R. Smith, S. Jensen, C. Gunn
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	N.M.P.M.
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	
USGS MAP:	Howardsville 7.5
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.00955 ft / ft

CHECKED BY:.....DATE.....

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

Total Data Points = 29

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	LS	0.00	6.28			0.00	0.00	0.00
1	G	4.00	6.86			0.00	0.00	0.00
		7.00	7.07			0.00	0.00	0.00
	W	8.00	8.48			0.00	0.00	0.00
		10	8.75	0.25	0.00	0.50	0.00	8.50
		12.00	8.81	0.30	0.52	0.60	0.31	8.51
		14	9.47	0.95	0.95	1.90	1.81	8.52
		16	9.42	1.00	1.92	2.00	3.84	8.42
		18	9.61	1.10	1.83	2.20	4.03	8.51
		20	9.31	0.85	1.66	1.70	2.82	8.46
	TDR	22	8.61	0.15	1.83	0.30	0.55	8.46
		24	9.33	0.90	1.81	1.80	3.26	8.43
		26	9.13	0.65	2.25	0.98	2.19	8.48
		27	9.50	0.95	1.30	0.95	1.24	8.55
		28	9.24	0.70	1.08	0.70	0.76	8.54
		29	9.05	0.60	2.21	0.60	1.33	8.45
		30	9.39	0.90	2.06	0.90	1.85	8.49
		31	9.53	1.10	1.52	1.10	1.67	8.43
		32	9.13	0.60	1.52	0.90	1.37	8.53
		34	9.42	0.95	1.42	1.90	2.70	8.47
		36	9.36	0.90	2.57	1.80	4.63	8.46
		38	8.93	0.45	1.98	0.90	1.78	8.48
		40	9.47	0.90	0.72	1.80	1.30	8.57
		42	9.26	0.80	0.97	1.60	1.55	8.46
		44	9.02	0.50	0.36	1.00	0.36	8.52
	TDR	46	8.40	0.00	0.00	0.00	0.00	0.00
	W	47	8.49	0.00	0.00	0.00	0.00	0.00
1	G	49.2	6.40			0.00	0.00	0.00
	RS	50.9	5.59			0.00	0.00	0.00
					Totals	26.13	39.33	

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

LOCATION INFORMATION

STREAM NAME:	Animas River
XS LOCATION:	500' downstream from powerline
XS NUMBER:	2
DATE:	20-Oct-04
OBSERVERS:	R. Smith, S. Jensen, C. Gunn
1/4 SEC:	NW
SECTION:	11
TWP:	41 N
RANGE:	7 W
PM:	N.M.P.M.
COUNTY:	San Juan
WATERSHED:	Animas
DIVISION:	7
DOW CODE:	0
USGS MAP:	Howardsville 7.5
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:	0.00955

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

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

STREAM NAME: Animas River
XS LOCATION: 500' downstream from powerline
XS NUMBER: 2

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
	LS	0.00	6.28			0.00		0.00	0.00	0.0%
1	G	4.00	6.86			0.00		0.00	0.00	0.0%
		7.00	7.07			0.00		0.00	0.00	0.0%
	W	8.00	8.48			0.00		0.00	0.00	0.0%
		10.00	8.75	0.25	0.00	2.02	0.25	0.50	0.00	0.0%
		12.00	8.81	0.30	0.52	2.00	0.30	0.60	0.31	0.8%
		14.00	9.47	0.95	0.95	2.11	0.95	1.90	1.81	4.6%
		16.00	9.42	1.00	1.92	2.00	1.00	2.00	3.84	9.8%
		18.00	9.61	1.10	1.83	2.01	1.10	2.20	4.03	10.2%
		20.00	9.31	0.85	1.66	2.02	0.85	1.70	2.82	7.2%
	TDR	22.00	8.61	0.15	1.83	2.12	0.15	0.30	0.55	1.4%
		24.00	9.33	0.90	1.81	2.13	0.90	1.80	3.26	8.3%
		26.00	9.13	0.65	2.25	2.01	0.65	0.98	2.19	5.6%
		27.00	9.50	0.95	1.30	1.07	0.95	0.95	1.24	3.1%
		28.00	9.24	0.70	1.08	1.03	0.70	0.70	0.76	1.9%
		29.00	9.05	0.60	2.21	1.02	0.60	0.60	1.33	3.4%
		30.00	9.39	0.90	2.06	1.06	0.90	0.90	1.85	4.7%
		31.00	9.53	1.10	1.52	1.01	1.10	1.10	1.67	4.3%
		32.00	9.13	0.60	1.52	1.08	0.60	0.90	1.37	3.5%
		34.00	9.42	0.95	1.42	2.02	0.95	1.90	2.70	6.9%
		36.00	9.36	0.90	2.57	2.00	0.90	1.80	4.63	11.8%
		38.00	8.93	0.45	1.98	2.05	0.45	0.90	1.78	4.5%
		40.00	9.47	0.90	0.72	2.07	0.90	1.80	1.30	3.3%
		42.00	9.26	0.80	0.97	2.01	0.80	1.60	1.55	3.9%
		44.00	9.02	0.50	0.36	2.01	0.50	1.00	0.36	0.9%
	TDR	46.00	8.40	0.00	0.00	2.09		0.00	0.00	0.0%
	W	47.00	8.49	0.00	0.00	0.00		0.00	0.00	0.0%
	G	49.20	6.40			0.00		0.00	0.00	0.0%
	RS	50.90	5.59			0.00		0.00	0.00	0.0%
	TOTALS ----------					38.93	1.1 (Max.)	26.13	39.33	100.0%

Manning's n = 0.0739
Hydraulic Radius= 0.67106774

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WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	26.13	27.82	6.5%
8.19	26.13	37.63	44.0%
8.21	26.13	36.84	41.0%
8.23	26.13	36.05	38.0%
8.25	26.13	35.26	35.0%
8.27	26.13	34.48	32.0%
8.29	26.13	33.69	29.0%
8.31	26.13	32.90	25.9%
8.33	26.13	32.12	22.9%
8.35	26.13	31.33	19.9%
8.37	26.13	30.55	16.9%
8.39	26.13	29.76	13.9%
8.40	26.13	29.37	12.4%
8.41	26.13	28.98	10.9%
8.42	26.13	28.59	9.4%
8.43	26.13	28.20	8.0%
8.44	26.13	27.82	6.5%
8.45	26.13	27.43	5.0%
8.46	26.13	27.05	3.5%
8.47	26.13	26.67	2.1%
8.48	26.13	26.29	0.6%
8.49	26.13	25.91	-0.8%
8.51	26.13	25.16	-3.7%
8.53	26.13	24.42	-6.5%
8.55	26.13	23.67	-9.4%
8.57	26.13	22.94	-12.2%
8.59	26.13	22.20	-15.0%
8.61	26.13	21.47	-17.8%
8.63	26.13	20.75	-20.6%
8.65	26.13	20.03	-23.3%
8.67	26.13	19.32	-26.0%
8.69	26.13	18.62	-28.7%

WATERLINE AT ZERO
AREA ERROR = 8.484

STREAM NAME: Animas River
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Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.86	44.72	2.06	2.75	92.05	47.04	100.0%	1.96	282.89	3.07
	7.48	40.76	1.62	2.13	65.96	42.62	90.6%	1.55	173.34	2.63
	7.53	40.68	1.57	2.08	63.92	42.48	90.3%	1.50	164.86	2.58
	7.58	40.59	1.52	2.03	61.89	42.35	90.0%	1.46	156.55	2.53
	7.63	40.50	1.48	1.98	59.86	42.21	89.7%	1.42	148.41	2.48
	7.68	40.41	1.43	1.93	57.84	42.08	89.5%	1.37	140.44	2.43
	7.73	40.32	1.38	1.88	55.82	41.95	89.2%	1.33	132.65	2.38
	7.78	40.24	1.34	1.83	53.81	41.81	88.9%	1.29	125.04	2.32
	7.83	40.15	1.29	1.78	51.80	41.68	88.6%	1.24	117.60	2.27
	7.88	40.06	1.24	1.73	49.79	41.54	88.3%	1.20	110.35	2.22
	7.93	39.97	1.20	1.68	47.79	41.41	88.0%	1.15	103.28	2.16
	7.98	39.88	1.15	1.63	45.80	41.28	87.8%	1.11	96.40	2.11
	8.03	39.80	1.10	1.58	43.80	41.14	87.5%	1.06	89.71	2.05
	8.08	39.71	1.05	1.53	41.82	41.01	87.2%	1.02	83.21	1.99
	8.13	39.62	1.01	1.48	39.83	40.87	86.9%	0.97	76.90	1.93
	8.18	39.53	0.96	1.43	37.85	40.74	86.6%	0.93	70.79	1.87
	8.23	39.44	0.91	1.38	35.88	40.61	86.3%	0.88	64.89	1.81
	8.28	39.36	0.86	1.33	33.91	40.47	86.0%	0.84	59.19	1.75
	8.33	39.27	0.81	1.28	31.94	40.34	85.8%	0.79	53.70	1.68
	8.38	39.18	0.77	1.23	29.98	40.21	85.5%	0.75	48.43	1.62
	8.43	38.60	0.73	1.18	28.03	39.57	84.1%	0.71	43.76	1.56
WL	8.48	37.76	0.69	1.13	26.12	38.68	82.2%	0.68	39.50	1.51
	8.53	37.16	0.65	1.08	24.25	38.07	80.9%	0.64	35.27	1.45
	8.58	36.63	0.61	1.03	22.41	37.53	79.8%	0.60	31.21	1.39
	8.63	35.96	0.57	0.98	20.59	36.84	78.3%	0.56	27.44	1.33
	8.68	35.15	0.54	0.93	18.81	36.00	76.5%	0.52	23.98	1.27
	8.73	34.34	0.50	0.88	17.08	35.16	74.7%	0.49	20.73	1.21
	8.78	32.63	0.47	0.83	15.40	33.42	71.1%	0.46	18.03	1.17
	8.83	31.26	0.44	0.78	13.81	32.02	68.1%	0.43	15.48	1.12
	8.88	30.67	0.40	0.73	12.26	31.40	66.8%	0.39	12.86	1.05
	8.93	30.03	0.36	0.68	10.74	30.73	65.3%	0.35	10.47	0.97
	8.98	29.02	0.32	0.63	9.26	29.68	63.1%	0.31	8.37	0.90
	9.03	27.94	0.28	0.58	7.84	28.55	60.7%	0.27	6.51	0.83
	9.08	26.39	0.25	0.53	6.48	26.95	57.3%	0.24	4.92	0.76
	9.13	24.61	0.21	0.48	5.20	25.12	53.4%	0.21	3.58	0.69
	9.18	21.83	0.19	0.43	4.04	22.26	47.3%	0.18	2.54	0.63
	9.23	19.05	0.16	0.38	3.02	19.40	41.2%	0.16	1.72	0.57
	9.28	16.30	0.13	0.33	2.14	16.57	35.2%	0.13	1.07	0.50
	9.33	13.49	0.10	0.28	1.39	13.68	29.1%	0.10	0.59	0.43
	9.38	10.47	0.07	0.23	0.78	10.60	22.5%	0.07	0.27	0.35
	9.43	6.37	0.06	0.18	0.36	6.45	13.7%	0.06	0.10	0.29
	9.48	2.70	0.05	0.13	0.15	2.73	5.8%	0.05	0.04	0.28
	9.53	1.30	0.04	0.08	0.05	1.31	2.8%	0.04	0.01	0.22
	9.58	0.44	0.01	0.03	0.01	0.44	0.9%	0.01	0.00	0.11

depth criteria: 0.45 ft.

1. 0.45 ft

0.44 15.48 0.01 / 0.03 = x / 2.55 = 0.84 + 15.48 = 16.32 cfs
0.45 x
0.47 18.03

2. 60% wetted perimeter = 6.18 ft

3. 1 ft/sec ✓

0.97 10.47 0.03 / 0.08 = x / 2.39 = 0.91 + 10.47 =
1.00 x
1.05 12.86

11.38 cfs

STREAM NAME: Animas River
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SUMMARY SHEET

MEASURED FLOW (Qm)=	39.33	cfs
CALCULATED FLOW (Qc)=	39.50	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	8.44	ft
CALCULATED WATERLINE (WLc)=	8.48	ft
(WLm-WLc)/WLm * 100 =	-0.5	%
MAX MEASURED DEPTH (Dm)=	1.10	ft
MAX CALCULATED DEPTH (Dc)=	1.13	ft
(Dm-Dc)/Dm * 100	-2.3	%
MEAN VELOCITY=	1.51	ft/sec
MANNING'S N=	0.074	
SLOPE=	0.00955	ft/ft
.4 * Qm =	15.7	cfs
2.5 * Qm=	98.3	cfs

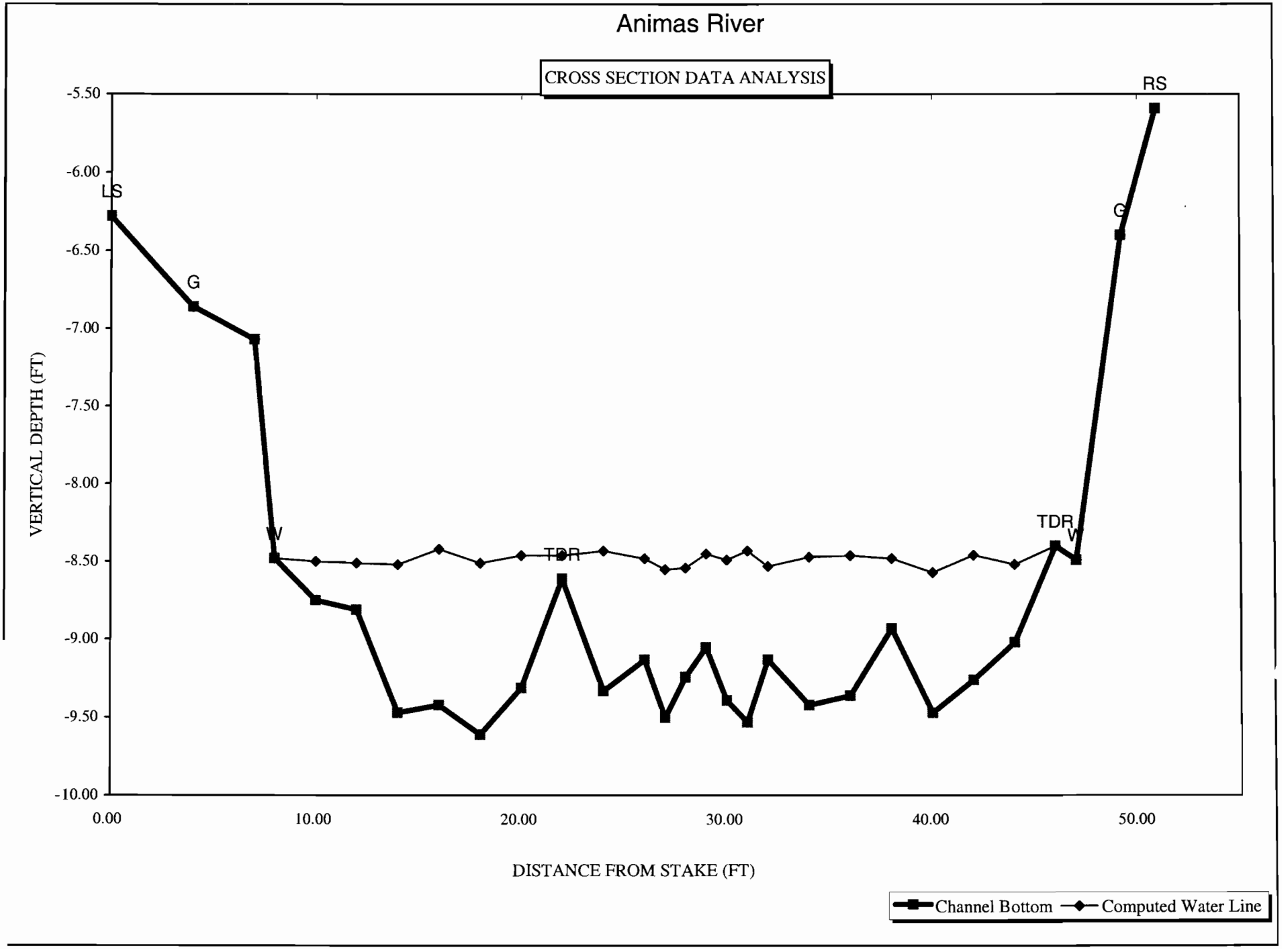
RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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


Animas River
CROSS SECTION DATA ANALYSIS
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
-10.00
VERTICAL DEPTH (FT)
LS
G
W
TDR
TDR
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