BEFORE THE COLORADO WATER CONSERVATION BOARD

STATE OF COLORADO

Prehearing Statement of Staff of the Colorado Water Conservation Board

---

IN THE MATTER OF THE CWCB STAFF'S RECOMMENDATIONS FOR AN INSTREAM FLOW APPROPRIATION ON THE HUERFANO RIVER, DIVISION 2

Pursuant to Rule 5n. (2) of the Rules Concerning the Colorado Instream Flow and Natural Lake Level, 2 CCR 408-2 ("ISF Rules"), the Staff of the Colorado Water Conservation Board ("CWCB") hereby submits its prehearing statement in support of the Staff's recommendations for instream flow ("ISF") appropriations on the subject reaches of the Huerfano River in the amounts set forth in the attached memorandum (attached as **Exhibit 1**).

A. FACTUAL CLAIMS

1) Based upon field surveys by the Colorado Division of Wildlife ("CDOW"), there is a natural environment that can be preserved on the subject reaches of the Huerfano River, in Huerfano County. None of the parties to this proceeding have contested the existence of a natural environment on the subject reaches of the Huerfano River.

2) The instream flow amounts recommended by Staff for the subject reaches of the Huerfano River:

   a) are based upon standard scientific methodology and accurate R2Cross analyses;

   b) reflect the amount of water available for appropriation as an ISF right; and

   c) are required to preserve the natural environment to a reasonable degree.

3) The natural environment on the subject reaches of the Huerfano River: (a) will be preserved to a reasonable degree with the proposed ISF water right; and (b) can exist without material injury to water rights.

B. LEGAL CLAIMS

1) Staff's recommendations for the Huerfano River ISF meet all of the procedural requirements of the ISF Rules.

2) ISF Rule 5j.(3) provides that "[i]n a hearing on a contested ISF appropriation, a Party may raise only those issues relevant to the statutory determinations required by section 37-92-102(3)(c) and the required findings in Rule 5i."

3) Staff reserves the right to supplement its legal claims in its Rebuttal Statement.

C. EXHIBITS TO BE INTRODUCED AT HEARING

1) January 19, 2009 Memorandum from Jeff Baessler to the CWCB, Agenda Item 5, containing the stream flow tabulation for the Huerfano River ISF and Staff's request that the Board form its intent to appropriate, attached as **Exhibit 1.**

2) Letter from the CDOW, dated January 7, 2009, along with supporting field data, photographs, maps, gage data and water availability analysis, attached as **Exhibit 2.**

3) The CWCB Staff recommendations and executive summaries containing the written recommendations for an instream flow appropriation on the Huerfano River subject reaches, along with supporting field data, photographs, maps, gage data and water availability analysis, attached as **Exhibit 3.**

4) Gregory D. Espegren, *Development of Instream Flow Recommendations in Colorado Using R2Cross, January 1996,* attached as **Exhibit 4.**

5) Colorado Water Conservation Board, *Rules Concerning the Colorado Instream Flow and Natural Lake Level Program*, attached as **Exhibit 5**

6) February 3, 2009 Notice to the ISF Subscription Mailing List, indicating that the CWCB Board declared its intent to appropriate an ISF on the Huerfano River and the deadline to contest the appropriation as March 31, 2009, attached as **Exhibit 6.**

7) November 13, 2008 Notice to the ISF Subscription Mailing List, indicating that the Huerfano River is being considered for an instream flow appropriation at the January 2009 CWCB Board meeting, attached as **Exhibit 7.**

8) March 14, 2008 Notice to the ISF Subscription Mailing List, indicating that the Huerfano River is being considered for an instream flow appropriation at the January 2009 CWCB Board meeting, attached as **Exhibit 8.**

9) November 6, 2008 Memorandum from Jeff Baessler to the CWCB, Agenda Item 5, indicating that the Huerfano River is being considered for an instream flow appropriation at the January 2009 CWCB Board meeting, attached as **Exhibit 9.**

10) March 9, 2008 Memorandum from Jeff Baessler to the CWCB, Agenda Item 25, outlining 35 new instream flow recommendations being noticed and processed by staff for possible inclusion into the Instream flow and Natural Lake Level Program in 2009, including the subject reaches of the Huerfano River, attached as **Exhibit 10.**

11) Staff may introduce demonstrative, rebuttal or other exhibits as allowed by the CWCB or agreed upon by the Parties.

12) Staff may rely on any exhibits introduced or disclosed by any other party to this hearing.

D. WITNESSES

1) Mark Uppendahl, Physical Scientist and Instream Flow Coordinator for the CDOW (resume provided upon request). Mr. Uppendahl will testify generally on how the CDOW conducts the R2Cross analysis as a basis for ISF recommendations, and specifically on the R2Cross analysis and other biological bases for the subject ISF appropriations. Mr. Uppendahl may give opinion and factual testimony.

2) Jeff Baessler, Deputy Section Chief of the CWCB Stream and Lake Protection Section (resume provided upon request). Mr. Baessler will testify on how the CWCB staff formulates the basis for its recommendations. Mr. Baessler may give opinion and factual testimony.

3) Owen Williams, Hydrologist for the CWCB (resume provided upon request). Mr. Williams will testify on how he conducted the water availability analysis for the subject ISF recommendations. Mr. Williams may give opinion and factual testimony.

4) Staff may call any witness declared by any other party to this hearing.

E. WRITTEN TESTIMONY

Staff is not submitting written testimony with its prehearing statement, but may submit written testimony with its rebuttal statement.

F. Legal Memoranda

Staff is not submitting legal memoranda with this prehearing statement, but may submit legal memoranda with its rebuttal statement.

JOHN W. SUTHERS
Attorney General

SUSAN J. SCHNEIDER, 19961*
First Assistant Attorney General
Natural Resources and Environment Section
Attorneys for the Colorado Water Conservation Board
*Counsel of Record

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on the 7th day of October, 2009, I caused a true and correct copy of the foregoing Prehearing Statement to be served via electronic mail to each of the following:

Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203
(303) 866-3441 ext. 3204
linda.bassi@state.co.us

Casey Shpall - Hearing Officer
Colorado Attorney General's Office
1525 Sherman Street, 7th Floor
Denver, Colorado 80203
(303) 866-5069
casey.shpall@state.co.us

Mark Uppendahl
Colorado Division of Wildlife
6060 Broadway
Denver, Colorado 80216
(303) 291-7267
mark.uppendahl@state.co.us

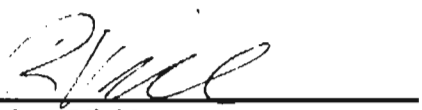
Cucharas Sanitation and Water District
Stuart B. Corbridge
Vranesh and Raisch, LLP
P.O. Box 871
1720 14th Street, Suite 200
Boulder, Colorado 80306-0871
(303) 443-6151
sbc@vrlaw.com

Huerfano County Commissioners
David M. Shohet
Felt, Monson & Culichia
319 N. Weber Street
Colorado Springs, CO 80903
(719) 471-1212
Dms@fmcwater.com

Huerfano County Water Conservancy District
David M. Shohet
Felt, Monson & Culichia, LLC
319 N. Weber Street
Colorado Springs, CO 80903
(719) 471-1212
Dms@fmcwater.com

Trout Unlimited
Andrew Peternell
Trout Unlimited
1320 Pearl Street, Suite 320
Boulder, Colorado 80302
(303) 440-2937
dpeternell@tu.org

SeEtta Moss
725 Frankie Lane
Canon City, CO 81212
seettam@gmail.com



Robert Viehl

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler
Stream and Lake Protection Section

DATE: January 19, 2008

SUBJECT: **Agenda Item 5, January 27-28, 2009, Board Meeting**
Stream and Lake Protection Section – New Appropriation Recommendations in Water Divisions 2, 4, 5, and 6

Summary

This memo outlines the history of ISF recommendations identified for appropriation in 2009 and provides an overview of the technical analyses that were performed by both the recommending entities and staff to provide the Board with sufficient information to declare its intent to appropriate in accordance with the Instream Flow Rules. Staff's detailed analysis of each stream contained in the "Instream Flow Recommendation Notebook", which was mailed separately, provides the technical basis for each appropriation.

Staff recommends that the Board declare its intent to appropriate 22 new instream flow water rights in Water Divisions 2, 4, 5 and 6 as identified in the attached tables.

Background

Pursuant to Rule 5d. of the Board's Instream Flow Rules, staff is requesting the Board to declare its intent to appropriate instream flow water rights on the stream segments identified in the attached tables. Staff has reviewed each proposed stream segment to ensure that for each flow recommendation, the data set is complete and standard methods and procedures were followed. In addition, staff has completed its water availability studies. Staff has identified 22 stream segments in Water Divisions 2, 4, 5 and 6 for which sufficient information has been compiled and analyses performed upon which the Board can base its intent to appropriate. These segments are located in Chaffee, Grand, Gunnison, Hinsdale, Huerfano, Lake, Las Animas, Mesa, Montrose, and Routt Counties.

It should be noted that although 37 recommendations either were received at the February 2008 workshop, or were carryover recommendations from previous years, only the attached 22 recommendations are being moved forward by staff at this time. Staff has been unable to move forward on the remaining streams because additional stakeholder discourse and/or additional data collection and analysis are required. The following table identifies the streams that will be brought back to the Board at a future date.

Exhibit 1

5d. Board's Intent to Appropriate. Notice of the Board's potential action to declare its intent to appropriate shall be given in the January Board meeting agenda and the Board will take public comment regarding its intent to appropriate at the January meeting.

(1) After reviewing Staff's ISF recommendations for proposed ISF appropriations, the Board may declare its intent to appropriate specific ISF water rights. At that time, the Board shall direct the Staff to publicly notice the Board's declaration of its intent to appropriate.

(2) After the Board declares its intent to appropriate, notice shall be published in a mailing to the ISF Subscription Mailing Lists for the relevant water divisions and shall include:

(a) A description of the appropriation (e.g. stream reach, lake location, amounts, etc.);
(b) Availability (time and place) for review of Summary Reports and Investigations Files for each recommendation; and,
(c) Summary identification of any data, exhibits, testimony or other information in addition to the Summary Reports and Investigations Files supporting the appropriation.

(3) Published notice shall also contain the following information:

(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.

(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any person desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.
(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to persons on the ISF Subscription Mailing List(s).
(d) Any Notice to Contest must be received at the Board office no later than March 31st, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant status must be received at the Board office no later than April 30th, or the first business day thereafter.
(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September Board meeting and will send notice of the Final Staff Recommendation to all persons on the Contested Hearing Mailing List.
(f) The Board may take final action on any uncontested ISF appropriations at the May Board meeting.

(4) After the Board declares its intent to appropriate, notice of the Board's action shall be mailed within five working days to the County Commissioners of the county(ies) in which the proposed reach or lake is located.

Staff Recommendation

Staff recommends that, pursuant to Rule 5d., the Board declare its intent to appropriate an ISF water right on each stream segment listed on the attached Tabulations of Instream Flow and Natural Lake Level Recommendations, and direct Staff to publicly notice the Board's declaration of its intent to appropriate.

Attachments

Division	Stream Name	County (ies)	Recommender(s)
1	Coal Creek	Boulder	City of Louisville, CDOW
2	Gibson Creek	Custer	CDOW
4	Big Dominguez Creek	Delta & Mesa	CDOW, BLM
4	Little Dominguez Creek		
4	San Miguel River	Montrose	BLM, CDOW
5	Eagle River (ISF Increase)	Eagle	Town of Minturn, CDOW
5	Colorado River	Eagle	Eagle County Board of County Commissioners
6	Moeller Creek	Rio Blanco	CDOW
6	South Fork Slater Creek	Routt, Moffat	CDOW, TU
6	West Prong South Fork Slater Creek		
6	Indian Creek	Jackson	BLM
6	North Fork North Platte River	Jackson	BLM
6	South Fork Big Creek	Jackson	BLM
6	Piceance Creek	Rio Blanco	BLM, CDOW
6	Yellow Creek	Rio Blanco	BLM, CDOW

Technical Investigations

Staff's executive summary and technical analysis of each stream, contained in the Instream Flow Recommendation Notebook (mailed separately), forms the basis for staff's recommendations.

Natural Environment Studies

The Bureau of Land Management (BLM), Colorado Division of Wildlife (CDOW), and Trout Unlimited (TU) have conducted field surveys of the natural environment resources on these streams and have found natural environments that can be preserved. To quantify the resources and to evaluate instream flow requirements, the recommending entities have collected biologic and hydraulic data that were analyzed by CWCB staff. Based on the results of these analyses, staff prepared recommendations of the amount of water necessary to preserve the natural environment to a reasonable degree for each of the streams listed on the attached Tabulations of Instream Flow and Natural Lake Level Recommendations.

Water Availability Studies

Staff has conducted an evaluation of water availability for the streams listed. To determine the amount of water physically available for the Board's appropriations, staff analyzed available USGS gage records, available streamflow models, and/or utilized appropriate standard methods to develop a hydrograph of mean daily flows for each stream flow recommendation. Staff also relied upon the flow measurements made as part of the field survey as an indicator of the amount of water physically available in each stream; analyzed the water rights tabulation for each stream; and has consulted with the Division Engineer's Office to identify any potential water availability problems. Based upon its analyses, staff has determined that water is available for appropriation on each stream to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid water rights.

Instream Flow Rule 5d.

Rule 5d. provides that the Board may declare its intent to appropriate ISF water rights after reviewing Staff's recommendations for the proposed appropriations. Rule 5d. also sets forth the activities that take place after the Board declares its intent that initiate the public notice and comment procedure for the ISF appropriations. Specifically,

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 2

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
08/2/A-003	Cucharas Creek	Alamosa-Trinchera	Huerfano	headwaters in the vicinity of lat 37 17 47N long 105 9 28W	State Highway 12 at lat 37 19 54N long 105 5 48W	5.30	Cucharas Reservoir Trinchera Peak	1.6 (4/1 - 5/14) 4.9 (5/15 - 6/30) 1.6 (7/1 - 9/15) 1.2 (9/16 - 3/31)	
09/2/A-003	Huerfano River	Huerfano	Huerfano	outlet of Lilly Lake at lat 37 35 40N long 105 29 22W	confl Central Branch Huerfano Crk at lat 37 40 16N long 105 25 16W	8.20	Mosca Pass	2.7 (11/1 - 4/30) 4.1 (5/1 - 10/31)	
09/2/A-004	Huerfano River	Huerfano	Huerfano	confl. w/ unnamed tributary at lat 37 41 2N long 105 24 9W	confl. w/ Stanely Creek at lat 37 42 33N long 105 22 16W	2.60	Mosca Pass Red Wing	2.75 (11/1 - 3/31) 5.75 (4/1 - 10/31)	
09/2/A-001	Maxwell Creek	Arkansas headwaters	Chaffee	headwaters in the vicinity of lat 38 45 11N long 106 14 55W	hdgt. O.W. Friskey Ditch at lat 38 46 26N long 106 11 2W	4.00	Buena Vista West	1 (10/01 - 10/31) 0.4 (11/01 - 5/31) 3.3 (6/1 - 7/31) 1.5 (8/01 - 9/30)	
08/2/A-001	Purgatoire River	Purgatoire	Las Animas	confl M/N Fork Purgatoire River at lat 37 9 26N long 104 56 27W	confl Lopez Canyon at lat 37 8 25N long 104 52 45W	4.80	Vigil	7 (12/1 - 4/14) 8.4 (4/15 - 5/14) 21 (5/15 - 8/15) 15 (8/16 - 9/15) 8.4 (9/16 - 11/30)	

Instream Flow Tabulation - Water Division 2

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
09/2/A-005	Rock Creek	Arkansas headwaters	Lake	outlet of Native Lake at lat 39 13 27N long 106 27 31W	confl. w/ Willow Creek at lat 39 12 40N long 106 22 49W	5.00	Mount Massive	1.7 (11/1 - 5/14) 11 (5/15 - 8/31) 5 (9/1 - 10/31)	
08/2/A-002	South Fork Purgatoire River	Purgatoire	Las Animas	confl with Unnameed Tributary at lat 37 03 49N long 104 58 60W	confl with Torres Canyon at lat 37 5 40N long 104 52 47W	8.20	Tercio	3 (10/16 - 4/30) 9.6 (5/1 - 5/31) 18 (6/1 - 6/30) 13 (7/1 - 8/15) 5 (8/16 - 10/15)	

Totals for Water Division 2

Total # of Stream Miles = 38.1

Total # of Appropriations = 7

(Totals do not include donated/acquired water rights)

Report Totals

Total # of Stream Miles = 38.1

Total # of Appropriations 7

(Totals do not include donated/acquired water rights)

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
09/4/A-005 (increase)	Bent Creek	Upper Gunnison	Hinsdale	headwaters in the vicinity of lat 37 56 23N long 107 24 31W	confl. Lake Fork Gunnison River at lat 37 54 22N long 107 22 46W	3.00	Redcloud Peak	1.55 (4/1 - 10/31)	
09/4/A-001	Clear Fork East Muddy Creek	North Fork Gunnison	Gunnison	headwaters in the vicinity of lat 39 15 12N long 107 25 37W	Forest Service Bounday at lat 39 8 45N long 107 26 10W	9.10	Elk Knob Quaker Mesa	13 (4/1 - 8/15) 5 (8/16 - 3/31)	
09/4/A-002 (increase)	East Elk Creek	Upper Gunnison	Gunnison	confl. w/ Bear Wallow Gulch at lat 38 32 42N long 107 10 13W	confl. w/ Blue Mesa Reservoir at lat 38 28 58N long 107 10 20W	4.50	Carpenter Ridge West Elk Peak SW	0.7 (4/1 - 10/31)	
09/4/A-006	Grizzly Gulch	Upper Gunnison	Hinsdale	outlet of Grizzly Lake at lat 37 55 7N long 107 28 58W	confl. Lake Fork Gunnison River at lat 37 56 6N long 107 27 35W	2.10	Redcloud Peak	2.9 (4/15 - 9/15) 0.6 (9/16 - 4/14)	
09/4/A-007 (increase)	Henson Creek	Upper Gunnison	Hinsdale	conf. North Fork of Henson Creek at lat 38 0 25N long 107 27 33W	confl. Nellie Creek at lat 38 1 13N long 107 24 4W	3.40	Uncompahgre Peak	11 (4/1 - 10/31)	
09/4/A-004	Little Spring Creek	North Fork Gunnison	Gunnison	Cyrstal Springs at lat 39 1 1N long 107 19 47W	Inlet of Ragged Res. #1 at lat 39 1 55N long 107 20 4W	0.40	Chair Mountain	1.25 (1/1 - 12/31)	
09/4/A-012	Little Spring Creek	North Fork Gunnison	Gunnison	outlet of Ragged Res #1 at lat 39 1 53N long 10 20 11W	Crystal Ditch hdgt lat 39 1 34N long 107 20 40W	0.70	Chair Mountain	1.25 (1/1 - 12/31)	
09/4/A-008 (increase)	Schafer Gulch	Upper Gunnison	Hinsdale	headwaters in the vicinity of lat 37 57 16N long 107 32 52W	confl. Henson Creek at lat 37 58 34N long 107 32 28W	1.70	Handies Peak	1.3 (4/1 - 10/31)	

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
09/4/A-010	Tabequache Creek	San Miguel	Montrose	conf. Fortyseven Creek at lat 38 22 10N long 108 31 5W	confl. San Miguel River at lat 38 21 26N long 108 42 42W	5.40	Nucla Uravan	1.6 (12/1 - 3/14) 4.75 (3/15 - 6/30) 1.9 (7/1 - 11/30)	
09/4/A-011	Tabequache Creek	San Miguel	Montrose	hdgt of Templeton Ditch at lat 38 21 42N long 108 35 25W	confl with San Miguel River at lat 38 21 26N long 108 42 43W	9.70	Nucla Uravan	4.75 (3/15 - 6/30)	

Totals for Water Division 4

Total # of Stream Miles = 40

Total # of Appropriations = 10

(Totals do not include donated/acquired water rights)

Report Totals

Total # of Stream Miles = 40

Total # of Appropriations = 10

(Totals do not include donated/acquired water rights)

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
09/5/A-002	Buzzard Creek	Colorado Headwaters-Plateau	Mesa	confl. Willow Creek at lat 39 11 41N long 107 37 24W	confl. Owens Creek at lat 39 14 7N long 107 37 58W	3.40	Porter Mountain Spruce Mountain	4.25 (4/1 - 8/31) 1.5 (9/1 - 3/31)	
08/5/A-013 (increase)	Corral Creek	Colorado headwaters	Grand	confl Smith Creek at lat 40 5 57N long 106 11 8W	hdgt of Home # 1 Ditch lat 40 3 55N long 106 11 8W	2.75	Parshall	0.9 (11/1 - 3/31) 2.75 (4/1 - 10/31)	
08/5/A-009	Troublesome Creek	Colorado headwaters	Grand	confl with Glomerate Creek at lat 40 17 9N long 106 17 51W	confl with Rabbit Ears Creek at lat 40 15 46N long 106 19 6W	3.00	Hyannis Peak	2.8 (11/1 - 3/31) 5.1 (4/1 - 10/31)	
08/5/A-010	Troublesome Creek	Colorado headwaters	Grand	confl with Rabbit Ears Creek at lat 40 15 46N long 106 19 7W	hdgt Pickering Ditch at lat 40 13 37N long 106 18 50W	3.00	Hyannis Peak	5.9 (11/1 - 3/31) 9.3 (4/1 - 10/31)	

Totals for Water Division 5

Total # of Stream Miles = 12.15

Total # of Appropriations = 4

(Totals do not include donated/acquired water rights)

Report Totals

Total # of Stream Miles = 12.15

Total # of Appropriations = 4

(Totals do not include donated/acquired water rights)

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 6

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
09/6/A-002	Grizzly Creek	Little Snake	Routt	confl. of two unnamed tributaries at lat 40 46 56N long 107 12 55W	Forest Service Boundary at lat 40 49 59N long 107 13 45W	2.90	Bears Ears Peaks	35 (1/1 - 12/31)	

Totals for Water Division 6

Total # of Stream Miles = 2.9

Total # of Appropriations = 1

(Totals do not include donated/acquired water rights)

Report Totals

Total # of Stream Miles = 2.9

Total # of Appropriations = 1

(Totals do not include donated/acquired water rights)

STATE OF COLORADO

Bill Ritter, Jr., Governor
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE
AN EQUAL OPPORTUNITY EMPLOYER

Thomas E. Remington, Director
6060 Broadway
Denver, Colorado 80216
Telephone: (303) 297-1192
wildlife.state.co.us

For Wildlife-
For People

January 7, 2009

Ms. Linda Bassi
Colorado Water Conservation Board
Stream and Lake Protection Section
1313 Sherman Street, Room 723
Denver, Colorado 80203

Re: Colorado Division of Wildlife Instream Flow Recommendations for the Huerfano River.

Dear Linda,

The purpose of this letter is to formally transmit the Colorado Division of Wildlife's (CDOW) Instream Flow Recommendations for Huerfano River (see attached Reports). The CDOW has collected data, including stream cross section information and natural environment data, needed to quantify the instream flow requirements for these reaches of Huerfano River identified in the report to preserve the natural environment to a reasonable degree. The Huerfano River should be considered for inclusion into the Instream Flow Program (ISFP) because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The State of Colorado's ISFP was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the Colorado Water Conservation Board (Board) with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW is recommending these two segments of the Huerfano River to the Board for inclusion into the ISFP.

The CDOW is forwarding these instream flow recommendations to the Board to meet Colorado's policy "... that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

Exhibit 2

These stream reaches are important to the CDOW and Colorado because they both support naturally reproducing populations of brown (*Salmo trutta*) and brook (*Salvelinus fontinalis*) trout. These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

The information contained in the two attached reports forms the basis for the instream flow recommendations to be considered by the Board. It is the CDOW staff's opinion that this information is sufficient for the Board to make the findings required in Rule 5 (i) of the Instream Flow Rules.

If you have any questions regarding the attached information or the instream flow recommendations, please contact me at (303)-291-7267.

Sincerely,

Mark Uppendahl

Mark Uppendahl
Colorado Division of Wildlife
Instream Flow Program Coordinator

Cc: Grady McNeill, CDOW Resource Support Section Manager – w/o attachments
Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
John Tonko, CDOW Water Resource Specialist – w/o attachments
Doug Krieger, CDOW Senior Fish Biologist – Southeast Region – w/o attachments
Jim Melby, CDOW Aquatic Biologist – w/o attachments
Michael Trujillo, CDOW AWM Area 11 – w/o attachments

Stream: Huerfano River

Executive Summary

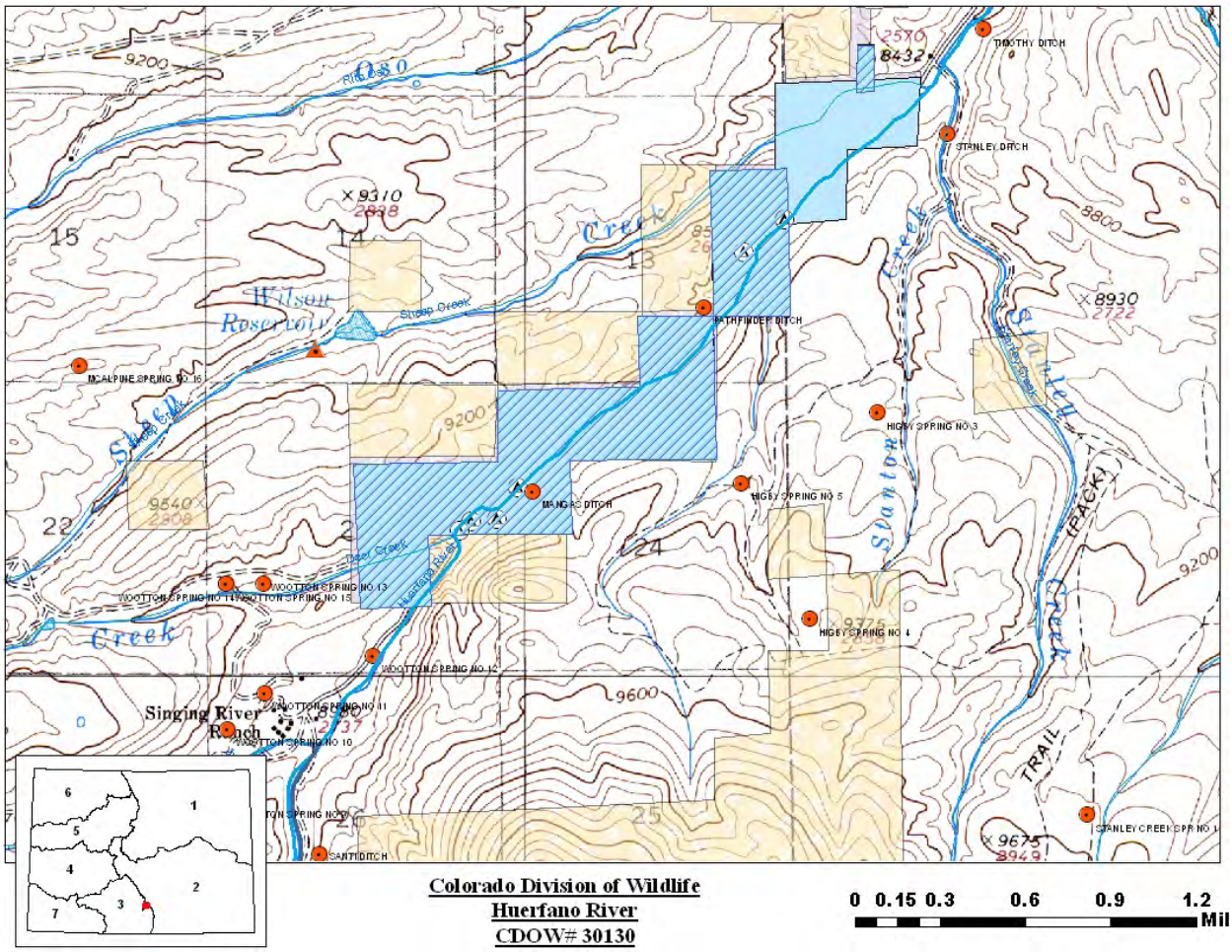
Water Division: 2
Water District: 79
CDOW#: 30130

Segment: UNNAMED TRIBUTARY TO STANLEY CREEK

Upper Terminus: UNNAMED TRIBUTARY
Latitude: 37º 41’ 02”N Longitude: 105º 24’ 09"W

Lower Terminus: STANLEY CREEK
Latitude: 37 42’ 33”N Longitude: 105º 22’ 16"W

Counties: Huerfano County
Length: 2.6 miles
USGS Quad(s): Mosca Pass.
ISF Appropriation: 5.75 cfs (April 1 – October 31)
2.75 cfs (November 1 – March 31)



The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and

managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

This segment of the Huerfano River is approximately 2.6 miles long. It begins at the confluence of an unnamed tributary at an elevation of approximately 8,875 feet and terminates at the confluence with Stanley Creek at an elevation of approximately 8,450 feet. Of the 2.6 mile segment addressed by this report, approximately 95% of the segment, or 2.5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 55 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the confluence of an unnamed tributary and extending downstream to confluence with the Stanley Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 5.75 cfs, summer and 2.75 cfs winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 5.5 cubic feet per second is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.75 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
UNNAMED TRIBUTARY	STANLEY CREEK	2.6	5	95

Biological and Field Survey Data

The CDOW, in 2006, 2007 and 2008, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a medium stream (between 20 to 35 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook

trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

CDOW staff used the R2CROSS methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The Board staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2CROSS data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	7/19/2006	14.6	36.6 - 5.9	3.1[R]	2.1[R]
DOW	7/19/2006	13.2	33.1 – 5.3	5.5	2.7[R]
DOW	8/22/2007	30.1	75.2 – 12.0	5.5[R]	3.8[R]
DOW	8/22/2007	26.0	65.1 – 10.4	2.3[R]	2.3[R]
DOW	11/25/2008	10.9	27.2 – 4.4	6.0	3.0[R]

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer flow recommendation, which met 3 of 3 criteria and were within the accuracy range of the R2CROSS model ranged from 6.0 cfs and 5.5 cfs, averaging the summer flow recommendations within range results in a 5.75 cfs recommendation (See Table 1). The winter flow recommendation, which met 2 of 3 criteria were all just outside of the accuracy range of the R2CROSS model. However, averaging all of the winter flow recommendations results in a 2.75

cfs recommendation. In addition, comparing this value (2.75 cfs) to the "within range" value requested for the upstream segment of the Huerfano River, Lily Lake to Central Branch Huerfano River Segment, of 2.7 cfs, supports this wintertime recommendation.

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

LOCATION INFORMATION

STREAM NAME:	Huerfano River
XS LOCATION:	Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER:	07/19/06-X1
DATE:	19-Jul-06
OBSERVERS:	Uppendahl & Molloy
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	0
USGS MAP:	MOSCA PASS
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:	0.0109375

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

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

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

DATA POINTS= 41

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
Top Pin	0.00	3.20			0.00		0.00	0.00	0.0%
B pin	0.01	3.68			0.00		0.00	0.00	0.0%
1 GL	0.50	3.76			0.00		0.00	0.00	0.0%
	1.65	4.34			0.00		0.00	0.00	0.0%
WL	2.25	5.09	0.00	0.00	0.00		0.00	0.00	0.0%
	2.30	5.59	0.50	0.89	0.50	0.50	0.06	0.06	0.4%
	2.50	5.60	0.45	1.28	0.20	0.45	0.16	0.20	1.4%
	3.00	5.50	0.40	1.66	0.51	0.40	0.20	0.33	2.3%
BR	3.50	5.85	0.80	0.12	0.61	0.80	0.40	0.05	0.3%
	4.00	5.85	0.80	2.09	0.50	0.80	0.40	0.84	5.7%
	4.50	5.85	0.75	2.32	0.50	0.75	0.38	0.87	5.9%
	5.00	5.80	0.70	1.44	0.50	0.70	0.35	0.50	3.4%
	5.50	5.80	0.60	1.75	0.50	0.60	0.30	0.53	3.6%
	6.00	5.85	0.65	2.08	0.50	0.65	0.33	0.68	4.6%
	6.50	5.85	0.80	1.84	0.50	0.80	0.40	0.74	5.0%
	7.00	5.85	0.55	2.86	0.50	0.55	0.28	0.79	5.4%
	7.50	5.80	0.50	2.58	0.50	0.50	0.25	0.65	4.4%
	8.00	5.90	0.80	2.20	0.51	0.80	0.40	0.88	6.0%
	8.50	5.30	0.20	2.25	0.78	0.20	0.10	0.23	1.5%
	9.00	5.40	0.20	1.95	0.51	0.20	0.10	0.20	1.3%
	9.50	5.65	0.60	2.60	0.56	0.60	0.30	0.78	5.3%
	10.00	5.80	0.70	2.60	0.52	0.70	0.35	0.91	6.2%
	10.50	5.85	0.75	2.38	0.50	0.75	0.38	0.89	6.1%
	11.00	5.80	0.65	1.79	0.50	0.65	0.33	0.58	4.0%
	11.50	6.05	0.65	0.47	0.56	0.65	0.33	0.15	1.0%
	12.00	6.10	0.95	0.78	0.50	0.95	0.48	0.37	2.5%
	12.50	6.10	0.85	0.98	0.50	0.85	0.43	0.42	2.8%
	13.00	5.80	0.75	1.99	0.58	0.75	0.38	0.75	5.1%
	13.50	5.85	0.70	2.68	0.50	0.70	0.35	0.94	6.4%
	14.00	6.00	0.60	1.60	0.52	0.60	0.45	0.72	4.9%
BR	15.00	5.90	0.65	0.14	1.00	0.65	0.65	0.09	0.6%
BR	16.00	5.60	0.40	0.60	1.04	0.40	0.40	0.24	1.6%
	17.00	5.30	0.15	0.62	1.04	0.15	0.15	0.09	0.6%
	18.00	5.45	0.25	0.74	1.01	0.25	0.25	0.19	1.3%
	19.00	5.25	0.10	0.00	1.02	0.10	0.10	0.00	0.0%
WL	20.00	5.12	0.00	0.00	1.01		0.00	0.00	0.0%
	21.50	5.00			0.00		0.00	0.00	0.0%
1 GL	22.00	3.90			0.00		0.00	0.00	0.0%
	24.00	3.60			0.00		0.00	0.00	0.0%
B pin	24.30	3.65			0.00		0.00	0.00	0.0%
Top Pin	34.31	3.26			0.00		0.00	0.00	0.0%
TOTALS ----------					19.02	0.95 (Max.)	9.40	14.63	100.0%

Manning's n = 0.0624
Hydraulic Radius= 0.493982995

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.40	10.53	12.1%
4.86	9.40	15.30	62.9%
4.88	9.40	14.91	58.7%
4.90	9.40	14.53	54.6%
4.92	9.40	14.14	50.5%
4.94	9.40	13.75	46.3%
4.96	9.40	13.36	42.2%
4.98	9.40	12.97	38.1%
5.00	9.40	12.59	34.0%
5.02	9.40	12.20	29.9%
5.04	9.40	11.82	25.8%
5.06	9.40	11.45	21.8%
5.07	9.40	11.26	19.9%
5.08	9.40	11.08	17.9%
5.09	9.40	10.89	16.0%
5.10	9.40	10.71	14.0%
5.11	9.40	10.53	12.1%
5.12	9.40	10.35	10.2%
5.13	9.40	10.18	8.3%
5.14	9.40	10.00	6.4%
5.15	9.40	9.82	4.6%
5.16	9.40	9.65	2.7%
5.18	9.40	9.30	-1.0%
5.20	9.40	8.96	-4.7%
5.22	9.40	8.62	-8.3%
5.24	9.40	8.28	-11.9%
5.26	9.40	7.94	-15.5%
5.28	9.40	7.61	-19.0%
5.30	9.40	7.28	-22.5%
5.32	9.40	6.95	-26.0%
5.34	9.40	6.63	-29.4%
5.36	9.40	6.32	-32.7%

WATERLINE AT ZERO
AREA ERROR = 5.170

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

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	3.90	21.22	1.63	2.20	34.62	23.67	100.0%	1.46	111.17	3.21
	4.17	20.57	1.41	1.93	28.98	22.77	96.2%	1.27	84.84	2.93
	4.22	20.44	1.37	1.88	27.96	22.61	95.5%	1.24	80.28	2.87
	4.27	20.32	1.33	1.83	26.94	22.44	94.8%	1.20	75.84	2.82
	4.32	20.20	1.28	1.78	25.93	22.28	94.1%	1.16	71.50	2.76
	4.37	20.11	1.24	1.73	24.92	22.14	93.5%	1.13	67.21	2.70
	4.42	20.05	1.19	1.68	23.91	22.02	93.0%	1.09	62.98	2.63
	4.47	19.99	1.15	1.63	22.91	21.90	92.5%	1.05	58.86	2.57
	4.52	19.92	1.10	1.58	21.92	21.78	92.0%	1.01	54.85	2.50
	4.57	19.86	1.05	1.53	20.92	21.66	91.5%	0.97	50.95	2.44
	4.62	19.80	1.01	1.48	19.93	21.54	91.0%	0.93	47.16	2.37
	4.67	19.74	0.96	1.43	18.94	21.42	90.5%	0.88	43.49	2.30
	4.72	19.67	0.91	1.38	17.96	21.31	90.0%	0.84	39.93	2.22
	4.77	19.61	0.87	1.33	16.97	21.19	89.5%	0.80	36.49	2.15
	4.82	19.55	0.82	1.28	15.99	21.07	89.0%	0.76	33.18	2.07
	4.87	19.49	0.77	1.23	15.02	20.95	88.5%	0.72	29.99	2.00
	4.92	19.42	0.72	1.18	14.05	20.83	88.0%	0.67	26.92	1.92
	4.97	19.36	0.68	1.13	13.08	20.71	87.5%	0.63	23.99	1.83
	5.02	19.06	0.64	1.08	12.11	20.37	86.0%	0.59	21.35	1.76
	5.07	18.40	0.61	1.03	11.18	19.68	83.1%	0.57	19.10	1.71
	5.12	17.75	0.58	0.98	10.27	18.99	80.2%	0.54	17.00	1.65
WL	5.17	17.36	0.54	0.93	9.39	18.55	78.4%	0.51	14.88	1.58
	5.22	16.97	0.50	0.88	8.54	18.12	76.5%	0.47	12.88	1.51
	5.27	16.63	0.46	0.83	7.70	17.73	74.9%	0.43	11.00	1.43
	5.32	16.07	0.43	0.78	6.87	17.10	72.2%	0.40	9.33	1.36
	5.37	15.02	0.41	0.73	6.10	15.96	67.4%	0.38	8.00	1.31
	5.42	14.03	0.38	0.68	5.37	14.88	62.9%	0.36	6.79	1.26
	5.47	13.37	0.35	0.63	4.69	14.12	59.7%	0.33	5.61	1.20
	5.52	12.93	0.31	0.58	4.03	13.59	57.4%	0.30	4.47	1.11
	5.57	12.29	0.28	0.53	3.40	12.84	54.3%	0.26	3.50	1.03
	5.62	11.56	0.24	0.48	2.81	12.03	50.8%	0.23	2.65	0.94
	5.67	11.15	0.20	0.43	2.24	11.57	48.9%	0.19	1.87	0.83
	5.72	10.71	0.16	0.38	1.69	11.07	46.8%	0.15	1.21	0.71
	5.77	10.26	0.11	0.33	1.17	10.57	44.6%	0.11	0.67	0.57
	5.82	8.03	0.09	0.28	0.69	8.27	34.9%	0.08	0.33	0.48
	5.87	3.46	0.12	0.23	0.41	3.61	15.3%	0.11	0.24	0.58
	5.92	2.63	0.10	0.18	0.26	2.73	11.5%	0.09	0.13	0.51
	5.97	1.78	0.08	0.13	0.14	1.85	7.8%	0.08	0.07	0.46
	6.02	1.19	0.06	0.08	0.07	1.23	5.2%	0.06	0.03	0.38
	6.07	0.85	0.02	0.03	0.02	0.86	3.7%	0.02	0.00	0.21

3/3 = 3.4

2/3 =

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

SUMMARY SHEET

MEASURED FLOW (Qm)=	14.63	cfs
CALCULATED FLOW (Qc)=	14.88	cfs
(Qm-Qc)/Qm * 100 =	-1.7	%
MEASURED WATERLINE (WLm)=	5.11	ft
CALCULATED WATERLINE (WLc)=	5.17	ft
(WLm-WLc)/WLm * 100 =	-1.3	%
MAX MEASURED DEPTH (Dm)=	0.95	ft
MAX CALCULATED DEPTH (Dc)=	0.93	ft
(Dm-Dc)/Dm * 100	2.1	%
MEAN VELOCITY=	1.58	ft/sec
MANNING'S N=	0.062	
SLOPE=	0.0109375	ft/ft
.4 * Qm =	5.9	cfs
2.5 * Qm=	36.6	cfs

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

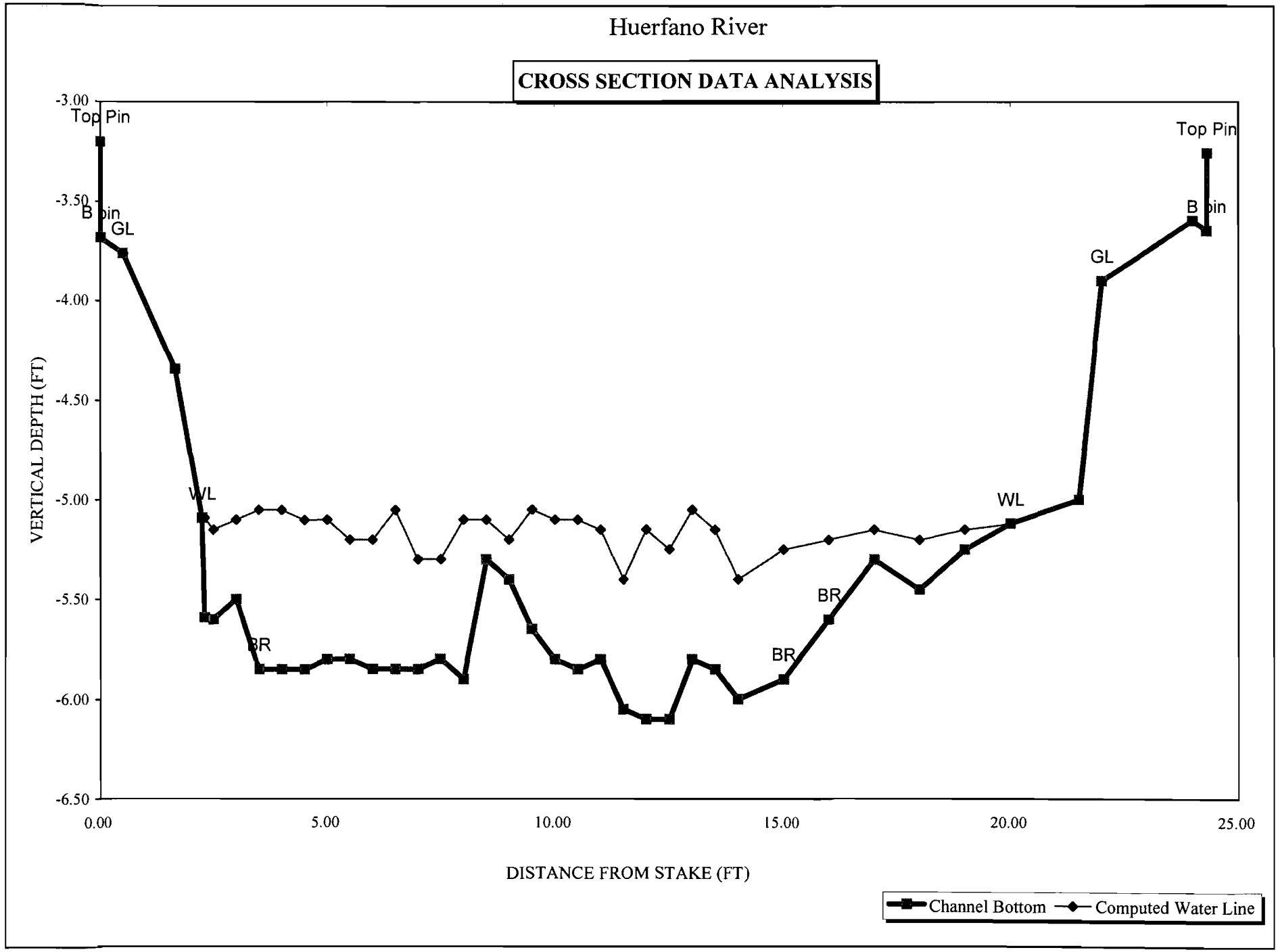
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

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

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

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

Huerfano River



STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.44

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

Velocity based on test of R/D84>1

	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	3.90	21.22	1.63	2.20	34.62	23.67	100.0%	1.46	155.53	4.49
	4.17	20.57	1.41	1.93	28.98	22.77	96.2%	1.27	114.81	3.96
	4.22	20.44	1.37	1.88	27.96	22.61	95.5%	1.24	107.87	3.86
	4.27	20.32	1.33	1.83	26.94	22.44	94.8%	1.20	101.13	3.75
	4.32	20.20	1.28	1.78	25.93	22.28	94.1%	1.16	94.59	3.65
	4.37	20.11	1.24	1.73	24.92	22.14	93.5%	1.13	88.15	3.54
	4.42	20.05	1.19	1.68	23.91	22.02	93.0%	1.09	81.84	3.42
	4.47	19.99	1.15	1.63	22.91	21.90	92.5%	1.05	75.74	3.31
	4.52	19.92	1.10	1.58	21.92	21.78	92.0%	1.01	69.84	3.19
	4.57	19.86	1.05	1.53	20.92	21.66	91.5%	0.97	64.14	3.07
	4.62	19.80	1.01	1.48	19.93	21.54	91.0%	0.93	58.66	2.94
	4.67	19.74	0.96	1.43	18.94	21.42	90.5%	0.88	53.39	2.82
	4.72	19.67	0.91	1.38	17.96	21.31	90.0%	0.84	48.33	2.69
	4.77	19.61	0.87	1.33	16.97	21.19	89.5%	0.80	43.49	2.56
	4.82	19.55	0.82	1.28	15.99	21.07	89.0%	0.76	38.88	2.43
	4.87	19.49	0.77	1.23	15.02	20.95	88.5%	0.72	34.49	2.30
	4.92	19.42	0.72	1.18	14.05	20.83	88.0%	0.67	30.34	2.16
	4.97	19.36	0.68	1.13	13.08	20.71	87.5%	0.63	26.42	2.02
	5.02	19.06	0.64	1.08	12.11	20.37	86.0%	0.59	22.98	1.90
	5.07	18.40	0.61	1.03	11.18	19.68	83.1%	0.57	20.14	1.80
	5.12	17.75	0.58	0.98	10.27	18.99	80.2%	0.54	17.51	1.70
WL	5.17	17.36	0.54	0.93	9.39	18.55	78.4%	0.51	14.88	1.58
	5.22	16.97	0.50	0.88	8.54	18.12	76.5%	0.47	12.46	1.46
	5.27	16.63	0.46	0.83	7.70	17.73	74.9%	0.43	11.65	1.51
	5.32	16.07	0.43	0.78	6.87	17.10	72.2%	0.40	9.30	1.35
	5.37	15.02	0.41	0.73	6.10	15.96	67.4%	0.38	7.74	1.27
	5.42	14.03	0.38	0.68	5.37	14.88	62.9%	0.36	6.34	1.18
	5.47	13.37	0.35	0.63	4.69	14.12	59.7%	0.33	4.93	1.05
	5.52	12.93	0.31	0.58	4.03	13.59	57.4%	0.30	3.62	0.90
	5.57	12.29	0.28	0.53	3.40	12.84	54.3%	0.26	2.63	0.77
	5.62	11.56	0.24	0.48	2.81	12.03	50.8%	0.23	1.85	0.66
	5.67	11.15	0.20	0.43	2.24	11.57	48.9%	0.19	1.19	0.53
	5.72	10.71	0.16	0.38	1.69	11.07	46.8%	0.15	0.71	0.42
	5.77	10.26	0.11	0.33	1.17	10.57	44.6%	0.11	0.38	0.32
	5.82	8.03	0.09	0.28	0.69	8.27	34.9%	0.08	0.17	0.25
	5.87	3.46	0.12	0.23	0.41	3.61	15.3%	0.11	0.10	0.24
	5.92	2.63	0.10	0.18	0.26	2.73	11.5%	0.09	0.05	0.18
	5.97	1.78	0.08	0.13	0.14	1.85	7.8%	0.08	0.02	0.13
	6.02	1.19	0.06	0.08	0.07	1.23	5.2%	0.06	0.01	0.08
	6.07	0.85	0.02	0.03	0.02	0.86	3.7%	0.02	0.00	0.03

Data Input & Proofing

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1
DATE: 7/19/2006
OBSERVERS: Uppendahl & Molloy

1/4 SEC:
SECTION:
TWP:
RANGE:
PM:

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE:
USGS MAP: MOSCA PASS
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

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

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

Total Data Points = 41

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	Top Pin	0.00	3.20			0.00	0.00	0.00
	B pin	0.01	3.68			0.00	0.00	0.00
1	GL	0.50	3.76			0.00	0.00	0.00
		1.65	4.34			0.00	0.00	0.00
	WL	2.25	5.09	0.00	0.00	0.00	0.00	0.00
		2.30	5.59	0.50	0.89	0.06	0.06	5.09
		2.50	5.60	0.45	1.28	0.16	0.20	5.15
		3.00	5.50	0.40	1.66	0.20	0.33	5.10
	BR	3.50	5.85	0.80	0.12	0.40	0.05	5.05
		4.00	5.85	0.80	2.09	0.40	0.84	5.05
		4.50	5.85	0.75	2.32	0.38	0.87	5.10
		5.00	5.80	0.70	1.44	0.35	0.50	5.10
		5.50	5.80	0.60	1.75	0.30	0.53	5.20
		6.00	5.85	0.65	2.08	0.33	0.68	5.20
		6.50	5.85	0.80	1.84	0.40	0.74	5.05
		7.00	5.85	0.55	2.86	0.28	0.79	5.30
		7.50	5.80	0.50	2.58	0.25	0.65	5.30
		8.00	5.90	0.80	2.20	0.40	0.88	5.10
		8.50	5.30	0.20	2.25	0.10	0.23	5.10
		9.00	5.40	0.20	1.95	0.10	0.20	5.20
		9.50	5.65	0.60	2.60	0.30	0.78	5.05
		10.00	5.80	0.70	2.60	0.35	0.91	5.10
		10.50	5.85	0.75	2.38	0.38	0.89	5.10
		11.00	5.80	0.65	1.79	0.33	0.58	5.15
		11.50	6.05	0.65	0.47	0.33	0.15	5.40
		12.00	6.10	0.95	0.78	0.48	0.37	5.15
		12.50	6.10	0.85	0.98	0.43	0.42	5.25
		13.00	5.80	0.75	1.99	0.38	0.75	5.05
		13.50	5.85	0.70	2.68	0.35	0.94	5.15
		14.00	6.00	0.60	1.60	0.45	0.72	5.40
	BR	15.00	5.90	0.65	0.14	0.65	0.09	5.25
	BR	16.00	5.60	0.40	0.60	0.40	0.24	5.20
		17.00	5.30	0.15	0.62	0.15	0.09	5.15
		18.00	5.45	0.25	0.74	0.25	0.19	5.20
		19.00	5.25	0.10	0.00	0.10	0.00	5.15
	WL	20.00	5.12	0.00	0.00	0.00	0.00	0.00
		21.50	5.00			0.00	0.00	0.00
1	GL	22.00	3.90			0.00	0.00	0.00
		24.00	3.60			0.00	0.00	0.00
	B pin	24.30	3.65			0.00	0.00	0.00
	Top Pin	24.31	3.26			0.00	0.00	0.00
					Totals	9.40	14.63	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Huerfano River					CROSS-SECTION NO.: #1
CROSS-SECTION LOCATION: Lower end SWA at Picnic					
37 42 18.2		105 22 35.7		WP # 29	
DATE: 7/19/06	OBSERVERS: Uppendahl + Malloy				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: Huerfano	WATERSHED: Huerfano		WATER DIVISION: 2		DOW WATER CODE:
MAP(S): USGS: Mosca Pass					
USFS:					

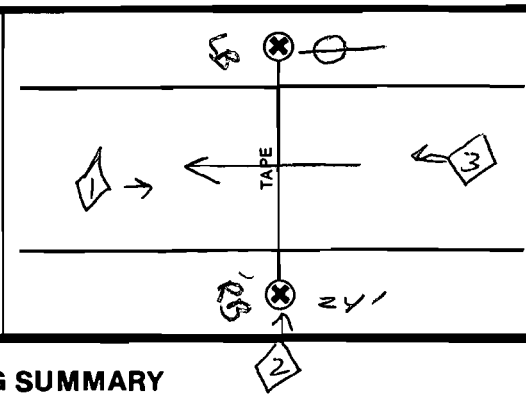
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: FLO-MATE			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 5		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	5.09 / 5.12
② WS Upstream	23.0'	4.95
③ WS Downstream	9.0'	5.30
SLOPE	.39/32' = 0.011	

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:

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Huerfano River | CROSS-SECTION NO.: 1 | DATE: 7/19/06 | SHEET 1 OF 1

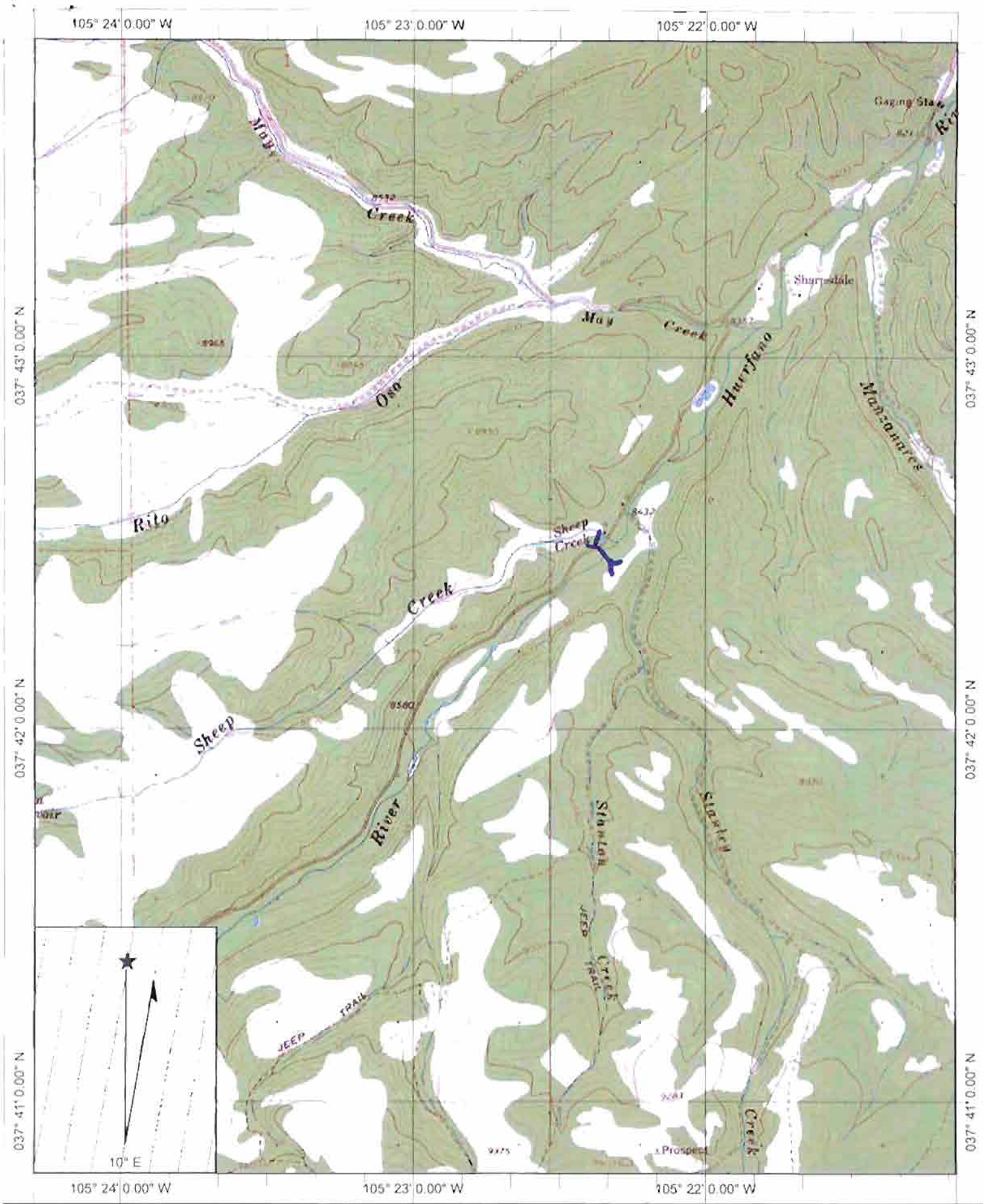
BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / (RIGHT) | Gage Reading: _____ ft | TIME: 14:30

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)
Top S	0		3.20								
Bot S	0		3.68								
GL	0.5		3.76								
	1.65		4.34								
WL	2.25		5.09	0	0.6			0			
	2.30		5.59	.50				.89			
	2.50		5.60	.45				1.28			
	3.0		5.50	.40				1.66			
	9.0		5.85	.80				2.09			
	1.5		5.85	.75				2.32			
	5.0		5.80	.70				1.44			
	5.5		5.80	.60				1.75			
	6.0		5.80	.65				2.08			
	6.5		5.85	.80				1.84			
	7.0		5.85	.55				2.86			
	7.5		5.80	.50				2.58			
	8.0		5.80	.80				2.20			
TB	8.5		5.80	.20				2.25			
	9.0		5.40	.20				1.95			
				.60				2.60			
	10.0		5.80	.70				2.60			
	10.5		5.85	.75				2.38			
	11.0		5.80	.65				1.79			
	11.5		6.05	.65				0.47			
	12.0		6.10	.95				0.78			
	12.5		6.10	.85				0.98			
	13.0		5.80	.75				1.99			
	13.5		5.85	.70				2.68			
	14.0		6.00	.60				1.60			
BR	15.0		5.90	.65				0.14			
BR	16.0		5.60	.40				0.60			
	17.0		5.30	.15				0.62			
	18.0		5.45	.25				0.74			
	19.0		5.25	.10				0			
WL	20.0		5.12	0				0			
	21.5		5.00								
GL	22.0		3.90								
	24.0		3.60		5.85	3.5	.80	0.12			
Bot S	24.3		3.65								
Top S	24.3		3.26								
TOTALS:											

End of Measurement | Time: 15:15 | Gage Reading: _____ ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

HUERFANO CREEK

@ LOWER SWA



Name: MOSCA PASS
Date: 7/31/2006
Scale: 1 inch equals 2000 feet

Location: 037° 42' 19.98" N 105° 22' 43.21" W
Caption: HUERFANO RIVER X#1

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

LOCATION INFORMATION

STREAM NAME:	Huerfano River
XS LOCATION:	Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER:	08/22/07-X1
DATE:	22-Aug-07
OBSERVERS:	Uppendahl
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	0
USGS MAP:	MOSCA PASS
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:	0.0109375

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

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

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

DATA POINTS= 28

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	TS	0.00	3.65			0.00		0.00	0.00	0.0%
	BS	0.01	4.14			0.00		0.00	0.00	0.0%
1	GL	1.50	4.57			0.00		0.00	0.00	0.0%
		1.70	5.00			0.00		0.00	0.00	0.0%
	WL	2.00	5.43	0.00	0.00	0.00		0.00	0.00	0.0%
		3.00	5.99	0.55	0.02	1.15	0.55	0.55	0.01	0.0%
		4.00	6.34	0.90	1.75	1.06	0.90	0.90	1.58	6.0%
		5.00	6.34	0.90	2.02	1.00	0.90	0.90	1.82	7.0%
		6.00	6.39	0.95	3.26	1.00	0.95	0.95	3.10	11.9%
		7.00	6.14	0.70	3.52	1.03	0.70	0.70	2.46	9.5%
		8.00	6.24	0.80	2.95	1.00	0.80	0.80	2.36	9.1%
		9.00	5.94	0.50	3.50	1.04	0.50	0.50	1.75	6.7%
		10.00	6.24	0.80	3.09	1.04	0.80	0.80	2.47	9.5%
		11.00	6.34	0.90	3.52	1.00	0.90	0.90	3.17	12.2%
		12.00	6.54	1.10	1.71	1.02	1.10	1.10	1.88	7.2%
		13.00	6.44	1.00	1.31	1.00	1.00	1.00	1.31	5.0%
		14.00	6.24	0.80	1.26	1.02	0.80	0.80	1.01	3.9%
	BR	15.00	6.14	0.70	0.00	1.00	0.70	0.70	0.00	0.0%
		16.00	5.94	0.50	2.04	1.02	0.50	0.50	1.02	3.9%
		17.00	5.94	0.50	2.58	1.00	0.50	0.50	1.29	5.0%
		18.00	5.74	0.30	1.78	1.02	0.30	0.30	0.53	2.1%
		19.00	5.79	0.35	0.10	1.00	0.35	0.35	0.04	0.1%
		20.00	5.64	0.20	1.07	1.01	0.20	0.20	0.21	0.8%
		21.00	5.49	0.05	0.76	1.01	0.05	0.04	0.03	0.1%
	WL	21.70	5.45	0.00	0.00	0.70		0.00	0.00	0.0%
1	GL	22.00	4.56			0.00		0.00	0.00	0.0%
	BS	24.30	4.04			0.00		0.00	0.00	0.0%
	TS	24.31	3.72			0.00		0.00	0.00	0.0%
	TOTALS ----------					20.15	1.1 (Max.)	12.49	26.04	100.0%

VALUES COMPUTED FROM RAW FIELD DATA

Manning's n = 0.0542
Hydraulic Radius= 0.619986765

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	12.49	12.49	0.0%
5.19	12.49	17.45	39.7%
5.21	12.49	17.05	36.5%
5.23	12.49	16.65	33.3%
5.25	12.49	16.25	30.1%
5.27	12.49	15.85	26.9%
5.29	12.49	15.46	23.7%
5.31	12.49	15.06	20.6%
5.33	12.49	14.66	17.4%
5.35	12.49	14.27	14.2%
5.37	12.49	13.87	11.0%
5.39	12.49	13.48	7.9%
5.40	12.49	13.28	6.3%
5.41	12.49	13.08	4.7%
5.42	12.49	12.89	3.1%
5.43	12.49	12.69	1.6%
5.44	12.49	12.49	0.0%
5.45	12.49	12.29	-1.6%
5.46	12.49	12.10	-3.2%
5.47	12.49	11.90	-4.7%
5.48	12.49	11.71	-6.2%
5.49	12.49	11.52	-7.8%
5.51	12.49	11.15	-10.8%
5.53	12.49	10.77	-13.8%
5.55	12.49	10.40	-16.7%
5.57	12.49	10.04	-19.6%
5.59	12.49	9.68	-22.5%
5.61	12.49	9.32	-25.4%
5.63	12.49	8.96	-28.3%
5.65	12.49	8.61	-31.1%
5.67	12.49	8.26	-33.9%
5.69	12.49	7.91	-36.7%

WATERLINE AT ZERO
AREA ERROR = 5.440

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

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	4.57	20.50	1.46	1.97	30.00	22.08	100.0%	1.36	105.50	3.52
	4.59	20.48	1.44	1.95	29.59	22.03	99.8%	1.34	103.25	3.49
	4.64	20.44	1.40	1.90	28.57	21.93	99.3%	1.30	97.69	3.42
	4.69	20.40	1.35	1.85	27.54	21.82	98.8%	1.26	92.24	3.35
	4.74	20.36	1.30	1.80	26.53	21.71	98.3%	1.22	86.91	3.28
	4.79	20.32	1.26	1.75	25.51	21.60	97.9%	1.18	81.70	3.20
	4.84	20.28	1.21	1.70	24.49	21.49	97.4%	1.14	76.61	3.13
	4.89	20.24	1.16	1.65	23.48	21.39	96.9%	1.10	71.64	3.05
	4.94	20.20	1.11	1.60	22.47	21.28	96.4%	1.06	66.80	2.97
	4.99	20.16	1.06	1.55	21.46	21.17	95.9%	1.01	62.08	2.89
	5.04	20.11	1.02	1.50	20.45	21.06	95.4%	0.97	57.51	2.81
	5.09	20.06	0.97	1.45	19.45	20.94	94.9%	0.93	53.07	2.73
	5.14	20.01	0.92	1.40	18.45	20.83	94.4%	0.89	48.77	2.64
	5.19	19.96	0.87	1.35	17.45	20.72	93.8%	0.84	44.61	2.56
	5.24	19.90	0.83	1.30	16.45	20.60	93.3%	0.80	40.60	2.47
	5.29	19.85	0.78	1.25	15.46	20.49	92.8%	0.75	36.73	2.38
	5.34	19.80	0.73	1.20	14.47	20.38	92.3%	0.71	33.01	2.28
	5.39	19.75	0.68	1.15	13.48	20.26	91.8%	0.67	29.45	2.18
WL	5.44	19.69	0.63	1.10	12.49	20.14	91.2%	0.62	26.05	2.09
	5.49	18.89	0.61	1.05	11.52	19.33	87.5%	0.60	23.41	2.03
	5.54	18.47	0.57	1.00	10.59	18.89	85.6%	0.56	20.64	1.95
	5.59	18.05	0.54	0.95	9.68	18.45	83.6%	0.52	18.05	1.86
	5.64	17.63	0.50	0.90	8.79	18.01	81.6%	0.49	15.61	1.78
	5.69	17.20	0.46	0.85	7.91	17.57	79.6%	0.45	13.33	1.68
	5.74	16.78	0.42	0.80	7.07	17.13	77.6%	0.41	11.22	1.59
	5.79	15.11	0.41	0.75	6.27	15.43	69.9%	0.41	9.85	1.57
	5.84	14.77	0.37	0.70	5.52	15.08	68.3%	0.37	8.10	1.47
	5.89	14.43	0.33	0.65	4.79	14.72	66.7%	0.33	6.50	1.36
	5.94	13.09	0.31	0.60	4.08	13.36	60.5%	0.31	5.30	1.30
	5.99	12.42	0.28	0.55	3.44	12.66	57.3%	0.27	4.14	1.20
	6.04	11.69	0.24	0.50	2.84	11.90	53.9%	0.24	3.13	1.10
	6.09	10.97	0.21	0.45	2.27	11.15	50.5%	0.20	2.25	0.99
	6.14	10.24	0.17	0.40	1.74	10.40	47.1%	0.17	1.52	0.87
	6.19	8.56	0.15	0.35	1.27	8.68	39.3%	0.15	1.01	0.80
	6.24	6.89	0.13	0.30	0.88	6.97	31.6%	0.13	0.64	0.72
	6.29	5.79	0.10	0.25	0.57	5.86	26.5%	0.10	0.34	0.60
	6.34	3.70	0.08	0.20	0.31	3.74	17.0%	0.08	0.16	0.54
	6.39	2.00	0.08	0.15	0.16	2.03	9.2%	0.08	0.09	0.53
	6.44	1.50	0.05	0.10	0.08	1.52	6.9%	0.05	0.03	0.39
	6.49	0.75	0.03	0.05	0.02	0.76	3.4%	0.02	0.00	0.24
	6.54	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

3/3 = 2.3

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

SUMMARY SHEET

MEASURED FLOW (Qm)=	26.04	cfs
CALCULATED FLOW (Qc)=	26.05	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.44	ft
CALCULATED WATERLINE (WLc)=	5.44	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=	2.09	ft/sec
MANNING'S N=	0.054	
SLOPE=	0.0109375	ft/ft
.4 * Qm =	10.4	cfs
2.5 * Qm=	65.1	cfs

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

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

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

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

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

Data Input & Proofing

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1
DATE: 8/22/2007
OBSERVERS: Uppendahl

1/4 SEC:
SECTION:
TWP:
RANGE:
PM:

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE:
USGS MAP: MOSCA PASS
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

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

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

Total Data Points = 28

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	3.65			0.00	0.00	0.00
	BS	0.01	4.14			0.00	0.00	0.00
1	GL	1.50	4.57			0.00	0.00	0.00
		1.70	5.00			0.00	0.00	0.00
	WL	2.00	5.43	0.00	0.00	0.00	0.00	0.00
		3.00	5.99	0.55	0.02	0.55	0.01	5.44
		4.00	6.34	0.90	1.75	0.90	1.58	5.44
		5.00	6.34	0.90	2.02	0.90	1.82	5.44
		6.00	6.39	0.95	3.26	0.95	3.10	5.44
		7.00	6.14	0.70	3.52	0.70	2.46	5.44
		8.00	6.24	0.80	2.95	0.80	2.36	5.44
		9.00	5.94	0.50	3.50	0.50	1.75	5.44
		10.00	6.24	0.80	3.09	0.80	2.47	5.44
		11.00	6.34	0.90	3.52	0.90	3.17	5.44
		12.00	6.54	1.10	1.71	1.10	1.88	5.44
		13.00	6.44	1.00	1.31	1.00	1.31	5.44
		14.00	6.24	0.80	1.26	0.80	1.01	5.44
	BR	15.00	6.14	0.70	0.00	0.70	0.00	5.44
		16.00	5.94	0.50	2.04	0.50	1.02	5.44
		17.00	5.94	0.50	2.58	0.50	1.29	5.44
		18.00	5.74	0.30	1.78	0.30	0.53	5.44
		19.00	5.79	0.35	0.10	0.35	0.04	5.44
		20.00	5.64	0.20	1.07	0.20	0.21	5.44
		21.00	5.49	0.05	0.76	0.04	0.03	5.44
	WL	21.70	5.45	0.00	0.00	0.00	0.00	0.00
1	GL	22.00	4.56			0.00	0.00	0.00
	BS	24.30	4.04			0.00	0.00	0.00
	TS	24.31	3.72			0.00	0.00	0.00
					Totals	12.49	26.04	

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.38

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

Velocity based on test of R/D84>1

	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	4.57	20.50	1.46	1.97	30.00	22.08	100.0%	1.36	129.04	4.30
	4.59	20.48	1.44	1.95	29.59	22.03	99.8%	1.34	125.98	4.26
	4.64	20.44	1.40	1.90	28.57	21.93	99.3%	1.30	118.43	4.15
	4.69	20.40	1.35	1.85	27.54	21.82	98.8%	1.26	111.07	4.03
	4.74	20.36	1.30	1.80	26.53	21.71	98.3%	1.22	103.91	3.92
	4.79	20.32	1.26	1.75	25.51	21.60	97.9%	1.18	96.94	3.80
	4.84	20.28	1.21	1.70	24.49	21.49	97.4%	1.14	90.18	3.68
	4.89	20.24	1.16	1.65	23.48	21.39	96.9%	1.10	83.61	3.56
	4.94	20.20	1.11	1.60	22.47	21.28	96.4%	1.06	77.25	3.44
	4.99	20.16	1.06	1.55	21.46	21.17	95.9%	1.01	71.10	3.31
	5.04	20.11	1.02	1.50	20.45	21.06	95.4%	0.97	65.18	3.19
	5.09	20.06	0.97	1.45	19.45	20.94	94.9%	0.93	59.48	3.06
	5.14	20.01	0.92	1.40	18.45	20.83	94.4%	0.89	54.00	2.93
	5.19	19.96	0.87	1.35	17.45	20.72	93.8%	0.84	48.75	2.79
	5.24	19.90	0.83	1.30	16.45	20.60	93.3%	0.80	43.72	2.66
	5.29	19.85	0.78	1.25	15.46	20.49	92.8%	0.75	38.94	2.52
	5.34	19.80	0.73	1.20	14.47	20.38	92.3%	0.71	34.39	2.38
	5.39	19.75	0.68	1.15	13.48	20.26	91.8%	0.67	30.09	2.23
WL	5.44	19.69	0.63	1.10	12.49	20.14	91.2%	0.62	26.05	2.09
	5.49	18.89	0.61	1.05	11.52	19.33	87.5%	0.60	23.02	2.00
	5.54	18.47	0.57	1.00	10.59	18.89	85.6%	0.56	19.86	1.88
	5.59	18.05	0.54	0.95	9.68	18.45	83.6%	0.52	16.92	1.75
	5.64	17.63	0.50	0.90	8.79	18.01	81.6%	0.49	14.22	1.62
	5.69	17.20	0.46	0.85	7.91	17.57	79.6%	0.45	11.76	1.49
	5.74	16.78	0.42	0.80	7.07	17.13	77.6%	0.41	9.52	1.35
	5.79	15.11	0.41	0.75	6.27	15.43	69.9%	0.41	8.20	1.31
	5.84	14.77	0.37	0.70	5.52	15.08	68.3%	0.37	7.11	1.29
	5.89	14.43	0.33	0.65	4.79	14.72	66.7%	0.33	5.19	1.08
	5.94	13.09	0.31	0.60	4.08	13.36	60.5%	0.31	4.11	1.01
	5.99	12.42	0.28	0.55	3.44	12.66	57.3%	0.27	2.97	0.86
	6.04	11.69	0.24	0.50	2.84	11.90	53.9%	0.24	2.07	0.73
	6.09	10.97	0.21	0.45	2.27	11.15	50.5%	0.20	1.37	0.60
	6.14	10.24	0.17	0.40	1.74	10.40	47.1%	0.17	0.84	0.48
	6.19	8.56	0.15	0.35	1.27	8.68	39.3%	0.15	0.53	0.41
	6.24	6.89	0.13	0.30	0.88	6.97	31.6%	0.13	0.31	0.35
	6.29	5.79	0.10	0.25	0.57	5.86	26.5%	0.10	0.15	0.26
	6.34	3.70	0.08	0.20	0.31	3.74	17.0%	0.08	0.06	0.20
	6.39	2.00	0.08	0.15	0.16	2.03	9.2%	0.08	0.03	0.15
	6.44	1.50	0.05	0.10	0.08	1.52	6.9%	0.05	0.01	0.08
	6.49	0.75	0.03	0.05	0.02	0.76	3.4%	0.02	0.00	0.03
	6.54	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO WATER CONSERVATION BOARD

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

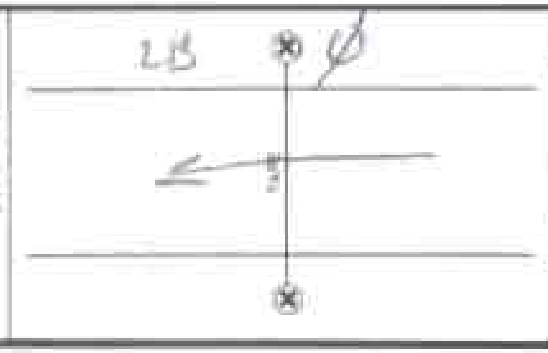
STREAM NAME: Huerfano River			CROSS-SECTION NO.:
CROSS-SECTION LOCATION: Lower SWA - 37 42 .72 105 22 35.7 u/s of Sheep Creek			
DATE: 8/21/07	OBSERVERS: Uppendahl		
LEGAL DESCRIPTION: ¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W PM:
COUNTY: Huerfano	WATERSHED: Huerfano	WATER DIVISION: 2	DOW WATER CODE:
MAPS: USGS:			
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: ____ lbs/foot · TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: (YES) NO	NUMBER OF PHOTOGRAPHS:	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream		
③ WS Downstream		
SLOPE	.35/32	



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Huerfano River	CROSS-SECTION NO: 2	DATE: 8/21/07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 14:30

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Rod (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)
TS	0		3.65								
BS	0		4.14								
GL	1.5		4.57								
	1.7		5.00								
WL	2.0		5.43	0				0			
	3			.55				.002			
	4			.90				1.75			
	5			.90				2.02			
	6			.85				3.26			
	7			.70				3.52			
	8			.80				2.95			
	9			.50				3.50			
	10			.80	.9			3.09	3.35		
	11			.9	.9			3.52			
	12			1.1	.9			1.71	2.35		
	13			1.0	1.1			1.31	1.01		
	14			.80				1.26			
BL	15			.70				0			
	16			.50				2.04			
	17			.50				2.58			
	18			.30				1.78			
	19			.35				0.10			
	20			.10				1.07			
	21			.05				.76			
SW	21.7		5.45	0				0			
GL	22.0		4.56								
BS	24.3		4.01								
TS	24.3		3.72								
TOTALS:											26.04

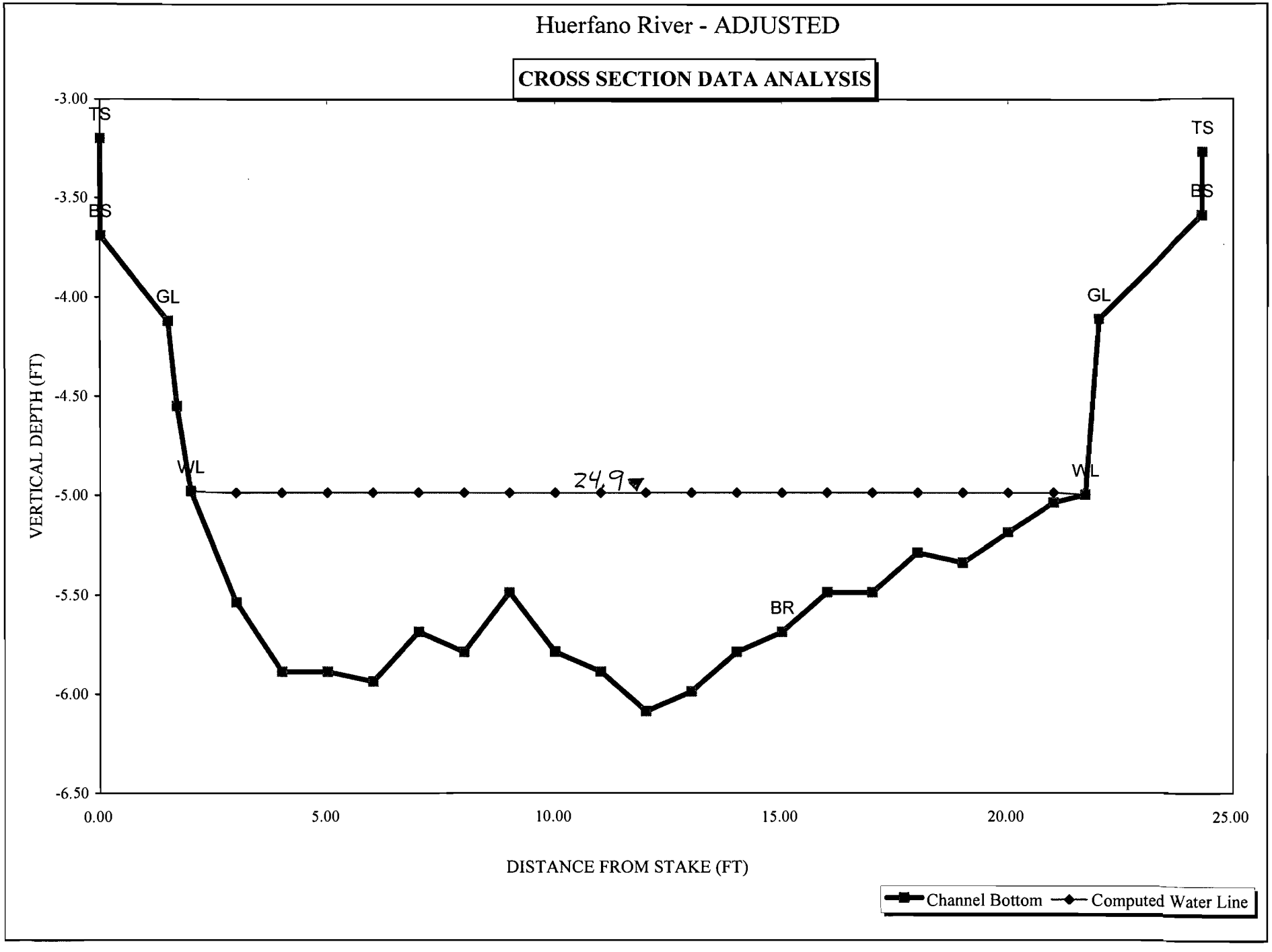
End of Measurement	Time: 15:30	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY	CALCULATIONS CHECKED BY:

HUERFANO RIVER

LOWER SWA - Tributary

37 42' 18.2" & 105 22' 35.7"

Huerfano River - ADJUSTED



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

LOCATION INFORMATION

STREAM NAME:	Huerfano River
XS LOCATION:	Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER:	07/19/06-X2
DATE:	19-Jul-06
OBSERVERS:	Uppendahl & Molloy
1/4 SEC:	SE
SECTION:	23
TWP:	27 S
RANGE:	72 W
PM:	6
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	0
USGS MAP:	MOSCA PASS
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:	0.01260504

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

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

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TOP PIN	0.00	1.63			0.00		0.00	0.00	0.0%
B PIN	0.01	2.39			0.00		0.00	0.00	0.0%
1 GL	1.00	2.53			0.00		0.00	0.00	0.0%
	2.00	3.00			0.00		0.00	0.00	0.0%
	2.15	4.22			0.00		0.00	0.00	0.0%
WL	2.75	4.68	0.00	0.00	0.00		0.00	0.00	0.0%
	4.00	4.90	0.20	1.05	1.27	0.20	0.23	0.24	1.8%
	5.00	4.85	0.15	1.12	1.00	0.15	0.15	0.17	1.3%
	6.00	5.00	0.35	0.66	1.01	0.35	0.35	0.23	1.7%
	7.00	4.95	0.30	1.71	1.00	0.30	0.30	0.51	3.9%
	8.00	5.00	0.35	1.12	1.00	0.35	0.35	0.39	3.0%
	9.00	5.10	0.45	1.76	1.00	0.45	0.45	0.79	6.0%
	10.00	5.00	0.35	1.23	1.00	0.35	0.26	0.32	2.4%
	10.50	5.25	0.50	1.20	0.56	0.50	0.25	0.30	2.3%
	11.00	5.40	0.60	0.75	0.52	0.60	0.30	0.23	1.7%
	11.50	5.40	0.70	1.22	0.50	0.70	0.35	0.43	3.2%
	12.00	5.35	0.60	2.13	0.50	0.60	0.30	0.64	4.8%
	12.50	5.40	0.85	2.55	0.50	0.85	0.43	1.08	8.2%
	13.00	5.40	0.55	2.89	0.50	0.55	0.28	0.79	6.0%
	13.50	5.35	0.70	2.00	0.50	0.70	0.35	0.70	5.3%
	14.00	5.20	0.60	2.80	0.52	0.60	0.30	0.84	6.3%
	14.50	5.20	0.60	1.72	0.50	0.60	0.30	0.52	3.9%
	15.00	5.10	0.40	2.89	0.51	0.40	0.20	0.58	4.4%
	15.50	5.25	0.75	3.09	0.52	0.75	0.38	1.16	8.8%
	16.00	5.25	0.55	2.50	0.50	0.55	0.28	0.69	5.2%
	16.50	5.25	0.70	1.77	0.50	0.70	0.35	0.62	4.7%
	17.00	5.20	0.60	1.93	0.50	0.60	0.45	0.87	6.6%
	18.00	5.00	0.30	1.01	1.02	0.30	0.30	0.30	2.3%
	19.00	5.05	0.25	1.89	1.00	0.25	0.25	0.47	3.6%
TR	20.00	4.90	0.05	0.79	1.01	0.05	0.05	0.04	0.3%
	21.00	5.00	0.25	1.11	1.00	0.25	0.25	0.28	2.1%
	22.00	4.85	0.10	0.50	1.01	0.10	0.10	0.05	0.4%
WL	23.00	4.68	0.00	0.00	1.01		0.00	0.00	0.0%
	26.00	4.50			0.00		0.00	0.00	0.0%
1 GL	26.50	3.80			0.00		0.00	0.00	0.0%
B PIN	27.90	3.65			0.00		0.00	0.00	0.0%
TOP PIN	27.91	2.95			0.00		0.00	0.00	0.0%
TOTALS ----------					20.50	0.85 (Max.)	7.54	13.24	100.0%

Manning's n = 0.0488
Hydraulic Radius= 0.367650193

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.54	7.76	2.9%
4.43	7.54	13.34	77.0%
4.45	7.54	12.87	70.8%
4.47	7.54	12.40	64.5%
4.49	7.54	11.93	58.3%
4.51	7.54	11.46	52.0%
4.53	7.54	11.00	45.9%
4.55	7.54	10.54	39.9%
4.57	7.54	10.09	33.9%
4.59	7.54	9.65	28.1%
4.61	7.54	9.22	22.3%
4.63	7.54	8.79	16.7%
4.64	7.54	8.58	13.9%
4.65	7.54	8.37	11.1%
4.66	7.54	8.17	8.3%
4.67	7.54	7.96	5.6%
4.68	7.54	7.76	2.9%
4.69	7.54	7.56	0.2%
4.70	7.54	7.35	-2.4%
4.71	7.54	7.16	-5.1%
4.72	7.54	6.96	-7.7%
4.73	7.54	6.76	-10.3%
4.75	7.54	6.37	-15.5%
4.77	7.54	5.98	-20.6%
4.79	7.54	5.60	-25.7%
4.81	7.54	5.22	-30.7%
4.83	7.54	4.85	-35.7%
4.85	7.54	4.48	-40.5%
4.87	7.54	4.12	-45.3%
4.89	7.54	3.78	-49.8%
4.91	7.54	3.45	-54.2%
4.93	7.54	3.14	-58.3%

WATERLINE AT ZERO
AREA ERROR = 4.691

STREAM NAME: [illegible]
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 08.2" 106 24' 06.3
XS NUMBER: [illegible]

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"	3.80	24.48	1.17	1.60	28.52	25.50	100.0%	1.12	105.34	3.69
	3.84	24.37	1.13	1.56	27.54	25.40	99.6%	1.08	99.27	3.60
	3.89	24.33	1.09	1.54	26.51	25.34	99.2%	1.04	92.20	3.51
	3.94	24.26	1.03	1.46	25.09	25.22	98.8%	0.99	85.05	3.44
	3.99	24.24	0.98	1.41	23.88	25.13	98.3%	0.95	79.00	3.31
	4.04	24.20	0.94	1.36	22.67	25.07	97.9%	0.91	72.60	3.20
	4.09	24.16	0.89	1.31	21.46	24.99	97.5%	0.86	66.51	3.10
	4.14	24.12	0.84	1.26	20.25	24.79	97.3%	0.82	60.53	2.99
	4.19	24.07	0.79	1.21	19.05	24.67	96.8%	0.77	54.85	2.88
	4.24	24.01	0.74	1.16	17.85	24.55	96.1%	0.73	49.37	2.77
	4.29	23.91	0.70	1.11	16.65	24.40	95.5%	0.68	44.14	2.65
	4.34	23.81	0.65	1.06	15.46	24.26	95.0%	0.64	39.11	2.53
	4.39	23.71	0.60	1.01	14.27	24.12	94.4%	0.59	34.40	2.41
	4.44	23.60	0.55	0.96	13.09	23.97	93.8%	0.55	29.90	2.28
	4.49	23.50	0.51	0.91	11.91	23.83	93.3%	0.50	25.65	2.15
	4.54	22.75	0.47	0.86	10.73	23.05	90.2%	0.47	22.11	2.06
	4.59	21.92	0.44	0.81	9.63	22.19	86.8%	0.43	19.30	2.00
	4.64	20.89	0.41	0.76	8.56	21.22	83.1%	0.40	16.00	1.87
"WL"	4.69	20.12	0.37	0.71	7.54	20.37	79.8%	0.37	13.29	1.76
	4.74	19.55	0.33	0.66	6.55	19.79	77.5%	0.33	10.77	1.64
	4.79	18.97	0.29	0.61	5.58	19.20	75.2%	0.29	8.38	1.50
	4.84	18.33	0.25	0.56	4.64	18.51	72.5%	0.25	6.23	1.36
	4.89	16.69	0.23	0.51	3.77	16.85	66.0%	0.22	4.72	1.25
	4.94	15.11	0.20	0.46	2.98	15.24	59.7%	0.20	3.44	1.15
	4.99	11.97	0.19	0.41	2.26	12.15	47.6%	0.19	2.57	1.12
	5.04	9.14	0.19	0.36	1.76	9.30	36.4%	0.19	1.99	1.13
	5.09	7.56	0.18	0.31	1.35	7.68	30.1%	0.18	1.45	1.07
	5.14	6.01	0.16	0.26	1.00	6.78	26.1%	0.15	0.95	0.95
	5.19	5.44	0.12	0.21	0.68	5.58	21.9%	0.12	0.55	0.81
	5.24	4.50	0.10	0.16	0.43	4.55	17.8%	0.09	0.31	0.71
	5.29	3.09	0.09	0.11	0.26	3.09	12.1%	0.08	0.17	0.66
	5.34	2.73	0.04	0.06	0.12	2.74	10.7%	0.04	0.05	0.42
	5.39	1.32	0.03	0.03	0.04	1.33	5.1%	0.03	0.00	0.13

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2

SUMMARY SHEET

MEASURED FLOW (Qm)=	13.24	cfs
CALCULATED FLOW (Qc)=	13.29	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	4.68	ft
CALCULATED WATERLINE (WLc)=	4.69	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.85	ft
MAX CALCULATED DEPTH (Dc)=	0.71	ft
(Dm-Dc)/Dm * 100	16.6	%
MEAN VELOCITY=	1.76	ft/sec
MANNING'S N=	0.049	
SLOPE=	0.01260504	ft/ft
.4 * Qm =	5.3	cfs
2.5 * Qm=	33.1	cfs

RECOMMENDED INSTREAM FLOW:

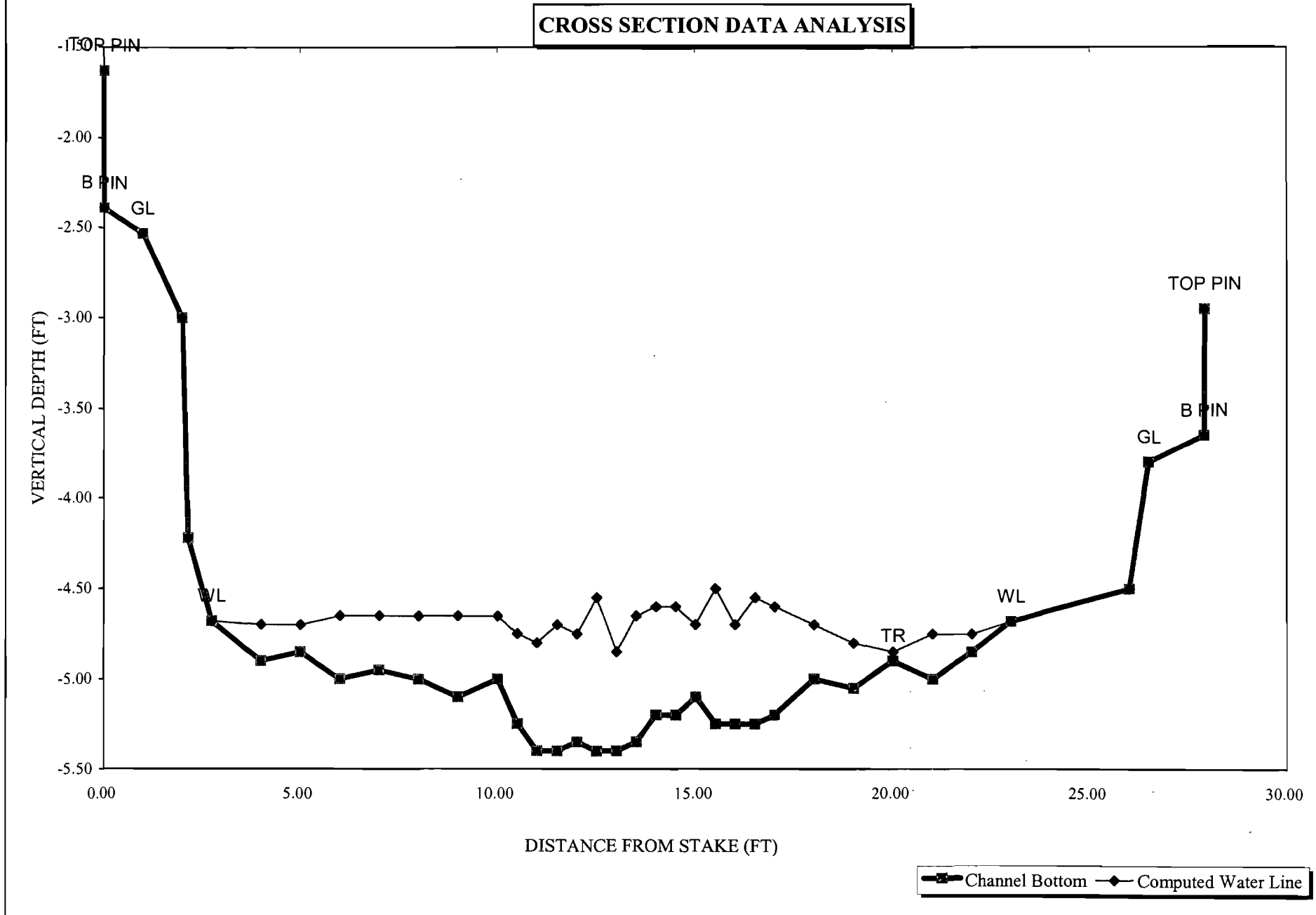
FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Huerfano River



Data Input & Proofing

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2
DATE: 7/19/2006
OBSERVERS: Uppendahl & Molloy

1/4 SEC: SE
SECTION: 23
TWP: 27 S
RANGE: 72 W
PM: 12:00 AM

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE:
USGS MAP: MOSCA PASS
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

SLOPE: 0.012605042 ft / ft

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

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

Total Data Points = 37

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TOP PIN	0.00	1.63			0.00	0.00	0.00
	B PIN	0.01	2.39			0.00	0.00	0.00
1	GL	1.00	2.53			0.00	0.00	0.00
		2.00	3.00			0.00	0.00	0.00
		2.15	4.22			0.00	0.00	0.00
	WL	2.75	4.68	0.00	0.00	0.00	0.00	0.00
		4.00	4.90	0.20	1.05	0.23	0.24	4.70
		5.00	4.85	0.15	1.12	0.15	0.17	4.70
		6.00	5.00	0.35	0.66	0.35	0.23	4.65
		7.00	4.95	0.30	1.71	0.30	0.51	4.65
		8.00	5.00	0.35	1.12	0.35	0.39	4.65
		9.00	5.10	0.45	1.76	0.45	0.79	4.65
		10.00	5.00	0.35	1.23	0.26	0.32	4.65
		10.50	5.25	0.50	1.20	0.25	0.30	4.75
		11.00	5.40	0.60	0.75	0.30	0.23	4.80
		11.50	5.40	0.70	1.22	0.35	0.43	4.70
		12.00	5.35	0.60	2.13	0.30	0.64	4.75
		12.50	5.40	0.85	2.55	0.43	1.08	4.55
		13.00	5.40	0.55	2.89	0.28	0.79	4.85
		13.50	5.35	0.70	2.00	0.35	0.70	4.65
		14.00	5.20	0.60	2.80	0.30	0.84	4.60
		14.50	5.20	0.60	1.72	0.30	0.52	4.60
		15.00	5.10	0.40	2.89	0.20	0.58	4.70
		15.50	5.25	0.75	3.09	0.38	1.16	4.50
		16.00	5.25	0.55	2.50	0.28	0.69	4.70
		16.50	5.25	0.70	1.77	0.35	0.62	4.55
		17.00	5.20	0.60	1.93	0.45	0.87	4.60
		18.00	5.00	0.30	1.01	0.30	0.30	4.70
		19.00	5.05	0.25	1.89	0.25	0.47	4.80
	TR	20.00	4.90	0.05	0.79	0.05	0.04	4.85
		21.00	5.00	0.25	1.11	0.25	0.28	4.75
		22.00	4.85	0.10	0.50	0.10	0.05	4.75
	WL	23.00	4.68	0.00	0.00	0.00	0.00	0.00
		26.00	4.50			0.00	0.00	0.00
1	GL	26.50	3.80			0.00	0.00	0.00
	B PIN	27.90	3.65			0.00	0.00	0.00
	TOP PIN	27.91	2.95			0.00	0.00	0.00
					Totals	7.54	13.24	

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.24

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

Velocity based on test of R/D84>1

	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	24.40	1.17	1.60	28.52	25.55	100.0%	1.12	136.79	4.80
	3.84	24.37	1.13	1.56	27.53	25.46	99.6%	1.08	128.51	4.67
	3.89	24.33	1.08	1.51	26.31	25.34	99.2%	1.04	118.69	4.51
	3.94	24.28	1.03	1.46	25.09	25.23	98.8%	0.99	109.19	4.35
	3.99	24.24	0.99	1.41	23.88	25.12	98.3%	0.95	100.01	4.19
	4.04	24.20	0.94	1.36	22.67	25.01	97.9%	0.91	91.17	4.02
	4.09	24.16	0.89	1.31	21.46	24.90	97.5%	0.86	82.67	3.85
	4.14	24.12	0.84	1.26	20.25	24.78	97.0%	0.82	74.52	3.68
	4.19	24.07	0.79	1.21	19.05	24.67	96.6%	0.77	66.73	3.50
	4.24	24.01	0.74	1.16	17.85	24.55	96.1%	0.73	59.32	3.32
	4.29	23.91	0.70	1.11	16.65	24.40	95.5%	0.68	52.33	3.14
	4.34	23.81	0.65	1.06	15.46	24.26	95.0%	0.64	45.72	2.96
	4.39	23.71	0.60	1.01	14.27	24.12	94.4%	0.59	39.50	2.77
	4.44	23.60	0.55	0.96	13.09	23.97	93.8%	0.55	33.68	2.57
	4.49	23.50	0.51	0.91	11.91	23.83	93.3%	0.50	28.27	2.37
	4.54	22.75	0.47	0.86	10.75	23.05	90.2%	0.47	23.88	2.22
	4.59	21.85	0.44	0.81	9.63	22.14	86.6%	0.44	19.99	2.08
	4.64	20.95	0.41	0.76	8.56	21.22	83.1%	0.40	16.48	1.92
WL	4.69	20.12	0.37	0.71	7.54	20.37	79.8%	0.37	13.29	1.76
	4.74	19.55	0.33	0.66	6.55	19.79	77.5%	0.33	10.31	1.57
	4.79	18.97	0.29	0.61	5.58	19.20	75.2%	0.29	7.69	1.38
	4.84	18.39	0.25	0.56	4.65	18.61	72.9%	0.25	5.44	1.17
	4.89	16.69	0.23	0.51	3.77	16.90	66.2%	0.22	3.49	0.93
	4.94	15.11	0.20	0.46	2.97	15.30	59.9%	0.19	2.38	0.80
	4.99	11.97	0.19	0.41	2.29	12.15	47.6%	0.19	1.84	0.80
	5.04	9.14	0.19	0.36	1.76	9.30	36.4%	0.19	1.51	0.85
	5.09	7.55	0.18	0.31	1.35	7.68	30.1%	0.18	1.08	0.80
	5.14	6.67	0.15	0.26	1.00	6.78	26.5%	0.15	0.63	0.63
	5.19	5.91	0.12	0.21	0.68	5.98	23.4%	0.11	0.32	0.46
	5.24	4.50	0.10	0.16	0.43	4.55	17.8%	0.09	0.16	0.37
	5.29	3.06	0.09	0.11	0.26	3.09	12.1%	0.08	0.08	0.31
	5.34	2.73	0.04	0.06	0.12	2.74	10.7%	0.04	0.02	0.16
	5.39	1.30	0.01	0.01	0.01	1.31	5.1%	0.01	0.00	0.08

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Huerfano River			CROSS-SECTION NO.: #2
CROSS-SECTION LOCATION: Upper SWA			
DATE: 7/19/06	OBSERVERS: Pamdell + Malloy		
LEGAL DESCRIPTION — ¼ SECTION: SE	SECTION: 23	TOWNSHIP: 27 N/(S)	RANGE: 72 E/(W) PM: 6 PM
COUNTY: Huerfano	WATERSHED: Huerfano River	WATER DIVISION: 2	DOW WATER CODE:
MAP(S): USGS: Mosca Pass	USFS:		

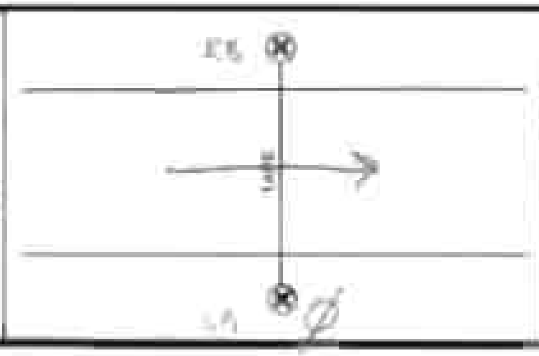
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: FLO-MATE	
METER NUMBER:	DATE RATED:	CALIB/SPIN: ___ sec; TAPE WEIGHT: ___ lbs/ft; TAPE TENSION: ___ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS:

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	4.48/4.48
② WS Upstream	16.0	4.50
③ WS Downstream	43.5'	5.25
SLOPE	.75/59.5 = 0.0126	

SKETCH



LEGEND: Stake ⊗; Station ①; Photo ◇—•; Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Huerfano River	CROSS-SECTION NO. 2	DATE 7/19/06	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME 16:30

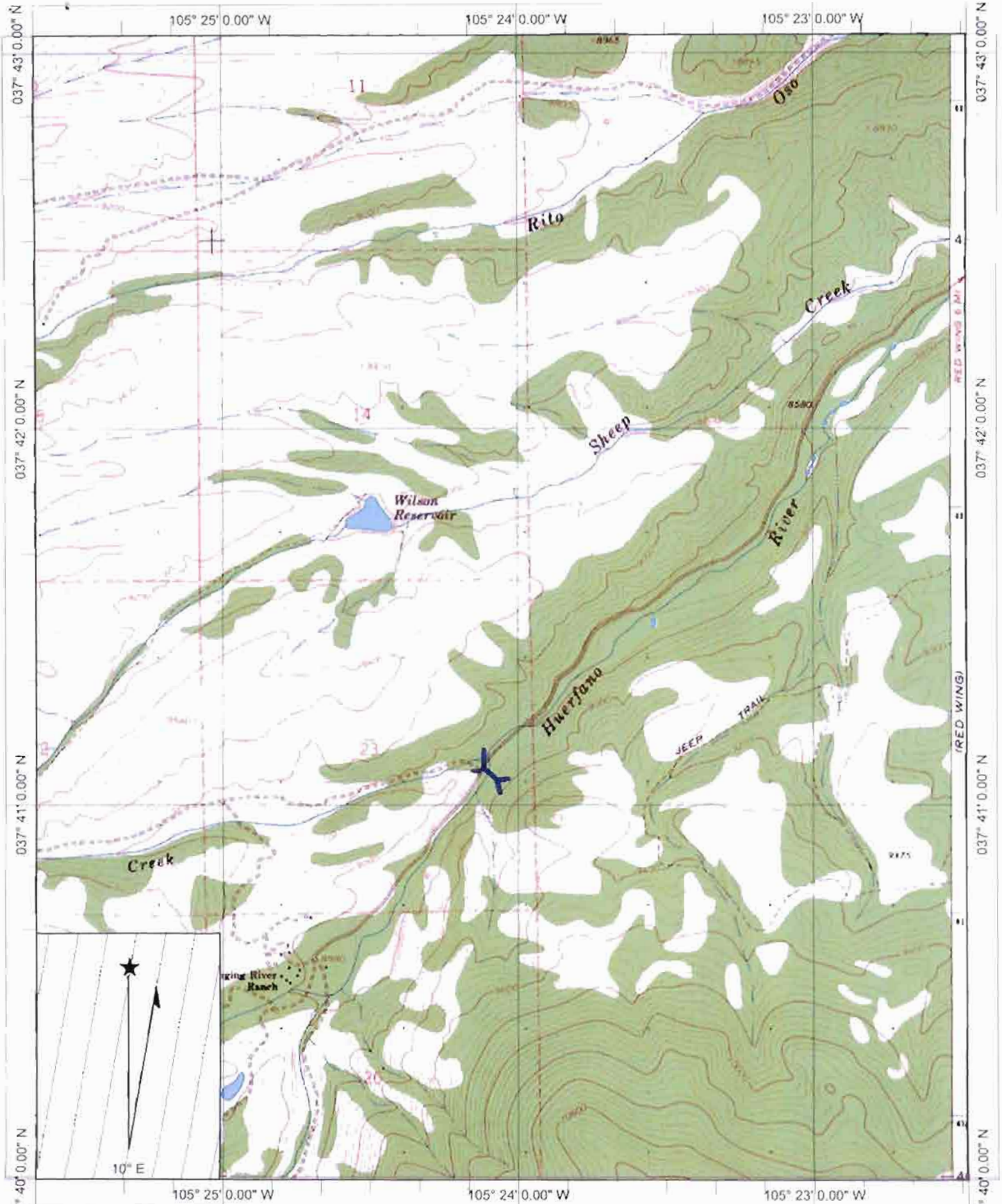
Features (Stake (S) Grassline (G) Waterline (W) Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Rod (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
Top S	0		1.63								
Bot S	0		2.39								
GL	1.0		2.53								
	2.0		3.00								
	2.15		4.22								
WL	2.75		4.68	0				0			
	4.00		4.90	.20				1.05			
	5.0		4.85	.15				1.12			
	6.0		5.00	.35				.66			
	7.0		4.95	.30				1.71			
	8.0		5.00	.35				1.12			
	9.0		5.10	.45				1.76			
	10.0		5.00	.35				1.23			
	10.5		5.25	.50	[illegible]			[illegible]	1.20		
	11		5.40	[illegible]	.60			[illegible]	.75		
	11.5		5.40	[illegible]	.70			[illegible]	1.22		
	12		5.35	.60				2.13			
	12.5		5.40	.85				2.55			
	13		5.40	.55				2.89			
	13.5		5.35	.70				[illegible]			
	14		5.20	.60					[illegible]		
	14.5		5.20	.60					1.72		
	15		5.10	.40					2.89		
	15.5		5.25	.75					3.09		
	16		5.25	.55					2.50		
	16.5		5.25	.70					1.77		
	17		5.20	.60					1.93		
	18		5.00	.30					1.01		
	19		5.05	.55					1.89		
TR	20		4.90	.05					.79		
	21		5.00	.25					1.11		
	22		4.85	.10					0.52		
WL	23		4.68	0							
	26		4.50								
GL	26.5		3.80								
Stake Bot	27.9		3.65								
Top S	27.9		2.95								
TOTALS											

37 41 06.0
105 24 06.0

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

HUERFANO CREEK

@ UPPER SWA



Name: MOSCA PASS
Date: 7/31/2006
Scale: 1 inch equals 2000 feet

Location: 037° 41' 31.26" N 105° 24' 3.45" W
Caption: HUERFANO RIVER X#2

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

LOCATION INFORMATION

STREAM NAME:	Huerfano River
XS LOCATION:	UPPER SWA - ~~37°42'18.2" 105°22'36.7"~~
XS NUMBER:	082107-X1 37 41 06.0 105 24 06.0
DATE:	21-Aug-07
OBSERVERS:	Uppendahl
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	0
USGS MAP:	MOSCA PASS
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:	0.0109375

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

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

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TS	0.00	5.03			0.00		0.00	0.00	0.0%
BS	0.01	5.80			0.00		0.00	0.00	0.0%
1 GL	1.00	6.04			0.00		0.00	0.00	0.0%
	1.80	6.30			0.00		0.00	0.00	0.0%
	2.00	7.65			0.00		0.00	0.00	0.0%
WL	2.50	7.96	0.00	0.00	0.00		0.00	0.00	0.0%
	2.80	8.30	0.30	1.24	0.45	0.30	0.23	0.28	0.9%
	4.00	8.25	0.30	1.78	1.20	0.30	0.33	0.59	2.0%
	5.00	8.40	0.40	2.27	1.01	0.40	0.40	0.91	3.0%
	6.00	8.50	0.50	2.70	1.00	0.50	0.50	1.35	4.5%
	7.00	8.35	0.40	2.33	1.01	0.40	0.40	0.93	3.1%
	8.00	8.50	0.50	2.95	1.01	0.50	0.50	1.48	4.9%
	9.00	8.55	0.60	2.22	1.00	0.60	0.60	1.33	4.4%
	10.00	8.70	0.70	1.67	1.01	0.70	0.70	1.17	3.9%
	11.00	8.85	0.90	1.89	1.01	0.90	0.68	1.28	4.2%
	11.50	8.85	0.95	2.42	0.50	0.95	0.48	1.15	3.8%
	12.00	8.85	0.95	3.03	0.50	0.95	0.48	1.44	4.8%
	12.50	8.55	0.70	3.23	0.58	0.70	0.35	1.13	3.8%
	13.00	8.65	0.80	3.19	0.51	0.80	0.40	1.28	4.2%
	13.50	8.65	0.80	3.43	0.50	0.80	0.40	1.37	4.6%
	14.00	8.65	0.70	1.68	0.50	0.70	0.53	0.88	2.9%
	15.00	8.75	0.80	3.07	1.00	0.80	0.80	2.46	8.2%
	16.00	8.70	0.70	3.04	1.00	0.70	0.70	2.13	7.1%
	17.00	8.85	0.90	2.64	1.01	0.90	0.90	2.38	7.9%
	18.00	8.75	0.80	2.80	1.00	0.80	0.80	2.24	7.5%
	19.00	8.55	0.60	2.46	1.02	0.60	0.60	1.48	4.9%
	20.00	8.40	0.40	2.46	1.01	0.40	0.40	0.98	3.3%
	21.00	8.40	0.40	1.47	1.00	0.40	0.40	0.59	2.0%
	22.00	8.30	0.35	1.58	1.00	0.35	0.35	0.55	1.8%
	23.00	8.30	0.35	1.84	1.00	0.35	0.35	0.64	2.1%
	24.00	8.25	0.20	0.28	1.00	0.20	0.20	0.06	0.2%
	25.00	8.05	0.05	0.05	1.02	0.05	0.05	0.00	0.0%
WL	25.80	8.00	0.00	0.00	0.80		0.00	0.00	0.0%
	26.00	7.90			0.00		0.00	0.00	0.0%
1 GL	26.50	7.20			0.00		0.00	0.00	0.0%
BS	27.90	7.05			0.00		0.00	0.00	0.0%
TS	27.91	6.35			0.00		0.00	0.00	0.0%
TOTALS ----------					23.69	0.95 (Max.)	12.50	30.06	100.0%

Manning's n = 0.0422
Hydraulic Radius= 0.527634357

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	12.50	12.16	-2.8%
7.73	12.50	18.08	44.6%
7.75	12.50	17.60	40.8%
7.77	12.50	17.12	37.0%
7.79	12.50	16.64	33.1%
7.81	12.50	16.17	29.3%
7.83	12.50	15.69	25.5%
7.85	12.50	15.21	21.7%
7.87	12.50	14.74	17.9%
7.89	12.50	14.27	14.1%
7.91	12.50	13.80	10.4%
7.93	12.50	13.33	6.6%
7.94	12.50	13.09	4.7%
7.95	12.50	12.86	2.9%
7.96	12.50	12.62	1.0%
7.97	12.50	12.39	-0.9%
7.98	12.50	12.16	-2.8%
7.99	12.50	11.92	-4.6%
8.00	12.50	11.69	-6.5%
8.01	12.50	11.46	-8.3%
8.02	12.50	11.23	-10.2%
8.03	12.50	11.00	-12.0%
8.05	12.50	10.55	-15.6%
8.07	12.50	10.10	-19.2%
8.09	12.50	9.66	-22.8%
8.11	12.50	9.21	-26.3%
8.13	12.50	8.77	-29.8%
8.15	12.50	8.34	-33.3%
8.17	12.50	7.90	-36.8%
8.19	12.50	7.47	-40.3%
8.21	12.50	7.04	-43.7%
8.23	12.50	6.61	-47.1%

WATERLINE AT ZERO
AREA ERROR = 7.965

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 16.2" 105 22' 35.7"
XS NUMBER: 082107-X1

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"	7.20	24.57	1.26	1.65	30.97	25.82	100.0%	1.20	128.79	4.16
	7.22	24.55	1.25	1.63	30.60	25.78	99.9%	1.19	126.31	4.13
	7.27	24.51	1.20	1.58	29.37	25.67	99.4%	1.14	118.33	4.03
	7.32	24.47	1.15	1.53	28.15	25.56	99.0%	1.10	110.54	3.93
	7.37	24.42	1.10	1.48	26.92	25.45	98.6%	1.06	102.96	3.82
	7.42	24.38	1.05	1.43	25.70	25.34	98.1%	1.01	95.58	3.72
	7.47	24.34	1.01	1.38	24.49	25.22	97.7%	0.97	88.41	3.61
	7.52	24.29	0.96	1.33	23.27	25.11	97.3%	0.93	81.46	3.50
	7.57	24.25	0.91	1.28	22.06	25.00	96.8%	0.88	74.73	3.39
	7.62	24.21	0.86	1.23	20.84	24.89	96.4%	0.84	68.21	3.27
	7.67	24.14	0.81	1.18	19.64	24.76	95.9%	0.79	61.96	3.16
	7.72	24.03	0.77	1.13	18.43	24.61	95.3%	0.75	55.99	3.04
	7.77	23.91	0.72	1.08	17.23	24.45	94.7%	0.70	50.27	2.92
	7.82	23.79	0.67	1.03	16.04	24.29	94.1%	0.66	44.79	2.79
	7.87	23.68	0.63	0.98	14.85	24.14	93.5%	0.62	39.58	2.66
	7.92	23.54	0.58	0.93	13.67	23.97	92.8%	0.57	34.64	2.53
"WL"	7.97	23.36	0.53	0.88	12.50	23.76	92.0%	0.53	30.00	2.40
	8.02	23.01	0.49	0.83	11.34	23.37	90.5%	0.49	25.78	2.27
	8.07	22.33	0.46	0.78	10.21	22.67	87.8%	0.45	22.08	2.16
	8.12	22.04	0.41	0.73	9.10	22.35	86.6%	0.41	18.40	2.02
	8.17	21.74	0.37	0.68	8.00	22.03	85.3%	0.36	15.01	1.88
	8.22	21.45	0.32	0.63	6.92	21.71	84.1%	0.32	11.90	1.72
	8.27	20.46	0.29	0.58	5.86	20.89	80.1%	0.28	9.32	1.59
	8.32	17.41	0.28	0.53	4.92	17.62	68.2%	0.28	7.73	1.57
	8.37	16.38	0.25	0.48	4.07	16.58	64.2%	0.25	5.87	1.44
	8.42	13.88	0.24	0.43	3.30	14.06	54.5%	0.23	4.63	1.40
	8.47	12.38	0.21	0.38	2.65	12.55	48.6%	0.21	3.45	1.30
	8.52	10.93	0.19	0.33	2.06	11.09	42.9%	0.19	2.48	1.20
	8.57	9.72	0.16	0.28	1.55	9.87	38.2%	0.16	1.66	1.07
	8.62	6.80	0.12	0.23	1.09	8.93	34.6%	0.12	0.98	0.90
	8.67	6.81	0.10	0.18	0.69	6.91	26.7%	0.10	0.54	0.79
	8.72	5.24	0.07	0.13	0.38	5.31	20.6%	0.07	0.24	0.63
	8.77	3.12	0.06	0.08	0.17	3.16	12.2%	0.06	0.09	0.53
	8.82	1.87	0.03	0.03	0.05	1.89	7.3%	0.03	0.02	0.33

9/3 = 5.25
2/3 = 3.75

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1

SUMMARY SHEET

MEASURED FLOW (Qm)=	30.06	cfs
CALCULATED FLOW (Qc)=	30.00	cfs
(Qm-Qc)/Qm * 100 =	0.2	%
MEASURED WATERLINE (WLm)=	7.98	ft
CALCULATED WATERLINE (WLc)=	7.97	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.95	ft
MAX CALCULATED DEPTH (Dc)=	0.88	ft
(Dm-Dc)/Dm * 100	6.9	%
MEAN VELOCITY=	2.40	ft/sec
MANNING'S N=	0.042	
SLOPE=	0.0109375	ft/ft
.4 * Qm =	12.0	cfs
2.5 * Qm=	75.2	cfs

RECOMMENDED INSTREAM FLOW:

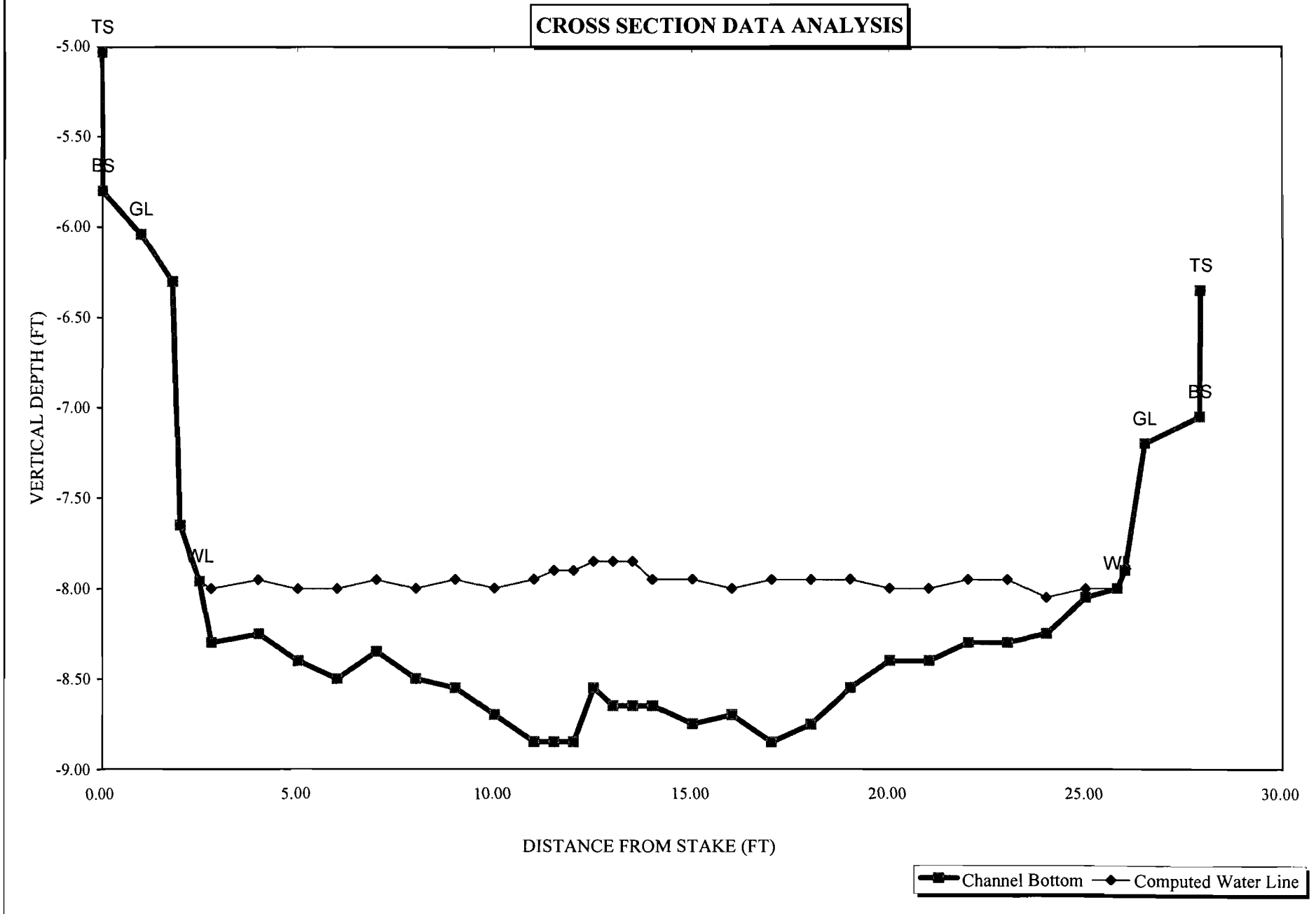
FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Huerfano River



Data Input & Proofing

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1
DATE: 8/21/2007
OBSERVERS: Uppendahl

1/4 SEC:
SECTION:
TWP:
RANGE:
PM:

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE:
USGS MAP: MOSCA PASS
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

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

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

Total Data Points = 37

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	5.03			0.00	0.00	0.00
	BS	0.01	5.80			0.00	0.00	0.00
1	GL	1.00	6.04			0.00	0.00	0.00
		1.80	6.30			0.00	0.00	0.00
		2.00	7.65			0.00	0.00	0.00
	WL	2.50	7.96	0.00	0.00	0.00	0.00	0.00
		2.80	8.30	0.30	1.24	0.23	0.28	8.00
		4.00	8.25	0.30	1.78	0.33	0.59	7.95
		5.00	8.40	0.40	2.27	0.40	0.91	8.00
		6.00	8.50	0.50	2.70	0.50	1.35	8.00
		7.00	8.35	0.40	2.33	0.40	0.93	7.95
		8.00	8.50	0.50	2.95	0.50	1.48	8.00
		9.00	8.55	0.60	2.22	0.60	1.33	7.95
		10.00	8.70	0.70	1.67	0.70	1.17	8.00
		11.00	8.85	0.90	1.89	0.68	1.28	7.95
		11.50	8.85	0.95	2.42	0.48	1.15	7.90
		12.00	8.85	0.95	3.03	0.48	1.44	7.90
		12.50	8.55	0.70	3.23	0.35	1.13	7.85
		13.00	8.65	0.80	3.19	0.40	1.28	7.85
		13.50	8.65	0.80	3.43	0.40	1.37	7.85
		14.00	8.65	0.70	1.68	0.53	0.88	7.95
		15.00	8.75	0.80	3.07	0.80	2.46	7.95
		16.00	8.70	0.70	3.04	0.70	2.13	8.00
		17.00	8.85	0.90	2.64	0.90	2.38	7.95
		18.00	8.75	0.80	2.80	0.80	2.24	7.95
		19.00	8.55	0.60	2.46	0.60	1.48	7.95
		20.00	8.40	0.40	2.46	0.40	0.98	8.00
		21.00	8.40	0.40	1.47	0.40	0.59	8.00
		22.00	8.30	0.35	1.58	0.35	0.55	7.95
		23.00	8.30	0.35	1.84	0.35	0.64	7.95
		24.00	8.25	0.20	0.28	0.20	0.06	8.05
		25.00	8.05	0.05	0.05	0.05	0.00	8.00
	WL	25.80	8.00	0.00	0.00	0.00	0.00	0.00
		26.00	7.90			0.00	0.00	0.00
1	GL	26.50	7.20			0.00	0.00	0.00
	BS	27.90	7.05			0.00	0.00	0.00
	TS	27.91	6.35			0.00	0.00	0.00
					Totals	12.50	30.06	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Huerfano River					CROSS-SECTION NO.
CROSS-SECTION LOCATION: Upper SWA - 37°41'06.0" 105°24'060"					
DATE: 8/2/07	OBSERVERS: Upendahl				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: Huerfano	WATERSHED: Huerfano River		WATER DIVISION: 2		DOW WATER CODE:
MAP(S): USGS: Mosca Pass					
USFS:					

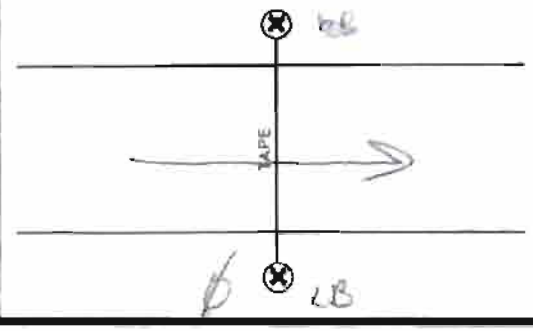
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Marsh - McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 1" - 10" D85 = 6"	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
Tape @ Stake LB	0.0	
Tape @ Stake RB	0.0	
WS @ Tape LB/RB	0.0	
2 WS Upstream		7.85
3 WS Downstream		8.57
SLOPE		

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

COMMENTS

WQ Taken.
Filtered - RWO7 6537 WATER Temp: 10°C
Filt - RWO7-6539

FORM #ISF ED 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Huerfano River	CROSS-SECTION NO	DATE 8/2/07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME 13'17

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft) .1?	Total Vertical Depth From Tape/Rod (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)
TP	0		5.03								
BPm	0		5.80								
GL	1.0		6.04								
	1.8		6.30								
	2.8		7.65								
SW	2.5		7.96	0				0			
	2.8		8.30	.3				1.24			
	4.0		8.25	.30				1.78			
	5.0		8.40	.40				2.27			
	6		8.50	.50				2.70			
	7		8.35	.40				2.33			
	8		8.50	.50				2.95			
	9		8.55	.60				2.22			
	10		8.70	.70				1.67			
	11		8.85	.90				1.89			
	12		8.75	.95				3.03			
	13		8.65	.80				3.19			
	14		8.65	.70				1.68			
	15		8.75	.8				3.07			
	16		8.70	.7				3.04			
	17		8.85	.9				2.64			
	18		8.75	.8				2.80			
	19		8.55	.6				2.46			
	20		8.40	.40				2.46			
	21		8.40	.40				1.47			
	22		8.20	.35				1.58			
	23		8.30	.35				1.84			
	24		8.25	.20				.28			
	25		8.05	.05				.05			
	25.8		8.00	0				0			
	11.5			.95				2.42			
	12.5			.70				3.23			
	13.5			.80				3.43			
	26.0		7.90								
	26.5		7.20								
	27.9		7.05								
	27.9		6.35								
TOTALS:											30.06

End of Measurement	Time 14:00	Gage Reading ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.21

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

Velocity based on test of R/D84>1

	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	7.20	24.57	1.26	1.65	30.97	25.82	100.0%	1.20	150.25	4.85
	7.22	24.55	1.25	1.63	30.60	25.78	99.9%	1.19	147.12	4.81
	7.27	24.51	1.20	1.58	29.37	25.67	99.4%	1.14	137.06	4.67
	7.32	24.47	1.15	1.53	28.15	25.56	99.0%	1.10	127.28	4.52
	7.37	24.42	1.10	1.48	26.92	25.45	98.6%	1.06	117.80	4.38
	7.42	24.38	1.05	1.43	25.70	25.34	98.1%	1.01	108.62	4.23
	7.47	24.34	1.01	1.38	24.49	25.22	97.7%	0.97	99.75	4.07
	7.52	24.29	0.96	1.33	23.27	25.11	97.3%	0.93	91.18	3.92
	7.57	24.25	0.91	1.28	22.06	25.00	96.8%	0.88	82.94	3.76
	7.62	24.21	0.86	1.23	20.84	24.89	96.4%	0.84	75.02	3.60
	7.67	24.14	0.81	1.18	19.64	24.76	95.9%	0.79	67.46	3.44
	7.72	24.03	0.77	1.13	18.43	24.61	95.3%	0.75	60.31	3.27
	7.77	23.91	0.72	1.08	17.23	24.45	94.7%	0.70	53.51	3.11
	7.82	23.79	0.67	1.03	16.04	24.29	94.1%	0.66	47.06	2.93
	7.87	23.68	0.63	0.98	14.85	24.14	93.5%	0.62	40.98	2.76
	7.92	23.54	0.58	0.93	13.67	23.97	92.8%	0.57	35.28	2.58
WL	7.97	23.36	0.53	0.88	12.50	23.76	92.0%	0.53	30.00	2.40
	8.02	23.01	0.49	0.83	11.34	23.37	90.5%	0.49	25.27	2.23
	8.07	22.33	0.46	0.78	10.21	22.67	87.8%	0.45	21.20	2.08
	8.12	22.04	0.41	0.73	9.10	22.35	86.6%	0.41	17.20	1.89
	8.17	21.74	0.37	0.68	8.00	22.03	85.3%	0.36	13.59	1.70
	8.22	21.45	0.32	0.63	6.92	21.71	84.1%	0.32	10.36	1.50
	8.27	20.46	0.29	0.58	5.86	20.69	80.1%	0.28	7.78	1.33
	8.32	17.41	0.28	0.53	4.92	17.62	68.2%	0.28	6.33	1.29
	8.37	16.38	0.25	0.48	4.07	16.58	64.2%	0.25	4.56	1.12
	8.42	13.88	0.24	0.43	3.30	14.06	54.5%	0.23	3.47	1.05
	8.47	12.38	0.21	0.38	2.65	12.55	48.6%	0.21	2.43	0.92
	8.52	10.93	0.19	0.33	2.06	11.09	42.9%	0.19	1.66	0.80
	8.57	9.72	0.16	0.28	1.55	9.87	38.2%	0.16	1.02	0.66
	8.62	8.80	0.12	0.23	1.09	8.93	34.6%	0.12	0.53	0.49
	8.67	6.81	0.10	0.18	0.69	6.91	26.7%	0.10	0.27	0.40
	8.72	5.24	0.07	0.13	0.38	5.31	20.6%	0.07	0.11	0.28
	8.77	3.12	0.06	0.08	0.17	3.16	12.2%	0.06	0.04	0.20
	8.82	1.87	0.03	0.03	0.05	1.89	7.3%	0.03	0.00	0.10

HUERFANO RIVER

UPPER SWA

37 42' 18.2" & 105 22' 35.7"

HUERFANO RIVER

UPPER SWA - Tributary

37 42' 18.2" & 105 22' 35.7"

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

LOCATION INFORMATION

STREAM NAME:	Huerfano Creek
XS LOCATION:	Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER:	112508-01
DATE:	25-Nov-08
OBSERVERS:	Uppendahl
1/4 SEC:	SE
SECTION:	23
TWP:	27 S
RANGE:	72 W
PM:	6
COUNTY:	HUERFANO
WATERSHED:	HUERFANO
DIVISION:	2
DOW CODE:	30130
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:	0.01125

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

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

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01

DATA POINTS= 41

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TP	0.00	5.16			0.00		0.00	0.00	0.0%
BP	0.01	5.92			0.00		0.00	0.00	0.0%
1 GL	1.00	6.05			0.00		0.00	0.00	0.0%
	2.00	6.50			0.00		0.00	0.00	0.0%
	2.10	7.75			0.00		0.00	0.00	0.0%
WL	2.80	8.25	0.00	0.00	0.00		0.00	0.00	0.0%
	3.00	8.45	0.20	1.01	0.28	0.20	0.12	0.12	1.1%
	4.00	8.35	0.10	0.80	1.00	0.10	0.10	0.08	0.7%
	5.00	8.40	0.10	0.77	1.00	0.10	0.10	0.08	0.7%
	6.00	8.55	0.30	0.58	1.01	0.30	0.30	0.17	1.6%
	7.00	8.45	0.20	1.93	1.00	0.20	0.20	0.39	3.5%
	8.00	8.50	0.25	1.87	1.00	0.25	0.25	0.47	4.3%
	9.00	8.40	0.10	1.13	1.00	0.10	0.10	0.11	1.0%
	10.00	8.50	0.30	1.41	1.00	0.30	0.23	0.32	2.9%
	10.50	8.70	0.50	1.22	0.54	0.50	0.25	0.31	2.8%
	11.00	8.65	0.40	1.12	0.50	0.40	0.20	0.22	2.1%
	11.50	8.55	0.35	1.58	0.51	0.35	0.18	0.28	2.5%
	12.00	8.60	0.40	1.99	0.50	0.40	0.20	0.40	3.7%
	12.50	8.65	0.40	2.32	0.50	0.40	0.20	0.46	4.3%
	13.00	8.95	0.70	1.92	0.58	0.70	0.35	0.67	6.2%
	13.50	9.00	0.80	1.04	0.50	0.80	0.40	0.42	3.8%
	14.00	9.00	0.75	1.99	0.50	0.75	0.38	0.75	6.9%
	14.50	9.10	0.90	2.00	0.51	0.90	0.45	0.90	8.3%
	15.00	8.75	0.50	1.70	0.61	0.50	0.25	0.43	3.9%
	15.50	9.00	0.80	2.26	0.56	0.80	0.40	0.90	8.3%
	16.00	9.00	0.75	2.16	0.50	0.75	0.38	0.81	7.4%
R	16.50	8.00	0.00	0.00	1.12		0.00	0.00	0.0%
R	17.00	7.90	0.00	0.00	0.00		0.00	0.00	0.0%
	17.50	8.35	0.10	1.47	0.67	0.10	0.05	0.07	0.7%
	18.00	8.45	0.20	1.80	0.51	0.20	0.15	0.27	2.5%
	19.00	8.70	0.50	1.64	1.03	0.50	0.50	0.82	7.5%
	20.00	8.70	0.45	1.61	1.00	0.45	0.45	0.72	6.7%
	21.00	8.45	0.20	1.28	1.03	0.20	0.20	0.26	2.4%
	22.00	8.65	0.40	0.78	1.02	0.40	0.40	0.31	2.9%
	23.00	8.45	0.20	0.75	1.02	0.20	0.20	0.15	1.4%
	24.00	8.35	0.10	0.10	1.00	0.10	0.09	0.01	0.1%
WL	24.90	8.25	0.00	0.00	0.91		0.00	0.00	0.0%
	26.00	8.00			0.00		0.00	0.00	0.0%
1 GL	26.50	7.30			0.00		0.00	0.00	0.0%
BP	27.90	7.20			0.00		0.00	0.00	0.0%
TP	27.91	6.50			0.00		0.00	0.00	0.0%
TOTALS ----------					22.95	0.9 (Max.)	7.07	10.89	100.0%

Manning's n = 0.0466
Hydraulic Radius= 0.3078496

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.07	6.86	-2.9%
8.00	7.07	12.36	75.0%
8.02	7.07	11.91	68.5%
8.04	7.07	11.45	62.1%
8.06	7.07	11.00	55.7%
8.08	7.07	10.55	49.4%
8.10	7.07	10.11	43.1%
8.12	7.07	9.67	36.8%
8.14	7.07	9.23	30.6%
8.16	7.07	8.79	24.4%
8.18	7.07	8.36	18.3%
8.20	7.07	7.92	12.2%
8.21	7.07	7.71	9.1%
8.22	7.07	7.50	6.1%
8.23	7.07	7.28	3.1%
8.24	7.07	7.07	0.1%
8.25	7.07	6.86	-2.9%
8.26	7.07	6.65	-5.9%
8.27	7.07	6.44	-8.8%
8.28	7.07	6.23	-11.8%
8.29	7.07	6.03	-14.7%
8.30	7.07	5.82	-17.6%
8.32	7.07	5.41	-23.4%
8.34	7.07	5.01	-29.1%
8.36	7.07	4.61	-34.7%
8.38	7.07	4.23	-40.1%
8.40	7.07	3.87	-45.2%
8.42	7.07	3.53	-50.0%
8.44	7.07	3.21	-54.5%
8.46	7.07	2.91	-58.8%
8.48	7.07	2.64	-62.6%
8.50	7.07	2.41	-65.9%

WATERLINE AT ZERO
AREA ERROR = 8.240

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01

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	7.30	24.44	1.20	1.80	29.20	26.76	100.0%	1.09	104.68	3.58
	7.34	24.40	1.16	1.76	28.22	26.67	99.7%	1.06	99.08	3.51
	7.39	24.36	1.11	1.71	27.00	26.56	99.2%	1.02	92.31	3.42
	7.44	24.32	1.06	1.66	25.78	26.45	98.8%	0.97	85.72	3.32
	7.49	24.28	1.01	1.61	24.57	26.33	98.4%	0.93	79.31	3.23
	7.54	24.25	0.96	1.56	23.35	26.22	98.0%	0.89	73.10	3.13
	7.59	24.21	0.91	1.51	22.14	26.11	97.6%	0.85	67.08	3.03
	7.64	24.17	0.87	1.46	20.93	26.00	97.2%	0.81	61.26	2.93
	7.69	24.13	0.82	1.41	19.72	25.89	96.7%	0.76	55.64	2.82
	7.74	24.09	0.77	1.36	18.52	25.78	96.3%	0.72	50.24	2.71
	7.79	23.99	0.72	1.31	17.32	25.64	95.8%	0.68	45.08	2.60
	7.84	23.89	0.67	1.26	16.12	25.49	95.3%	0.63	40.17	2.49
	7.89	23.78	0.63	1.21	14.93	25.34	94.7%	0.59	35.48	2.38
	7.94	23.43	0.59	1.16	13.75	24.93	93.2%	0.55	31.26	2.27
	7.99	23.02	0.55	1.11	12.59	24.45	91.4%	0.51	27.34	2.17
	8.04	22.64	0.51	1.06	11.44	24.00	89.7%	0.48	23.62	2.06
	8.09	22.27	0.46	1.01	10.32	23.56	88.0%	0.44	20.14	1.95
	8.14	21.90	0.42	0.96	9.22	23.12	86.4%	0.40	16.89	1.83
	8.19	21.53	0.38	0.91	8.13	22.67	84.7%	0.36	13.88	1.71
WL	8.24	21.16	0.33	0.86	7.06	22.23	83.1%	0.32	11.13	1.57
	8.29	20.62	0.29	0.81	6.02	21.62	80.8%	0.28	8.68	1.44
	8.34	20.04	0.25	0.76	5.00	20.96	78.3%	0.24	6.51	1.30
	8.39	18.05	0.22	0.71	4.04	18.91	70.7%	0.21	4.89	1.21
	8.44	15.45	0.21	0.66	3.21	16.25	60.7%	0.20	3.67	1.15
	8.49	11.91	0.21	0.61	2.52	12.64	47.2%	0.20	2.90	1.15
	8.54	9.66	0.21	0.56	1.99	10.32	38.6%	0.19	2.24	1.13
	8.59	7.85	0.20	0.51	1.55	8.44	31.5%	0.18	1.69	1.09
	8.64	6.05	0.20	0.46	1.20	6.57	24.5%	0.18	1.31	1.09
	8.69	4.79	0.19	0.41	0.93	5.24	19.6%	0.18	1.00	1.07
	8.74	3.48	0.21	0.36	0.74	3.88	14.5%	0.19	0.84	1.13
	8.79	3.23	0.18	0.31	0.58	3.57	13.3%	0.16	0.58	1.00
	8.84	2.95	0.14	0.26	0.42	3.21	12.0%	0.13	0.37	0.87
	8.89	2.67	0.11	0.21	0.28	2.86	10.7%	0.10	0.20	0.72
	8.94	2.39	0.06	0.16	0.15	2.51	9.4%	0.06	0.08	0.53
	8.99	1.78	0.03	0.11	0.05	1.83	6.8%	0.03	0.01	0.30
	9.04	0.38	0.03	0.06	0.01	0.41	1.5%	0.03	0.00	0.31
	9.09	0.06	0.00	0.01	0.00	0.07	0.2%	0.00	0.00	0.09

3/3 = 6.0

2/3 = 3.0

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01

SUMMARY SHEET

MEASURED FLOW (Qm)=	10.89	cfs
CALCULATED FLOW (Qc)=	11.13	cfs
(Qm-Qc)/Qm * 100 =	-2.1	%
MEASURED WATERLINE (WLm)=	8.25	ft
CALCULATED WATERLINE (WLc)=	8.24	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.90	ft
MAX CALCULATED DEPTH (Dc)=	0.86	ft
(Dm-Dc)/Dm * 100	4.5	%
MEAN VELOCITY=	1.57	ft/sec
MANNING'S N=	0.047	
SLOPE=	0.01125	ft/ft
.4 * Qm =	4.4	cfs
2.5 * Qm=	27.2	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

FIELD DATA
FOR
INSTREAM FLOW DETERMINATIONS

COLORADO WATER CONSERVATION BOARD

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: HUERFANO RIVER					CROSS-SECTION NO.: 11-2508-?1
CROSS-SECTION LOCATION: UPPER SWA SITE					
LAT 37 41 06 103 24 06					
DATE: 11/25/08	OBSERVERS: UPPENDAHL				
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 25	TOWNSHIP: 27 N/(S)	RANGE: 72 E/(W)	PM: 6
COUNTY: HUERFANO	WATERSHED: HUERFANO		WATER DIVISION: 2		DOW WATER CODE: 30130
MAP(S): USGS:					
USFS:					

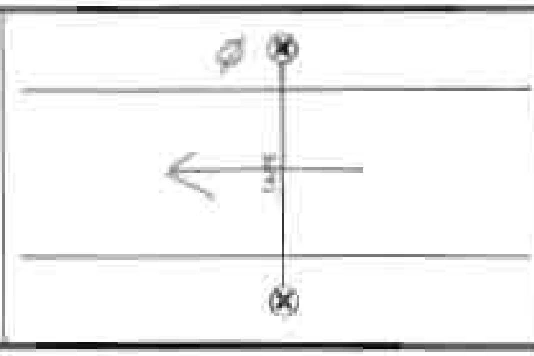
SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	8.25 / 8.25
② WS Upstream	16	8.10
③ WS Downstream	16	8.46
SLOPE	.36/32 = 0.0113	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: HUERFANO RIVER | CROSS-SECTION NO: 1 | DATE: 11/26/00 | SHEET 1 OF 1

BEGINNING OF MEASUREMENT: EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading ____ ft | TIME: 12:51

Features: Stake (S) Crossing (C) Waterline (W) Point (P)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Rod (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)
TP	0		5.16	2.4							
BP	0		5.92								
EL	1.0		6.05								
	2.0		6.50								
	2.10		7.75								
SW$_{lc}$	2.8		8.25	0				0			
	3.0		8.45	.20				1.01			
	4.0		8.35	.40				.80			
	5.0		8.40	.10				.77			
	6.0		8.55	.30				.58			
	7.0		8.45	.20				1.93			
	8.0		8.50	.25				1.67			
	9.0		8.40	.10				1.13			
	10.0		8.50	.30				1.41			
	10.5		8.70	.50				1.22			
	11.0		8.65	.40				1.12			
	11.5		8.55	.35				1.58			
	12.0		8.60	.40				1.99			
	12.5		8.65	.40				2.32			
	13.0		8.95	.70				1.92			
	13.5		9.00	.80				1.04			
	14		9.00	.75				1.99			
	14.5		9.10	.90				2.00			
	15		8.75	.50				1.70			
	15.5		9.00	.80				2.26			
	16		9.00	.75				2.16			
TR	16.6		8.00	0				0			
TR	17		7.90	0				0			
	17.5		8.35	.10				1.47			
	18		8.45	.20				1.90			
	19		8.70	.50				1.64			
	20		8.70	.45				1.61			
	21		8.45	.20				1.18			
	22		8.65	.40				.78			
	23		8.45	.20				.75			
	24		8.25	.10				.10			
SW$_{rc}$	24.9		8.25	0				0			
	26.0		8.00								
	26.5		9.30								
BP	27.9		7.20								
TP	27.9		6.50								
TOTALS											

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

Data Input & Proofing

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01
DATE: 11/25/2008
OBSERVERS: Uppendahl

1/4 SEC: SE
SECTION: 23
TWP: 27 S
RANGE: 72 W
PM: 6

COUNTY: HUERFANO
WATERSHED: HUERFANO
DIVISION: 2
DOW CODE: 30130
USGS MAP:
USFS MAP:

Level and Rod Survey
TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

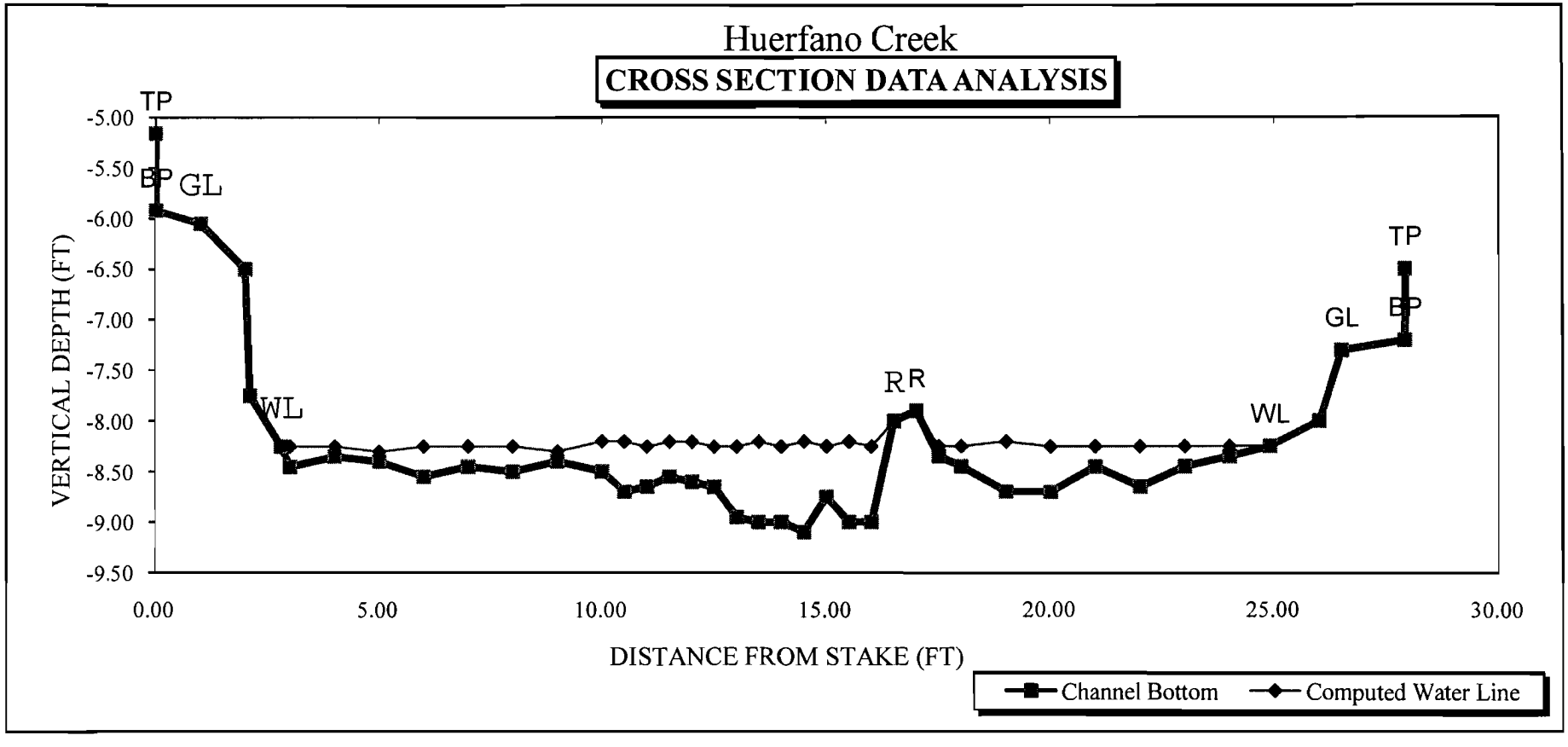
SLOPE: 0.01125 ft / ft

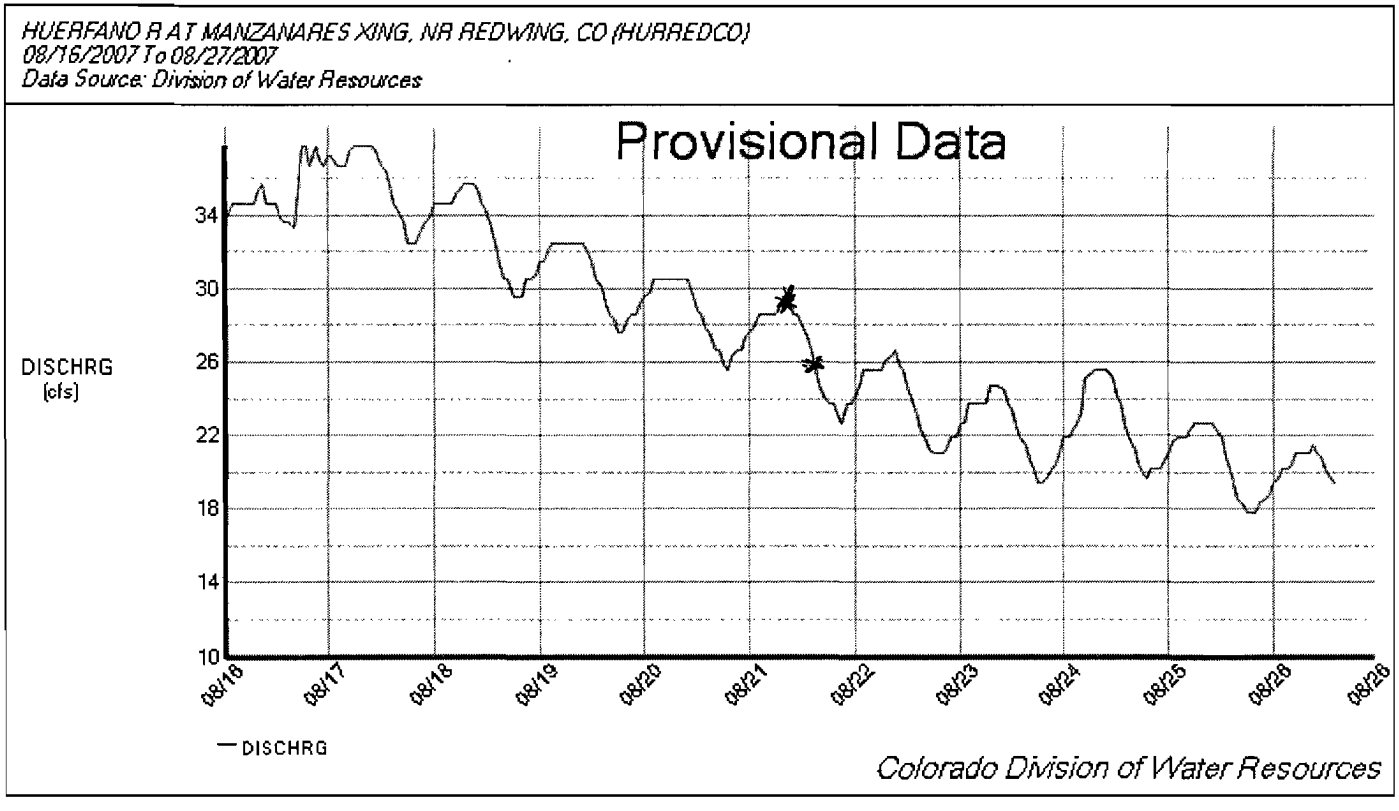
CHECKED BY:.....DATE.....

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

Total Data Points = 41

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TP	0.00	5.16			0.00	0.00	0.00
	BP	0.01	5.92			0.00	0.00	0.00
1	GL	1.00	6.05			0.00	0.00	0.00
		2.00	6.50			0.00	0.00	0.00
		2.10	7.75			0.00	0.00	0.00
	WL	2.80	8.25	0.00	0.00	0.00	0.00	0.00
		3.00	8.45	0.20	1.01	0.12	0.12	8.25
		4.00	8.35	0.10	0.80	0.10	0.08	8.25
		5.00	8.40	0.10	0.77	0.10	0.08	8.30
		6.00	8.55	0.30	0.58	0.30	0.17	8.25
		7.00	8.45	0.20	1.93	0.20	0.39	8.25
		8.00	8.50	0.25	1.87	0.25	0.47	8.25
		9.00	8.40	0.10	1.13	0.10	0.11	8.30
		10.00	8.50	0.30	1.41	0.23	0.32	8.20
		10.50	8.70	0.50	1.22	0.25	0.31	8.20
		11.00	8.65	0.40	1.12	0.20	0.22	8.25
		11.50	8.55	0.35	1.58	0.18	0.28	8.20
		12.00	8.60	0.40	1.99	0.20	0.40	8.20
		12.50	8.65	0.40	2.32	0.20	0.46	8.25
		13.00	8.95	0.70	1.92	0.35	0.67	8.25
		13.50	9.00	0.80	1.04	0.40	0.42	8.20
		14.00	9.00	0.75	1.99	0.38	0.75	8.25
		14.50	9.10	0.90	2.00	0.45	0.90	8.20
		15.00	8.75	0.50	1.70	0.25	0.43	8.25
		15.50	9.00	0.80	2.26	0.40	0.90	8.20
		16.00	9.00	0.75	2.16	0.38	0.81	8.25
	R	16.50	8.00	0.00	0.00	0.00	0.00	0.00
	R	17.00	7.90	0.00	0.00	0.00	0.00	0.00
		17.50	8.35	0.10	1.47	0.05	0.07	8.25
		18.00	8.45	0.20	1.80	0.15	0.27	8.25
		19.00	8.70	0.50	1.64	0.50	0.82	8.20
		20.00	8.70	0.45	1.61	0.45	0.72	8.25
		21.00	8.45	0.20	1.28	0.20	0.26	8.25
		22.00	8.65	0.40	0.78	0.40	0.31	8.25
		23.00	8.45	0.20	0.75	0.20	0.15	8.25
		24.00	8.35	0.10	0.10	0.09	0.01	8.25
	WL	24.90	8.25	0.00	0.00	0.00	0.00	0.00
		26.00	8.00			0.00	0.00	0.00
1	GL	26.50	7.30			0.00	0.00	0.00
	BP	27.90	7.20			0.00	0.00	0.00
	TP	27.91	6.50			0.00	0.00	0.00
					Totals	7.07	10.89	


Huerfano Creek
CROSS SECTION DATA ANALYSIS
TP
BP
GL
WL
RR
WL
GL
BP
TP
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line



Qm @ 13:17 USWA = 30.06

Qm @ 14:30 LSWA = 26.04

STREAM SURVEY
(1980 Revision)

rveyed By: Dave Weber "Office survey"

de No.	32/30
te	--/--/81 ~~6/15/80~~
ction No.	
ream Name	Huerfano R #2
imary Drainage	Huerfano R
jor Drainage	Arkansas
WER TERMINUS LOCATION:	//////////////////
	HUE
	265
	69W
	35
dth	
evation	6640
ow (c.f.s.)	
ith	
DTA	
onductivity	
If stream profile obtained	
PPER TERMINUS LOCATION	//////////////////
	HUE
.	27S
.	72W
.	26
idth	
levation	9000
low (c.f.s.)	
H	
Hth	
o	
DTA	
onductivity	

X If stream profile obtained

SECTION SUMMARY	//////////////////
Meander Factor	1.2
Length in Miles	22.4
Width in Feet	
Acreage	
Observed Flow	
X if inundated by reservoir	
Mileage unsectioned	
Counties where section is located.	
County HUE	
Miles 22.4	
County	
Miles	
County	
Miles	
Region SE	
Beaver Dams (count or estimate)	//////////////
Number	
Physical stream damage (% of section affected)	
Bank degredation	
Channelization	
Dredging	
Mine Tailing Encroachment	
Road Encroachment	
ACCESSIBILITY (Miles)	//////////////////
Surfaced 5.0	
Non-Surfaced 17.4	
4 - Wheel	
Established Trail	
No Established Trail	
Boat only	

rveved By:

ND STATUS AND MILEAGE	////////////////
S.F.S.	
L.M.	0.4
nicipal	
vision of Wildlife	
ivate, no public access	22.0
ivate, open to public	
ate Land Board	
unty	
xed small tracts, open	
xed small tracts, closed	
OCKING	////////////////
les Creel Size	
les Fingerling	
les not stocked	
UATIC VEGETATION	////////////////
lamentous Algae (x one)	////////////////
sent	
re	
mmon	
undant	
tercress (x if present)	
RADIENT 2.0	////////////////
rcent per mile	
ISHERY VALUE (x one)	////////////////
Fishery	
or	
low Average	
verage	
ove Average	
xcellent	

Limiting Factors (5 most important)

FISH SAMPLNG	////////////////
Lower or Only station	////////////////
Elevation	
Describe Or Map Station Location	

Sampling Method	
Length-feet	
Sampling adequate	
Sampling inadequate	
X if scales collected	
Estimated % of fish biomass	////////////////

urveyed By: ____________________

almonidae Fish	
ther fish	

****

nctaluridae	
yprinidae	
ottidae	
atostomidae	
entrarchidae	
PPER STATION	////////////////
levation	

escribe Or Map Station Location

ampling Method	
ength-feet	
ampling adequate	
ampling inadequate	
if scales collected	
stimated % of fish biomass	////////////////
almonidae Fish	
ther fish	

****

nctaluridae	
yprinidae	
ottidae	
atostomidae	
entrarchidae	

COMBINED STATIONS	////////////////
Estimated % of fish biomass	////////////////
Salmonidae Fish	
Other fish	

****

Inctaluridae	
Cyprinidae	
Cottidae	
Catostomidae	
Centrarchidae	
No. of Salmonidae fish - 6" per mile	////////
Pounds of salmonidae per acre	

Length-frequency distribution by one-inch size groups (1.0 - 1.9 etc.)

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	>15	Total
						LOWER STATION										
Rainbow																
Brown																
Brook																
Native																
Whitefish																
Total																
						UPPER STATION										
Rainbow																
Brown																
Brook																
Native																
Whitefish																
Total																
						COMBINED STATIONS										
Rainbow																
Brown																
Brook																
Native																
Whitefish																
Total																

UNSURVEYED STREAM SUMMARY

STREAM NAME Huerfano R #2 CODE # 31030

MAJOR DRAINAGE A PRIMARY DRAINAGE Huerfano R

LT COUNTY Hue LT T-R-S T26S, R69W, S35 LT ELEVATION 6640

UT COUNTY Hue UT T-R-S T27S, R72W, S26 UT ELEVATION 9000

LENGTH(inches) 28.5 SL LENGTH(inches) 24.5 MEANDER FACTOR _____

LENGTH(miles) 22.4 GRADIENT 2.0

FIRST COUNTY Hue Miles 22.4

SECOND COUNTY _____ Miles _____

THIRD COUNTY _____ Miles _____

REGION SE COUNTY MAP SHEET Huerfano #2

ACCESS:

PAVED 5.0 miles

GRAVEL 17.4 miles

4WD _____ miles

TRAIL _____ miles

NO TRAIL _____ miles

LAND OWNERSHIP:

USFS _____ miles

BLM 0.4 miles

CDOW _____ miles

PRIVATE 22.0 miles

SLB _____ miles

Other:

_____ _____ miles

_____ _____ miles

STOCKING: STOCK 79-83 ____ YRS STOCK 84-85 ____ YRS

STOCKYRS _ _ _ _ _ STOCK YRS _ _

FISH STOCKED _____ _____

_____ _____

CREEL CENSUS: _____

COMMENTS: _____

_____

HUERFANO R #2(FARASITA TO S HUERFANO CONFL),A,HUE SES 30130

	SPC	1979	MO	SPC	1980	MO	SPC	1981	MO	SPC	1982	MO	SPC	1983	MO	SPC	0	MO
0-2		0	0	B	1012	5	L	2043	4	B	1031	4		0	0		0	0
		0	0	L	2015	5		0	0		0	0		0	0		0	0
	+	0	0		3027	0		2043	0		1031	0		0	0		0	0
2-3	SRN	5213	6	R	2056	6	B	1040	4		0	0		0	0		0	0
	+	5213	0		2056	0		1040	0		0	0		0	0		0	0
6 +	R	2270	5	R	1500	4	R	3650	4	R	1050	4	R	500	4		0	0
	R	2030	6	R	3240	5		0	0	R	805	5	R	475	5		0	0
	R	1225	7	R	3780	6		0	0	R	875	6	R	1260	6		0	0
	R	2495	8	R	2800	7		0	0	R	1120	7	R	700	7		0	0
		0	0	R	3500	8		0	0		0	0	R	2010	8		0	0
	+	8020	0		14820	0		3650	0		3850	0		4945	0		0	0

FM	15		FM	66		FM	71		FM	83		FM	16			0		
NR	0		NR	0		NR	13		NR	0		NR	0			0		
HR	50		HR	185		HR	327		HR	196		HR	38			0		
TFC	33		TFC	81		TFC	120		TFC	121		TFC	13			0		
CPMH	.660		CPMH	.438		CPMH	.367		CPMH	.617		CPMH	.342			0.000		

SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S
R	78.8	10.0	R	80.2	10.0	R	50.0	9.7	R	41.3	10.7	R	46.1	8.0		0.0	0.0
B	12.1	6.0	B	11.1	8.0	N	15.0	13.2	B	47.1	7.0	B	30.8	7.0		0.0	0.0
L	9.1	8.0	L	8.6	8.0	B	28.3	6.5	L	11.6	9.1	L	23.1	10.0		0.0	0.0
	0.0	0.0		0.0	0.0	L	6.7	9.4		0.0	0.0		0.0	0.0		0.0	0.0

STOCKING AND FISH SAMPLING DATA

STREAM CODE 30130 u
HUER FANO R #2 HUE

STOCKING

STOCK 79-83 5 YRS

STOCKYRS Y Y Y Y Y

SPECIES-SIZE STOCKED:

B..1 / L..1 / SRN2 / R..2 / B..2 / R..4

FISH SAMPLING

SAMPLE DATE: -- / -- / 81

METHODS: CLEN

	SPECIES	#TAKEN	AVG. LENGTH (cm)	RANGE (cm)	AVG. WT (g)	RANGE (g)	%TOTAL CATCH
1.	R..	60	24.6				
2.	N..	18	33.5				
3.	B..	34	16.5				
4.	L..	8	23.8				
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

R B L N

Stream: Huerfano River

Executive Summary

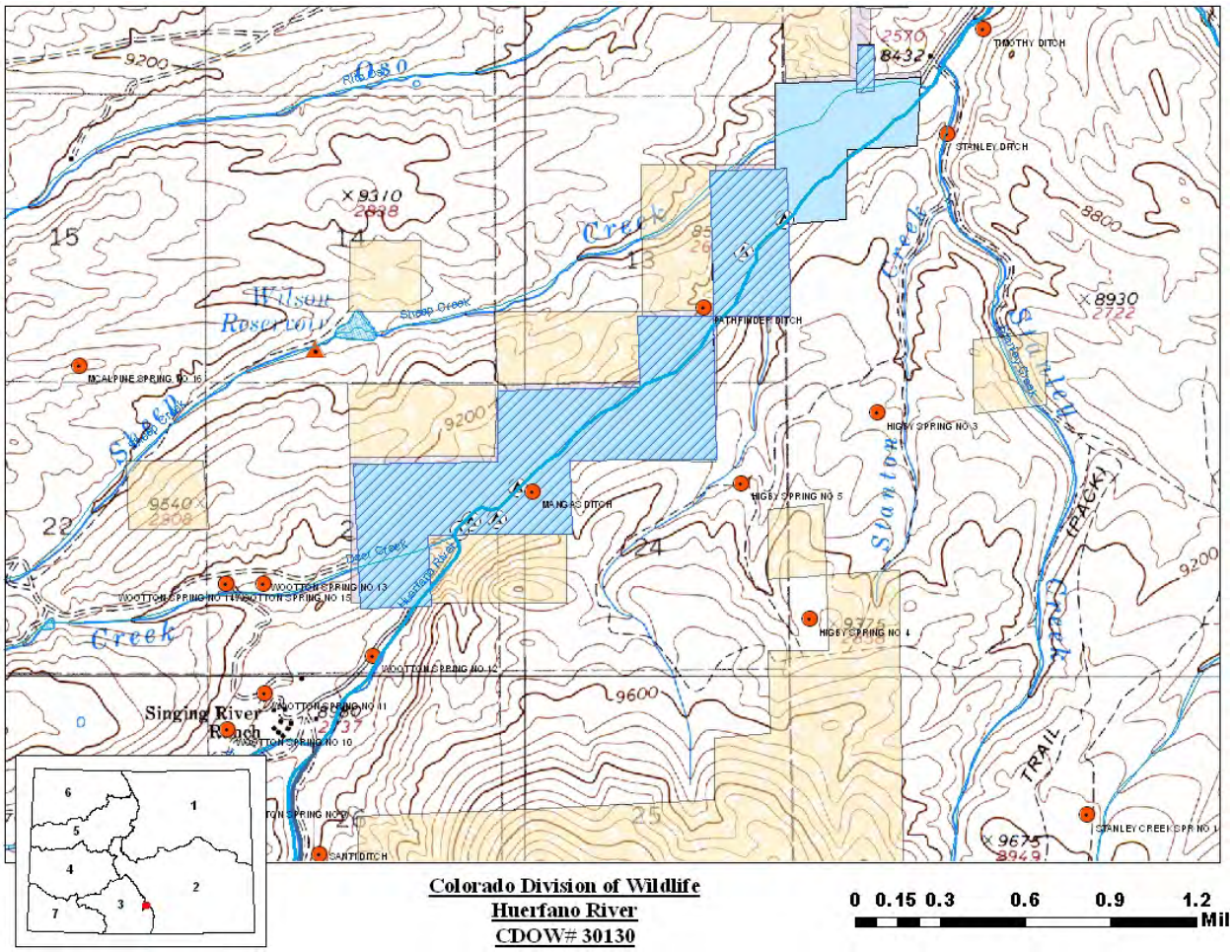
Water Division: 2
Water District: 79
CDOW#: 30130

Segment: UNNAMED TRIBUTARY TO STANLEY CREEK

Upper Terminus: UNNAMED TRIBUTARY
Latitude: 37º 41’ 02”N Longitude: 105º 24’ 09"W

Lower Terminus: STANLEY CREEK
Latitude: 37 42’ 33”N Longitude: 105º 22’ 16"W

Counties: Huerfano County
Length: 2.6 miles
USGS Quad(s): Mosca Pass.
ISF Appropriation: 5.5 cfs (January 1 – December 31)*



The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and

managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

This segment of the Huerfano River is approximately 2.6 miles long. It begins at the confluence of an unnamed tributary at an elevation of approximately 8,875 feet and terminates at the confluence with Stanley Creek at an elevation of approximately 8,450 feet. Of the 2.6 mile segment addressed by this report, approximately 95% of the segment, or 2.5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 55 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the confluence of an unnamed tributary and extending downstream to confluence with the Stanley Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 5.5 cfs, summer and winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 5.5 cubic feet per second is recommended is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
UNNAMED TRIBUTARY	STANLEY CREEK	2.6	5	95

Biological and Field Survey Data

The CDOW, in 2006 & 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a medium stream (between 20 to 35 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

CDOW staff used the R2CROSS methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The BOARD staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2CROSS data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	7/19/2006	14.6	36.6 - 5.9	3.1 OR	2.1 OR
DOW	7/19/2006	13.2	33.1 – 5.3	5.5	2.7 OR
DOW	8/22/2007	30.1	75.2 – 12.0	5.5 OR	3.8 OR
DOW	8/22/2007	26.0	65.1 – 10.4	2.3 OR	2.3 OR

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer and winter flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS model is 5.5s (See Table 1).

Hydrologic Data

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. The hydrograph below was derived from data collected by the USGS stream gage for the Huerfano River near Redwing, CO (#07111000), which has a drainage area of 73 square miles (See Gage Summary in Appendix C). The total drainage area upstream of this ISF segment of Huerfano River is 55 square miles. The

period of record for the Huerfano River gage was 1923 to 1985, the period of record used by staff in their analysis was 1923 to 1985, or 59 years of record. Table 2 below displays the estimated flow of Huerfano River in cfs at the lower terminus of the instream flow reach in terms of a percentage of exceedence.

Table 2: Estimated Stream Flow for Huerfano River

Exceedences	January	February	March	April	May	June	July	August	September	October	November	December
1%	14.32	13.56	18.84	61.78	189.34	190.84	126.58	108.49	68.07	32.40	23.36	18.08
5%	12.05	11.30	15.07	43.32	137.58	144.66	88.90	61.78	43.70	24.11	18.84	13.56
10%	10.55	11.30	13.56	31.64	107.82	126.58	71.58	47.47	33.15	21.85	16.58	12.05
20%	9.79	9.79	12.81	21.85	71.58	99.45	54.25	36.92	24.11	17.33	13.56	11.30
50%	7.53	7.53	9.04	13.56	39.18	54.25	31.64	22.60	15.07	12.81	10.55	8.29
80%	6.00	6.40	7.16	9.79	21.10	28.63	16.58	15.07	10.55	9.79	7.53	6.48
90%	4.90	5.27	6.03	8.29	15.82	20.49	12.81	11.30	8.29	8.29	6.93	5.65
95%	3.77	4.97	5.54	7.38	13.56	17.33	10.55	9.04	6.55	7.20	6.25	4.82
99%	3.32	3.77	4.29	6.40	9.04	12.05	6.40	6.50	4.90	4.97	5.27	3.99

- Table 2 shows that the summer flow recommendation of 5.5 cfs is available at least 50% of the time all year.

However, if additional water is determined to be available in further investigations, the CDOW would recommend appropriating the additional water up to the recommended flow amounts to preserve the natural environment to a reasonable degree.

Precipitation Data

CDOW staff identified 4 local precipitation data sets located near the Huerfano River Drainage: Gardner (3222), Redwing 1 WSW (6977), Sheep Mountain (7572) and Blanco Station (BLA01) (see Precipitation Data in Appendix C).

Existing Water Right Information

CDOW staff has analyzed the water rights tabulation and will consult with the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. Records indicate that there are no surface water rights within this reach of Huerfano River.

Stream: Huerfano River

Executive Summary

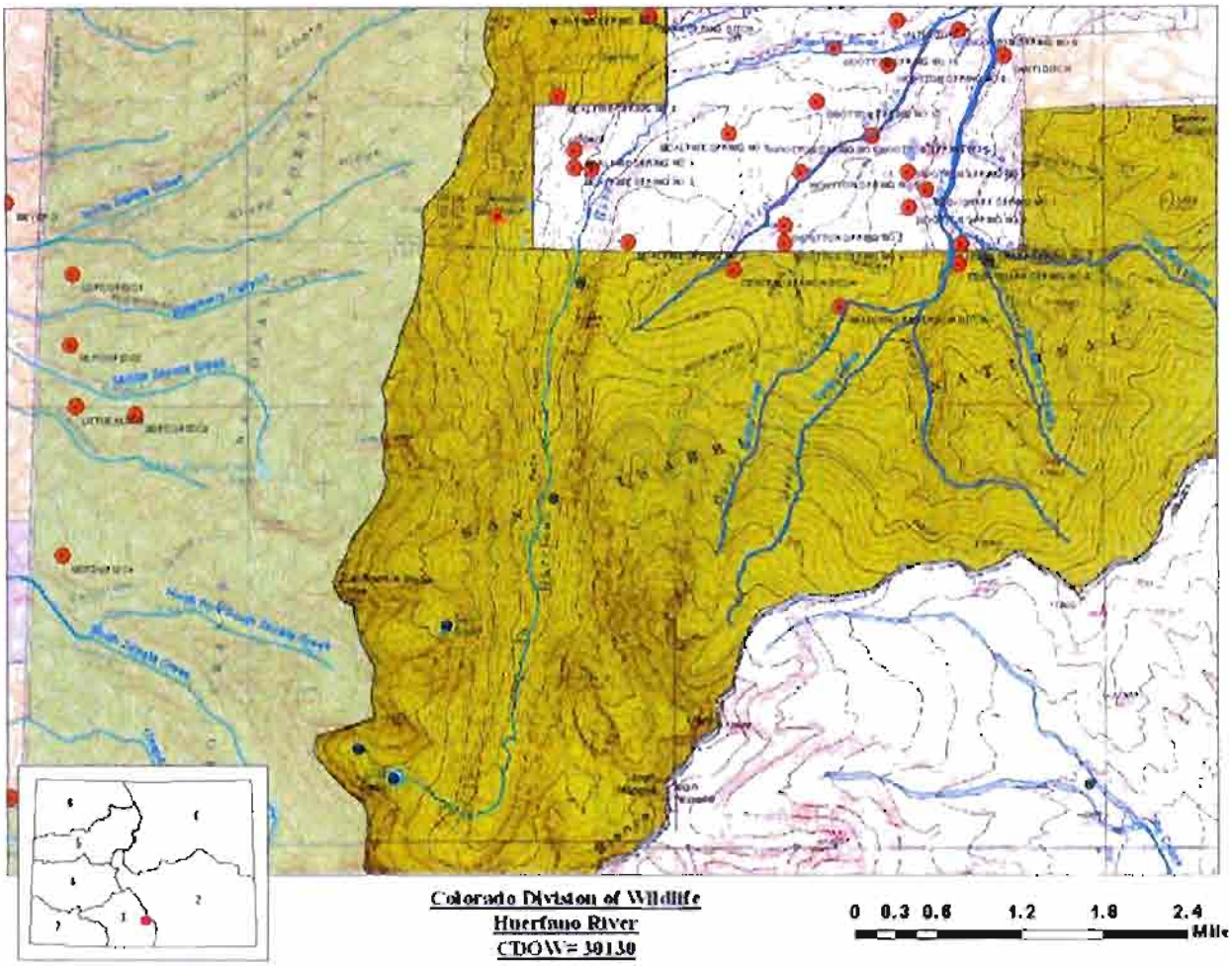
Water Division: 2
Water District: 79
CDOW#: 30130

Segment: LILY LAKE TO CENTRAL BRANCH HUERFANO RIVER

Upper Terminus: LILY LAKE
Latitude: 37° 35' 40"N Longitude: 105° 29' 22"W

Lower Terminus: CENTRAL BRANCH HUERFANO RIVER
Latitude: 37 40' 15"N Longitude: 105° 25' 16"W

Counties: Huerfano County
Length: 8.2 miles
USGS Quad(s): Mosca Pass.
ISF Appropriation: 4.10 cfs (May 1 - October 31)
2.70 cfs (November 1 - April 30)



The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet Colorado's policy "... that the wildlife and their environment are to be protected, preserved, enhanced, and

managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

This segment of the Huerfano River is approximately 8.2 miles long. It begins on the north side of Blanca Peak at an elevation of approximately 12,250 feet and terminates at the confluence with the Central Branch of the Huerfano River at an elevation of approximately 9,200 feet. Of the 8.2 mile segment addressed by this report, approximately 60% of the segment, or 5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 11 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the outlet of Lily Lake and extending downstream to confluence with the Central Branch of Huerfano Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 4.1 cfs, summer, and 2.7 cfs, winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 4.1 cubic feet per second is recommended is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.7 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
LILY LAKE	C. B. HUERFANO RIVER	8.2	40	60

Biological and Field Survey Data

The CDOW, in 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a small stream (between 9 to 19 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus*

fontinalis) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

CDOW staff used the R2CROSS methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The BOARD staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2CROSS data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	8/22/2007	2.6	6.5 – 1.0	4.1	2.7

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS model is 4.1 cfs (See Table 1). The winter flow recommendation, which met 2 of 3 criteria and is within the accuracy range of the R2CROSS model range is 2.7 cfs (See Table 1).

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

LOCATION INFORMATION

STREAM NAME:	Huerfano River
XS LOCATION:	NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER:	082107-X3
DATE:	21-Aug-07
OBSERVERS:	Uppendahl
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	0
USGS MAP:	MOSCA PASS
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:	0.02058824

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

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

STREAM NAME: Huerfano River
XS LOCATION: NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER: 082107-X3

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TS	0.00	5.95			0.00		0.00	0.00	0.0%
BS	0.01	6.28			0.00		0.00	0.00	0.0%
	1.00	6.40			0.00		0.00	0.00	0.0%
	2.00	6.80			0.00		0.00	0.00	0.0%
	2.50	6.85			0.00		0.00	0.00	0.0%
1 GL	3.00	7.00			0.00		0.00	0.00	0.0%
	3.50	7.35			0.00		0.00	0.00	0.0%
	4.00	7.75			0.00		0.00	0.00	0.0%
WL	4.30	8.00	0.00	0.00	0.00		0.00	0.00	0.0%
	5.00	8.25	0.25	0.49	0.74	0.25	0.21	0.10	4.0%
	6.00	8.15	0.15	0.89	1.00	0.15	0.15	0.13	5.1%
	7.00	8.20	0.20	1.30	1.00	0.20	0.15	0.20	7.5%
	7.50	8.20	0.20	1.87	0.50	0.20	0.10	0.19	7.2%
	8.00	8.25	0.25	2.01	0.50	0.25	0.13	0.25	9.6%
	8.50	8.30	0.30	2.03	0.50	0.30	0.15	0.30	11.7%
	9.00	8.20	0.20	1.57	0.51	0.20	0.15	0.24	9.0%
BR	10.00	8.20	0.20	0.16	1.00	0.20	0.20	0.03	1.2%
	11.00	8.20	0.20	1.30	1.00	0.20	0.15	0.20	7.5%
	11.50	8.15	0.15	0.90	0.50	0.15	0.08	0.07	2.6%
	12.00	8.20	0.20	1.19	0.50	0.20	0.15	0.18	6.8%
	13.00	8.15	0.15	1.03	1.00	0.15	0.15	0.15	5.9%
	14.00	8.10	0.10	0.45	1.00	0.10	0.10	0.05	1.7%
	15.00	8.10	0.10	1.03	1.00	0.10	0.10	0.10	4.0%
	16.00	8.10	0.10	0.65	1.00	0.10	0.08	0.05	1.9%
	16.50	8.20	0.20	0.50	0.51	0.20	0.10	0.05	1.9%
	17.00	8.15	0.15	1.29	0.50	0.15	0.11	0.15	5.6%
	18.00	8.20	0.20	0.63	1.00	0.20	0.20	0.13	4.8%
	19.00	8.05	0.05	0.05	1.01	0.05	0.05	0.00	0.1%
	20.00	8.10	0.10	0.45	1.00	0.10	0.10	0.05	1.7%
	21.00	8.05	0.05	0.10	1.00	0.05	0.03	0.00	0.1%
WL	21.30	8.00	0.00	0.00	0.30		0.00	0.00	0.0%
	21.50	7.85			0.00		0.00	0.00	0.0%
	22.00	7.65			0.00		0.00	0.00	0.0%
1 GL	23.00	7.05			0.00		0.00	0.00	0.0%
	26.00	7.05			0.00		0.00	0.00	0.0%
BS	27.30	6.55			0.00		0.00	0.00	0.0%
TS	27.31	6.05			0.00		0.00	0.00	0.0%
TOTALS ----------					17.10	0.3 (Max.)	2.63	2.61	100.0%

Manning's n = 0.0618
Hydraulic Radius= 0.153916903

STREAM NAME: Huerfano River
XS LOCATION: NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER: 082107-X3

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.63	2.63	0.0%
7.75	2.63	6.97	164.7%
7.77	2.63	6.61	151.2%
7.79	2.63	6.26	137.8%
7.81	2.63	5.91	124.5%
7.83	2.63	5.56	111.2%
7.85	2.63	5.21	98.0%
7.87	2.63	4.86	84.8%
7.89	2.63	4.52	71.6%
7.91	2.63	4.17	58.5%
7.93	2.63	3.83	45.4%
7.95	2.63	3.49	32.4%
7.96	2.63	3.31	25.9%
7.97	2.63	3.14	19.4%
7.98	2.63	2.97	12.9%
7.99	2.63	2.80	6.5%
8.00	2.63	2.63	0.0%
8.01	2.63	2.46	-6.4%
8.02	2.63	2.29	-12.8%
8.03	2.63	2.13	-19.2%
8.04	2.63	1.96	-25.6%
8.05	2.63	1.79	-31.9%
8.07	2.63	1.47	-44.1%
8.09	2.63	1.17	-55.5%
8.11	2.63	0.91	-65.5%
8.13	2.63	0.68	-74.2%
8.15	2.63	0.47	-82.3%
8.17	2.63	0.28	-89.3%
8.19	2.63	0.14	-94.6%
8.21	2.63	0.07	-97.3%
8.23	2.63	0.04	-98.5%
8.25	2.63	0.02	-99.3%

WATERLINE AT ZERO
AREA ERROR = 8.000

STREAM NAME: Huerfano River
XS LOCATION: NF LANDS - 37 33' 50" 105 28' 13"
XS NUMBER: 062107 X3

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"	7.00	19.93	1.01	1.25	20.17	20.61	100.0%	0.98	98.18	4.87
	7.05	19.93	1.01	1.25	20.17	20.61	100.0%	0.98	98.89	4.90
	7.10	19.17	0.91	1.20	19.18	20.44	99.1%	0.94	62.46	4.71
	7.15	19.62	0.93	1.15	18.19	20.24	98.2%	0.90	56.47	3.21
	7.20	19.46	0.88	1.10	17.21	20.00	97.0%	0.86	53.41	3.11
	7.25	19.31	0.84	1.05	16.25	19.87	96.4%	0.82	49.97	3.07
	7.30	19.15	0.80	1.00	15.28	19.69	95.5%	0.78	44.11	2.87
	7.35	19.00	0.75	0.95	14.33	19.51	94.6%	0.73	40.23	2.81
	7.40	18.85	0.71	0.90	13.38	19.33	93.8%	0.69	36.12	2.70
	7.45	18.71	0.67	0.85	12.44	19.15	92.9%	0.65	32.19	2.59
	7.50	18.56	0.62	0.80	11.51	18.97	92.1%	0.61	28.45	2.47
	7.55	18.42	0.57	0.75	10.59	18.80	91.2%	0.56	24.90	2.35
	7.60	18.27	0.53	0.70	9.67	18.62	90.3%	0.52	21.55	2.23
	7.65	18.12	0.48	0.65	8.76	18.44	89.5%	0.48	18.39	2.10
	7.70	17.94	0.44	0.60	7.86	18.22	88.4%	0.43	15.41	1.97
	7.75	17.75	0.39	0.55	6.97	18.01	87.4%	0.39	12.75	1.83
	7.80	17.58	0.35	0.50	6.08	17.80	86.4%	0.34	10.26	1.69
	7.85	17.38	0.30	0.45	5.21	17.59	85.3%	0.30	7.99	1.53
	7.90	17.23	0.25	0.40	4.35	17.43	84.5%	0.25	5.94	1.37
	7.95	17.13	0.20	0.35	3.49	17.29	83.8%	0.20	4.14	1.19
"WL"	8.00	17.00	0.15	0.30	2.63	17.10	83.0%	0.15	2.61	0.99
	8.05	16.56	0.11	0.25	1.79	16.63	80.8%	0.11	1.40	0.78
	8.10	12.09	0.08	0.20	1.02	12.18	59.0%	0.08	0.60	0.59
	8.15	10.36	0.04	0.15	0.47	10.42	50.6%	0.04	0.20	0.43
	8.20	2.14	0.04	0.10	0.09	2.17	10.5%	0.04	0.04	0.41
	8.25	0.75	0.02	0.05	0.02	0.76	3.7%	0.02	0.01	0.29

3/3 ~ 4.1
2/2 ~ [illegible]

STREAM NAME: Huerfano River
XS LOCATION: NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER: 082107-X3

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.61	cfs
CALCULATED FLOW (Qc)=	2.61	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	8.00	ft
CALCULATED WATERLINE (WLc)=	8.00	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.99	ft/sec
MANNING'S N=	0.062	
SLOPE=	0.02058824	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.5	cfs

RECOMMENDED INSTREAM FLOW:

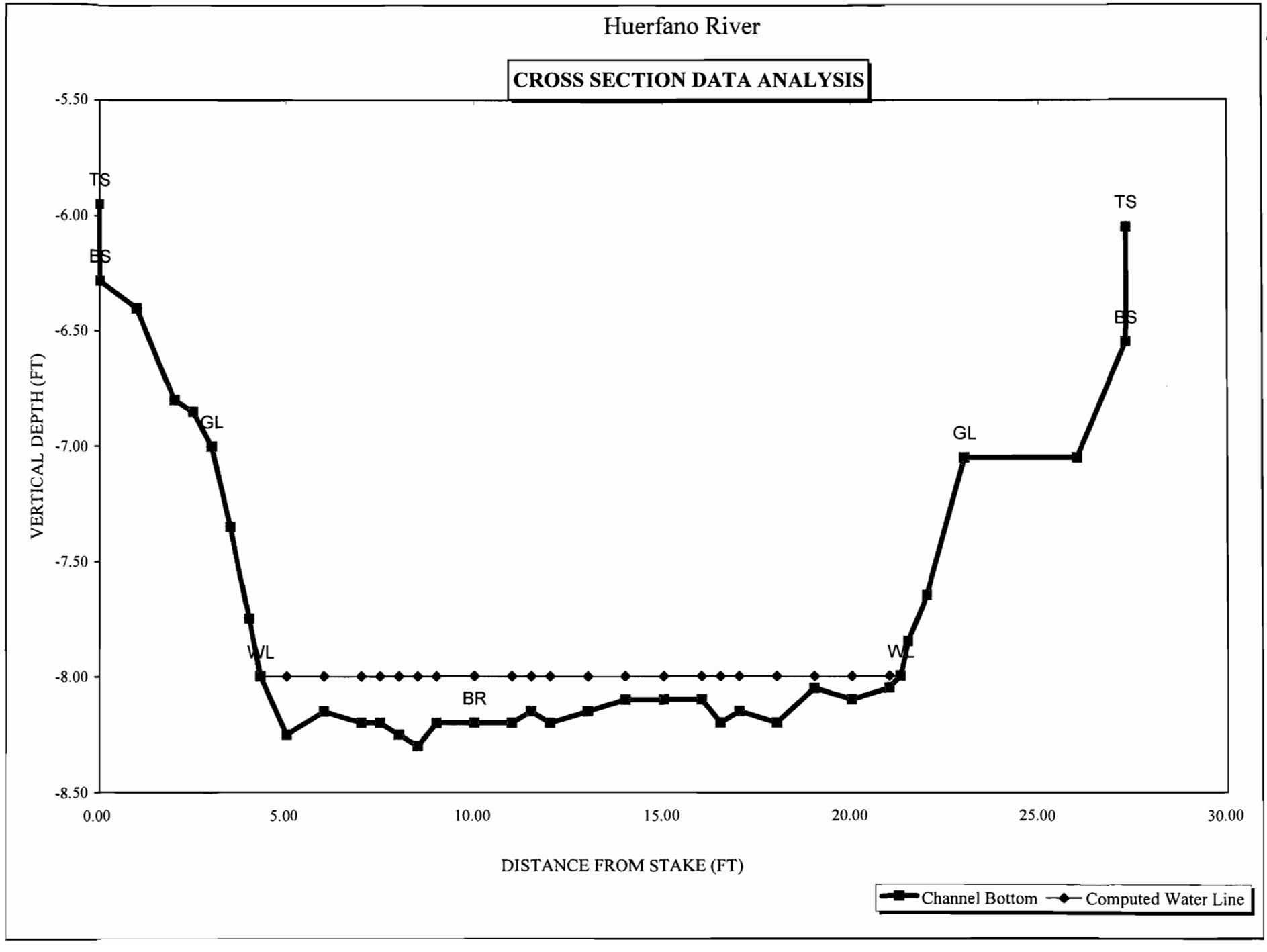
FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Huerfano River



Data Input & Proofing

STREAM NAME:	Huerfano River
XS LOCATION:	NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER:	082107-X3
DATE:	8/21/2007
OBSERVERS:	Uppendahl
1/4 SEC:	
SECTION:	
TWP:	
RANGE:	
PM:	
COUNTY:	HUERFANO
WATERSHED:	HUERFANO RIVER
DIVISION:	2
DOW CODE:	
USGS MAP:	MOSCA PASS
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.020588235 ft / ft

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

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

Total Data Points = 37

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	5.95			0.00	0.00	0.00
	BS	0.01	6.28			0.00	0.00	0.00
		1.00	6.40			0.00	0.00	0.00
		2.00	6.80			0.00	0.00	0.00
		2.50	6.85			0.00	0.00	0.00
1	GL	3.00	7.00			0.00	0.00	0.00
		3.50	7.35			0.00	0.00	0.00
		4.00	7.75			0.00	0.00	0.00
	WL	4.30	8.00	0.00	0.00	0.00	0.00	0.00
		5.00	8.25	0.25	0.49	0.21	0.10	8.00
		6.00	8.15	0.15	0.89	0.15	0.13	8.00
		7.00	8.20	0.20	1.30	0.15	0.20	8.00
		7.50	8.20	0.20	1.87	0.10	0.19	8.00
		8.00	8.25	0.25	2.01	0.13	0.25	8.00
		8.50	8.30	0.30	2.03	0.15	0.30	8.00
		9.00	8.20	0.20	1.57	0.15	0.24	8.00
	BR	10.00	8.20	0.20	0.16	0.20	0.03	8.00
		11.00	8.20	0.20	1.30	0.15	0.20	8.00
		11.50	8.15	0.15	0.90	0.08	0.07	8.00
		12.00	8.20	0.20	1.19	0.15	0.18	8.00
		13.00	8.15	0.15	1.03	0.15	0.15	8.00
		14.00	8.10	0.10	0.45	0.10	0.05	8.00
		15.00	8.10	0.10	1.03	0.10	0.10	8.00
		16.00	8.10	0.10	0.65	0.08	0.05	8.00
		16.50	8.20	0.20	0.50	0.10	0.05	8.00
		17.00	8.15	0.15	1.29	0.11	0.15	8.00
		18.00	8.20	0.20	0.63	0.20	0.13	8.00
		19.00	8.05	0.05	0.05	0.05	0.00	8.00
		20.00	8.10	0.10	0.45	0.10	0.05	8.00
		21.00	8.05	0.05	0.10	0.03	0.00	8.00
	WL	21.30	8.00	0.00	0.00	0.00	0.00	0.00
		21.50	7.85			0.00	0.00	0.00
		22.00	7.65			0.00	0.00	0.00
1	GL	23.00	7.05			0.00	0.00	0.00
		26.00	7.05			0.00	0.00	0.00
	BS	27.30	6.55			0.00	0.00	0.00
	TS	27.31	6.05			0.00	0.00	0.00
					Totals	2.63	2.61	

STREAM NAME: Huerfano River
XS LOCATION: NF LANDS - 37 38' 30" 105 28' 12"
XS NUMBER: 082107-X3

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.11

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

Velocity based on test of R/D84>1

	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	7.05	19.93	1.01	1.25	20.17	20.61	100.0%	0.98	136.00	6.74
	7.05	19.93	1.01	1.25	20.17	20.61	100.0%	0.98	136.00	6.74
	7.10	19.77	0.97	1.20	19.18	20.43	99.1%	0.94	125.11	6.52
	7.15	19.62	0.93	1.15	18.19	20.24	98.2%	0.90	114.62	6.30
	7.20	19.46	0.88	1.10	17.21	20.06	97.3%	0.86	104.54	6.07
	7.25	19.31	0.84	1.05	16.25	19.87	96.4%	0.82	94.86	5.84
	7.30	19.15	0.80	1.00	15.28	19.69	95.5%	0.78	85.60	5.60
	7.35	19.00	0.75	0.95	14.33	19.51	94.6%	0.73	76.75	5.36
	7.40	18.85	0.71	0.90	13.38	19.33	93.8%	0.69	68.30	5.10
	7.45	18.71	0.67	0.85	12.44	19.15	92.9%	0.65	60.28	4.84
	7.50	18.56	0.62	0.80	11.51	18.97	92.1%	0.61	52.70	4.58
	7.55	18.42	0.57	0.75	10.59	18.80	91.2%	0.56	45.57	4.30
	7.60	18.27	0.53	0.70	9.67	18.62	90.3%	0.52	38.88	4.02
	7.65	18.12	0.48	0.65	8.76	18.44	89.5%	0.48	32.66	3.73
	7.70	17.94	0.44	0.60	7.86	18.23	88.4%	0.43	26.97	3.43
	7.75	17.75	0.39	0.55	6.97	18.01	87.4%	0.39	21.76	3.12
	7.80	17.56	0.35	0.50	6.08	17.80	86.4%	0.34	17.04	2.80
	7.85	17.38	0.30	0.45	5.21	17.59	85.3%	0.30	12.84	2.46
	7.90	17.25	0.25	0.40	4.35	17.43	84.5%	0.25	9.15	2.10
	7.95	17.13	0.20	0.35	3.49	17.26	83.8%	0.20	6.01	1.73
WL	8.00	17.00	0.15	0.30	2.63	17.10	83.0%	0.15	3.48	1.32
	8.05	16.56	0.11	0.25	1.79	16.65	80.8%	0.11	1.20	0.67
	8.10	12.09	0.08	0.20	1.03	12.16	59.0%	0.08	0.58	0.57
	8.15	10.36	0.04	0.15	0.47	10.42	50.6%	0.04	0.17	0.37
	8.20	2.14	0.04	0.10	0.09	2.17	10.5%	0.04	0.03	0.30
	8.25	0.75	0.02	0.05	0.02	0.76	3.7%	0.02	0.00	0.13

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

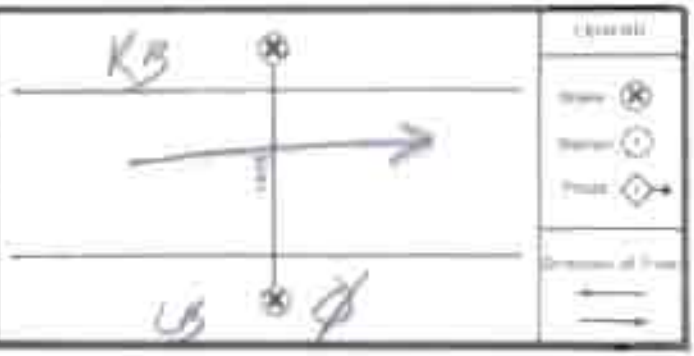
STREAM NAME: Huerfano River on N.F. Lands					CROSS SECTION NO:
CROSS SECTION LOCATION: u/s of Habitat Imp Structure #3 0.5 miles above FS boundary					
DATE: 8/21/02	OBSERVERS: Appendelt				
LEGAL DESCRIPTION:	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: Huerfano	WATERSHED: Huerfano	WATER DIVISION: 2			WDID WATER CODE:
MAP(S):	USGS:				
	UTM:				

SUPPLEMENTAL DATA

MAJ TAPE SECTION BANK NO. DISCHARGE SECTION:	METER TYPE: Marsh McBirney			
WATER NUMBER:	DATE TAKEN:	CALIBRATION: ___ sec	DATE VERIFIED: ___ sec/ft	DEPTH STATION: ___ ft
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape or Stake LB	0.0	5.95
⊗ Tape or Stake RB	0.0	6.05
① Rib or base LB/RB	0.0	8.0 / 8.0
② WS Headpin	32.0'	7.39
③ WS Downstream	53.0'	9.14
SLOPE	.75/85	



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" 2" 3" 4" 5" ETC.)

SPECIES FILE NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL

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

COMMENTS

Water Temp 6°C

RW07-6536 F

WQ Sample Taken RW07-WS38 NF

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Hurricane River on NF	CROSS-SECTION NO. #3	DATE 8/21/07	SHEET __ OF __
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM (LEFT / RIGHT) (0.0 AT STAKE)	Gage Reading: ____ ft	TIME 17:00

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)
TS	0		5.95								
BS	0		6.28								
	1		6.40								
	2		6.80								
	2.5		6.85								
GL	3		7.00								
	3.5		7.35								
	4		7.75								
SWL	4.3		8.00	0				0			
	5			.25				.49			
	6			.15				.89			
	7			.22				1.30			
	7.5			.20				1.87			
	8			.25				2.01			
	8.5			.30				2.03			
	9			.20				1.57			
[illegible]	10			.20				.16			
	11			.20				1.70			
	11.5			.15				.90			
	12			.20				1.19			
	13			.15				1.03			
	14			[illegible]				.95			
	15			.10				1.03			
	16			.10				.65			
	16.5			.10				.50			
	17			.15				1.29			
	18			.20				.63			
	19			.05				.05			
	20			.10				.43			
	21			.05				.10			
SWL	21.3		8.00	0				0			
	21.5		7.85								
	22.0		7.65								
GL	23.0		8.05								
	26		7.05								
BS	27.5		6.55								
TS	27.5		6.05								
TOTALS											2.61

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

HUERFANO RIVER

NATIONAL FOREST LANDS

37 38' 30" & 105 28' 12"

Stream: Huerfano River

Executive Summary

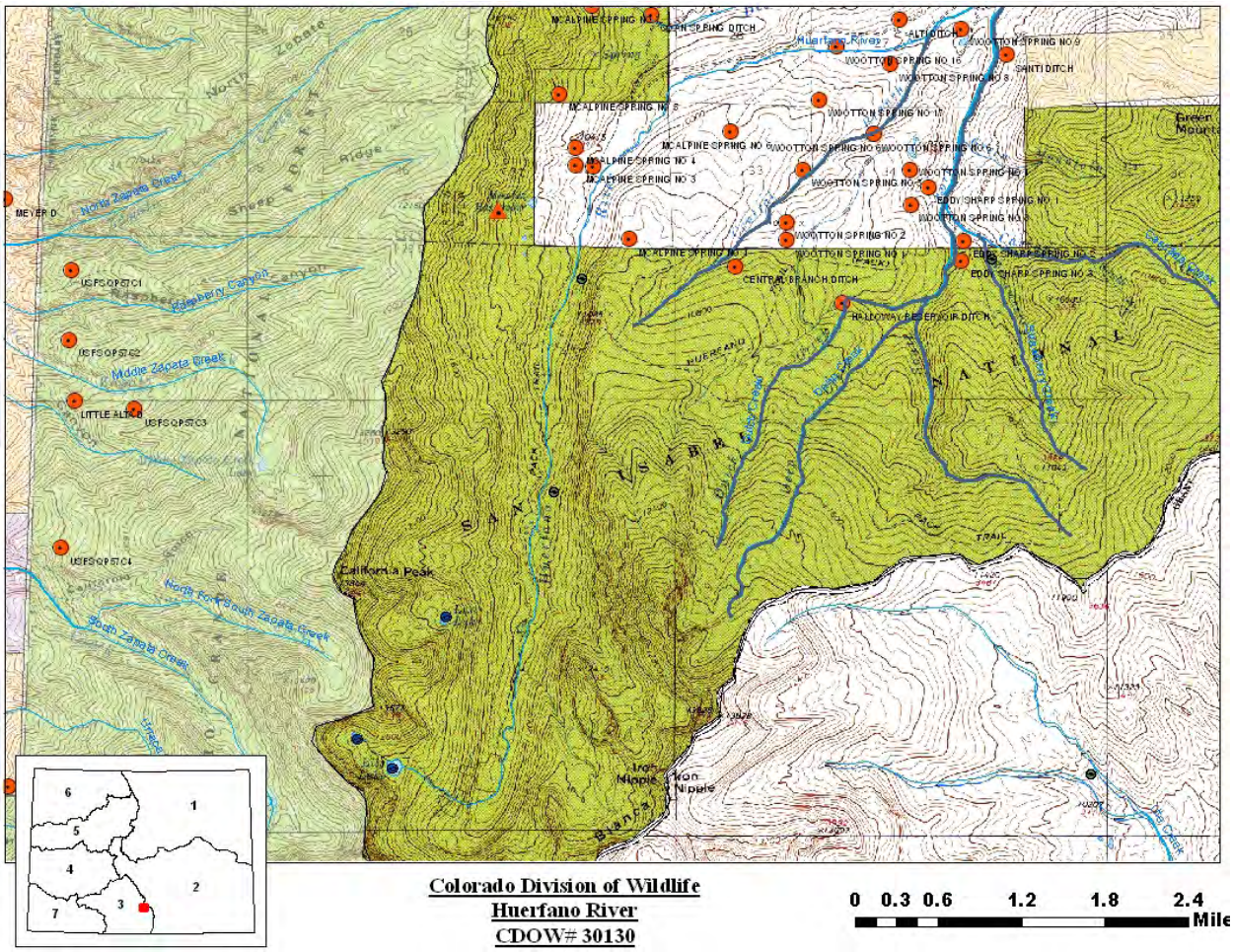
Water Division: 2
Water District: 79
CDOW#: 30130

Segment: LILY LAKE TO CENTRAL BRANCH HUERFANO RIVER

Upper Terminus: LILY LAKE
Latitude: 37º 35’ 40”N Longitude: 105º 29’ 22"W

Lower Terminus: CENTRAL BRANCH HUERFANO RIVER
Latitude: 37 40’ 15”N Longitude: 105º 25’ 16"W

Counties: Huerfano County
Length: 8.2 miles
USGS Quad(s): Mosca Pass.
ISF Appropriation: 4.10 cfs (May 1 – August 31)
2.50 cfs (September 1 - October 31)*
1.50 cfs (November 1 – March 31)
2.70 cfs (April 1 – April 30)



The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and

managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

This segment of the Huerfano River is approximately 8.2 miles long. It begins on the north side of Blanca Peak at an elevation of approximately 12,250 feet and terminates at the confluence with the Central Branch of the Huerfano River at an elevation of approximately 9,200 feet. Of the 8.2 mile segment addressed by this report, approximately 60% of the segment, or 5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 11 square miles. Huerfano River generally flows in an northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the outlet of Lily Lake and extending downstream to confluence with the Central Branch of Huerfano Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 4.1 cfs, summer, and 2.7 cfs, winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 4.1 cubic feet per second is recommended is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.7 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
LILY LAKE	C. B. HUERFANO RIVER	8.2	40	60

Biological and Field Survey Data

The CDOW, in 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a small stream (between 9 to 19 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus*

fontinalis) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

CDOW staff used the R2CROSS methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The BOARD staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2CROSS data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	8/22/2007	2.6	6.5 – 1.0	4.1	2.7

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS model is 4.1 cfs (See Table 1). The winter flow recommendation, which met 2 of 3 criteria and is within the accuracy range of the R2CROSS model range is 2.7 cfs (See Table 1).

Hydrologic Data

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. The hydrograph below was derived from data collected by the USGS stream gage for the Huerfano River near Redwing, CO (#07111000), which has a drainage area of 73 square miles (See Gage Summary in Appendix C).

The total drainage area upstream of this ISF segment of Huerfano River is 11 square miles. The period of record for the Huerfano River gage was 1923 to 1985, the period of record used by staff in their analysis was 1923 to 1985, or 59 years of record. Table 2 below displays the estimated flow of Huerfano River in cfs at the lower terminus of the instream flow reach in terms of a percentage of exceedence.

Table 2: Estimated Stream Flow for Huerfano River

Exceedences	January	February	March	April	May	June	July	August	September	October	November	December
1%	2.86	2.71	3.77	12.36	37.87	38.17	25.32	21.70	13.61	6.48	4.67	3.62
5%	2.41	2.26	3.01	8.66	27.52	28.93	17.78	12.36	8.74	4.82	3.77	2.71
10%	2.11	2.26	2.71	6.33	21.56	25.32	14.32	9.49	6.63	4.37	3.32	2.41
20%	1.96	1.96	2.56	4.37	14.32	19.89	10.85	7.38	4.82	3.47	2.71	2.26
50%	1.51	1.51	1.81	2.71	7.84	10.85	6.33	4.52	3.01	2.56	2.11	1.66
80%	1.20	1.28	1.43	1.96	4.22	5.73	3.32	3.01	2.11	1.96	1.51	1.30
90%	0.98	1.05	1.21	1.66	3.16	4.10	2.56	2.26	1.66	1.66	1.39	1.13
95%	0.75	0.99	1.11	1.48	2.71	3.47	2.11	1.81	1.31	1.44	1.25	0.96
99%	0.66	0.75	0.86	1.28	1.81	2.41	1.28	1.30	0.98	0.99	1.05	0.80

Table 2 shows that the summer flow recommendation of 4.1 cfs is available at least 50% of the time from May through August. The winter flow recommendation of 2.7 cfs is available at least 50% of the time in April. Based on this water availability analysis, the fall/winter recommendation was further reduced to 2.5 cfs for the months of September through October and 1.5 cfs November through March. After incorporating the above water availability constraints, the original instream flow recommendation was modified to the following:

- 4.10 cubic feet per second is recommended from May 1 through August 31;
- 2.50 cubic feet per second is recommended from September 1 through October 31;
- 1.50 feet per second is recommended from November 1 through March 31;
- 2.70 cubic feet per second is recommended from April 1 through April 30.

However, if additional water is determined to be available in further investigations, the CDOW would recommend appropriating the additional water up to the recommended flow amounts to preserve the natural environment to a reasonable degree.

Precipitation Data

CDOW staff identified 4 local precipitation data sets located near the Huerfano River Drainage: Gardner (3222), Redwing 1 WSW (6977), Sheep Mountain (7572) and Blanco Station (BLA01) (see Precipitation Data in Appendix C).

Existing Water Right Information

CDOW staff has analyzed the water rights tabulation and will consult with the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. Records indicate that there are no surface water rights within this reach of Huerfano River.

Stream: Huerfano River (Upper Segment)

Executive Summary

Water Division:2
Water District: 79
CDOW#: 30130
CWCB ID: 09/2/A-003

Segment: Outlet of Lilly Lake to the Confluence with the Central Branch of Huerfano Creek

Upper Terminus: OUTLET OF LILLY LAKE
(Latitude 37° 35' 40.21"N) (Longitude 105° 29' 21.93"W)

Lower Terminus: CONFLUENCE WITH CENTRAL BRANCH OF HUERFANO CREEK
(Latitude 37° 40' 15.95"N) (Longitude 105° 25' 16.32"W)

Watershed: Little Snake (HUC#: 11020006)
Counties: Huerfano
Length: 8.2 miles
USGS Quad(s): Mosca Pass
Flow Recommendation: 4.10 cfs (May 1 – October 31)
2.70 cfs (November 1 – April 30)

Exhibit 3

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The Colorado Division of Wildlife (CDOW) recommended this segment of the Huerfano River to the CWCB for inclusion into the Instream Flow Program. The Huerfano River is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

This segment of the Huerfano River is approximately 8.2 miles long. It begins on the north side of Blanca Peak at an elevation of approximately 12,250 feet and terminates at the confluence with the Central Branch of the Huerfano River at an elevation of approximately 9,200 feet. Of the 8.2 mile segment addressed by this report, approximately 60% of the segment, or 5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 11 square miles. The Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the outlet of Lilly Lake and extending downstream to confluence with the Central Branch of Huerfano Creek. The proposed segment is located near the Town of Redwing. The staff has received only one recommendation for this segment, from the CDOW. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 4.1 cfs, summer, and 2.7 cfs, winter, based on their data collection efforts. The modeling results from this survey effort are within the confidence interval produced by the R2Cross model.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Outlet of Lily Lake	Confl. w/ Central Branch of Huerfano Creek	8.2	40%	60%

100% of the public lands are the San Isabel National Forest.

Biological Data

The CDOW, in 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a small stream (between 9 to 19 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold-water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

BLM staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. It is believed that recommendations that fall outside of the accuracy range of the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
CDOW	8/22/2007	2.6	6.5 – 1.0	4.1	2.7

CDOW = Division of Wildlife

The summer flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS model is 4.1 cfs. The winter flow recommendation, which met 2 of 3 criteria and is within the accuracy range of the R2CROSS model range is 2.7 cfs.

Hydrologic Data and Analysis

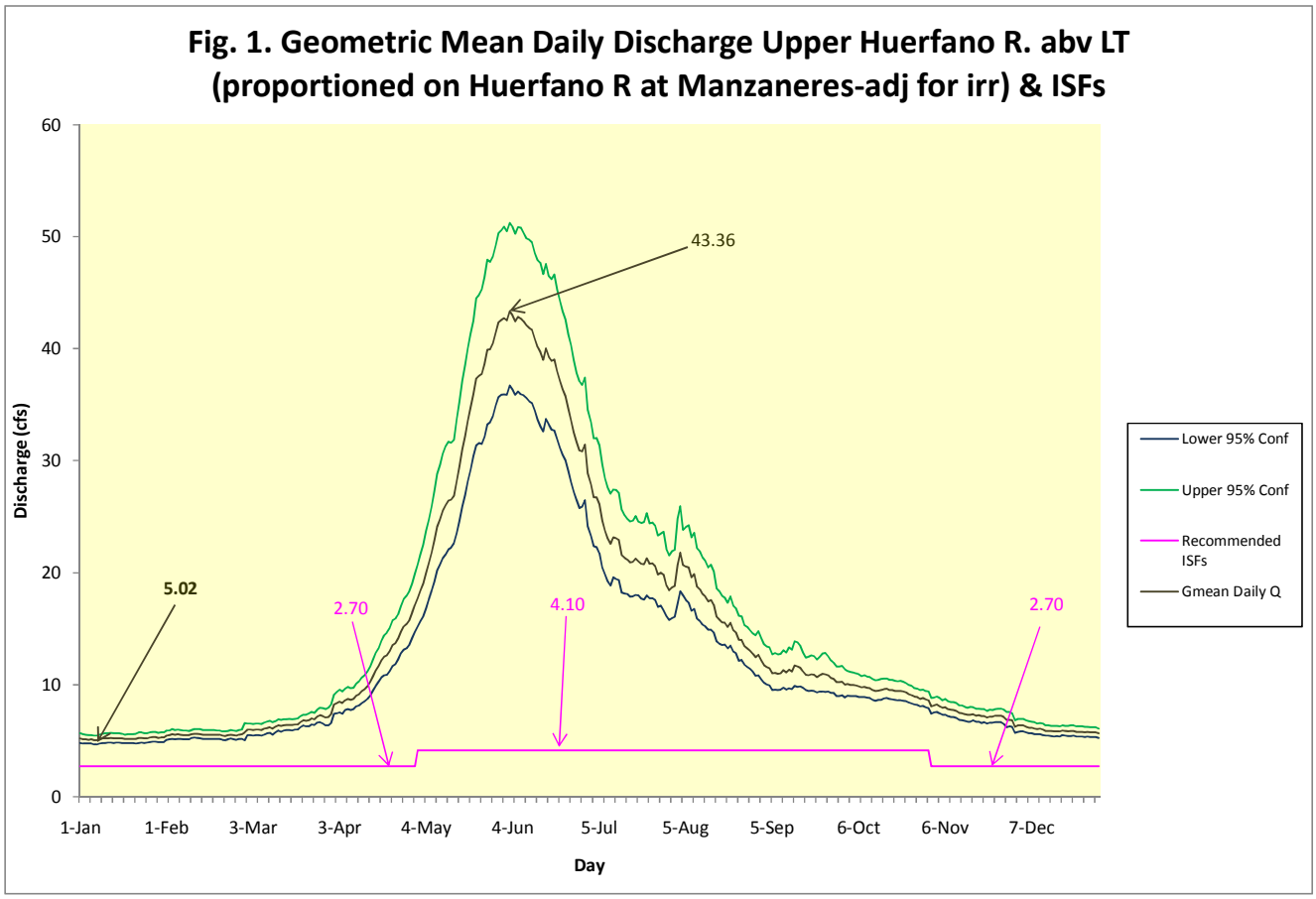
After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Upper Huerfano River** there is a USGS gage record of discharge on the stream. However, the gage station is downstream from the LT. The USGS gage is HUERFANO R AT MANZANARES XING, NR REDWING, CO (USGS 07111000); it has a period of record (POR) of 58 years collected between 1923 and 1982. The gage is at an elevation of 8,270 ft above mean sea level (amsl) and has a drainage area of 73.0 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses of numerous diversions. However, the existence of these diversions does not preclude use of the data from the gage. To make the measured data transferable to Upper Huerfano River above the LT, the consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Upper Huerfano River above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Upper Huerfano River above the LT (12.77 mi^2) to Huerfano River at Manzanares Crossing near Redwing, CO (73.0 mi^2). In this instance, due to the absence of existing significant upstream consumptive irrigation uses or transbasin diversions on Upper Huerfano River above the LT, the resulting proportioned "adjusted" hydrograph was not further "adjusted" (decreased). Nevertheless, the final hydrograph represents the existing distribution of flow over time.

{The Following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

The next step in producing a representation of the discharge at Upper Huerfano River is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Huerfano River at Manzanares Crossing near Redwing hydrograph. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in figure 1 with an enlargement displayed in figure 2. The data displayed by this hydrograph follow in Table 1.



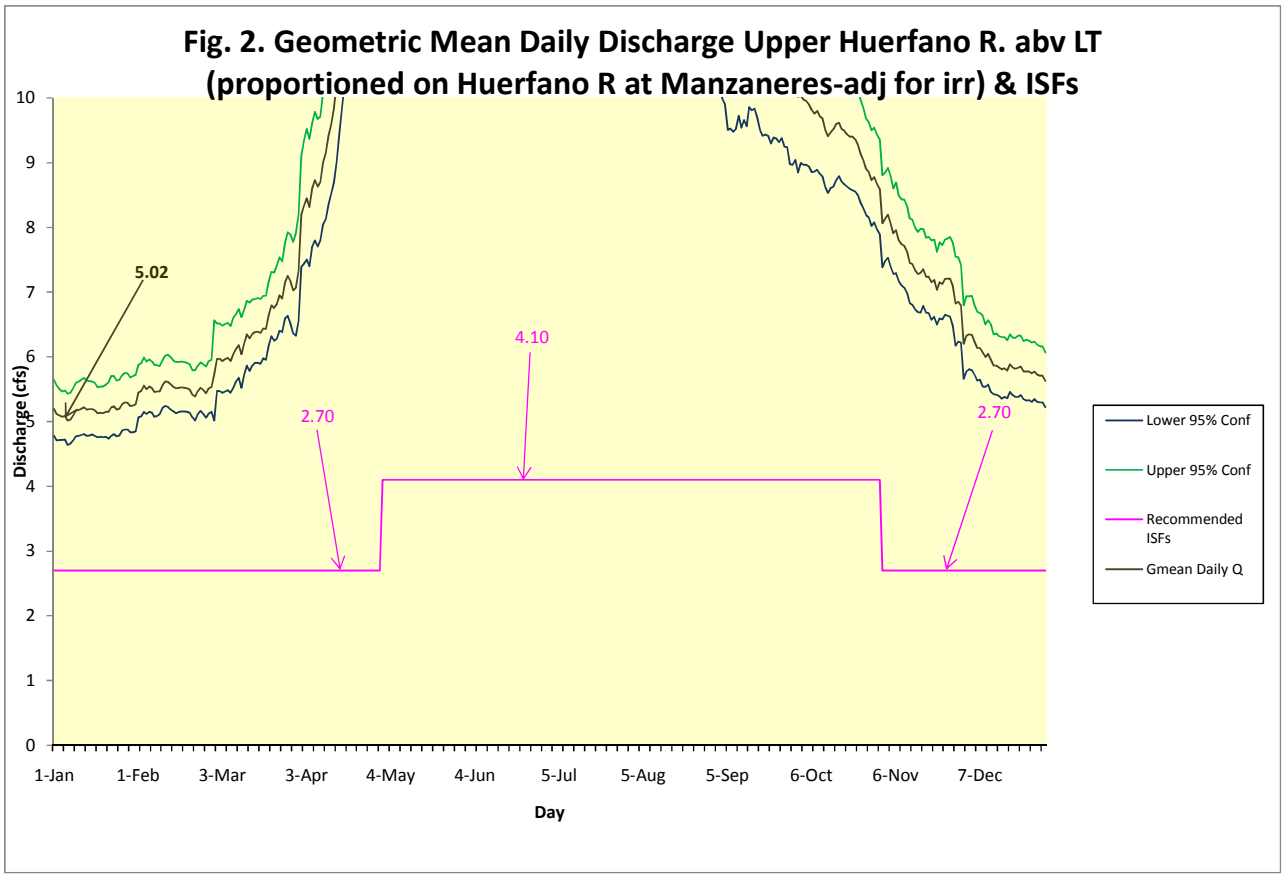


Table 1. Geometric Mean Discharge and Recommended Instream Flows

Date	Recommended ISF	Proportioned Adjusted GM (abv gage) No Adj (-) for Irr & OoB in Upper Huerfano R abv LT
1-Jan	1.50	5.19
2-Jan	1.50	5.11
3-Jan	1.50	5.09
4-Jan	1.50	5.07
5-Jan	1.50	5.08
6-Jan	1.50	5.02
7-Jan	1.50	5.03
8-Jan	1.50	5.09
9-Jan	1.50	5.17
10-Jan	1.50	5.18
11-Jan	1.50	5.20
12-Jan	1.50	5.22
13-Jan	1.50	5.19
14-Jan	1.50	5.19
15-Jan	1.50	5.19

16-Jan	1.50	5.17
17-Jan	1.50	5.13
18-Jan	1.50	5.13
19-Jan	1.50	5.13
20-Jan	1.50	5.15
21-Jan	1.50	5.15
22-Jan	1.50	5.22
23-Jan	1.50	5.23
24-Jan	1.50	5.18
25-Jan	1.50	5.20
26-Jan	1.50	5.27
27-Jan	1.50	5.29
28-Jan	1.50	5.29
29-Jan	1.50	5.24
30-Jan	1.50	5.25
31-Jan	1.50	5.27
1-Feb	1.50	5.45
2-Feb	1.50	5.47
3-Feb	1.50	5.55
4-Feb	1.50	5.50
5-Feb	1.50	5.54
6-Feb	1.50	5.51
7-Feb	1.50	5.46
8-Feb	1.50	5.46
9-Feb	1.50	5.47
10-Feb	1.50	5.56
11-Feb	1.50	5.62
12-Feb	1.50	5.61
13-Feb	1.50	5.57
14-Feb	1.50	5.53
15-Feb	1.50	5.51
16-Feb	1.50	5.52
17-Feb	1.50	5.53
18-Feb	1.50	5.52
19-Feb	1.50	5.51
20-Feb	1.50	5.49
21-Feb	1.50	5.41
22-Feb	1.50	5.39
23-Feb	1.50	5.47
24-Feb	1.50	5.52
25-Feb	1.50	5.48
26-Feb	1.50	5.44
27-Feb	1.50	5.51
28-Feb	1.50	5.54
29-Feb	1.50	5.73
1-Mar	1.50	5.97
2-Mar	1.50	5.97
3-Mar	1.50	5.94
4-Mar	1.50	5.96
5-Mar	1.50	5.98

6-Mar	1.50	5.93
7-Mar	1.50	6.04
8-Mar	1.50	6.11
9-Mar	1.50	6.18
10-Mar	1.50	6.04
11-Mar	1.50	6.20
12-Mar	1.50	6.34
13-Mar	1.50	6.28
14-Mar	1.50	6.36
15-Mar	1.50	6.38
16-Mar	1.50	6.39
17-Mar	1.50	6.37
18-Mar	1.50	6.44
19-Mar	1.50	6.43
20-Mar	1.50	6.64
21-Mar	1.50	6.80
22-Mar	1.50	6.75
23-Mar	1.50	6.82
24-Mar	1.50	6.95
25-Mar	1.50	6.90
26-Mar	1.50	7.14
27-Mar	1.50	7.25
28-Mar	1.50	7.17
29-Mar	1.50	7.03
30-Mar	1.50	7.07
31-Mar	1.50	7.33
1-Apr	2.70	8.19
2-Apr	2.70	8.33
3-Apr	2.70	8.45
4-Apr	2.70	8.32
5-Apr	2.70	8.60
6-Apr	2.70	8.73
7-Apr	2.70	8.63
8-Apr	2.70	8.70
9-Apr	2.70	9.00
10-Apr	2.70	9.14
11-Apr	2.70	9.42
12-Apr	2.70	9.59
13-Apr	2.70	9.84
14-Apr	2.70	10.23
15-Apr	2.70	10.75
16-Apr	2.70	11.23
17-Apr	2.70	11.65
18-Apr	2.70	12.13
19-Apr	2.70	12.48
20-Apr	2.70	12.60
21-Apr	2.70	12.96
22-Apr	2.70	13.53
23-Apr	2.70	13.68
24-Apr	2.70	14.10

25-Apr	2.70	14.72
26-Apr	2.70	15.20
27-Apr	2.70	15.39
28-Apr	2.70	15.74
29-Apr	2.70	16.38
30-Apr	2.70	17.09
1-May	4.10	17.71
2-May	4.10	18.41
3-May	4.10	19.01
4-May	4.10	19.95
5-May	4.10	20.83
6-May	4.10	21.79
7-May	4.10	22.85
8-May	4.10	24.11
9-May	4.10	24.75
10-May	4.10	25.50
11-May	4.10	25.99
12-May	4.10	26.43
13-May	4.10	26.49
14-May	4.10	26.83
15-May	4.10	28.15
16-May	4.10	29.44
17-May	4.10	30.98
18-May	4.10	32.20
19-May	4.10	33.56
20-May	4.10	34.72
21-May	4.10	35.92
22-May	4.10	37.36
23-May	4.10	37.59
24-May	4.10	37.76
25-May	4.10	38.61
26-May	4.10	39.90
27-May	4.10	39.94
28-May	4.10	40.48
29-May	4.10	41.46
30-May	4.10	42.35
31-May	4.10	42.58
1-Jun	4.10	42.73
2-Jun	4.10	42.54
3-Jun	4.10	43.36
4-Jun	4.10	42.98
5-Jun	4.10	42.45
6-Jun	4.10	42.88
7-Jun	4.10	42.71
8-Jun	4.10	42.46
9-Jun	4.10	42.11
10-Jun	4.10	41.88
11-Jun	4.10	41.69
12-Jun	4.10	40.88
13-Jun	4.10	40.16

14-Jun	4.10	39.70
15-Jun	4.10	39.00
16-Jun	4.10	40.05
17-Jun	4.10	39.30
18-Jun	4.10	38.90
19-Jun	4.10	39.03
20-Jun	4.10	38.01
21-Jun	4.10	37.15
22-Jun	4.10	36.37
23-Jun	4.10	35.75
24-Jun	4.10	34.63
25-Jun	4.10	33.62
26-Jun	4.10	32.53
27-Jun	4.10	31.65
28-Jun	4.10	30.90
29-Jun	4.10	30.83
30-Jun	4.10	31.47
1-Jul	4.10	28.87
2-Jul	4.10	27.88
3-Jul	4.10	26.73
4-Jul	4.10	26.71
5-Jul	4.10	26.10
6-Jul	4.10	24.63
7-Jul	4.10	23.72
8-Jul	4.10	23.02
9-Jul	4.10	22.57
10-Jul	4.10	23.16
11-Jul	4.10	23.05
12-Jul	4.10	22.89
13-Jul	4.10	21.58
14-Jul	4.10	21.34
15-Jul	4.10	21.17
16-Jul	4.10	20.92
17-Jul	4.10	20.97
18-Jul	4.10	21.23
19-Jul	4.10	21.01
20-Jul	4.10	20.77
21-Jul	4.10	20.75
22-Jul	4.10	21.29
23-Jul	4.10	20.77
24-Jul	4.10	20.81
25-Jul	4.10	20.58
26-Jul	4.10	19.83
27-Jul	4.10	20.01
28-Jul	4.10	19.82
29-Jul	4.10	18.87
30-Jul	4.10	18.41
31-Jul	4.10	18.65
1-Aug	4.10	18.79
2-Aug	4.10	20.66

3-Aug	4.10	21.77
4-Aug	4.10	20.67
5-Aug	4.10	20.52
6-Aug	4.10	20.46
7-Aug	4.10	19.57
8-Aug	4.10	19.87
9-Aug	4.10	18.76
10-Aug	4.10	18.51
11-Aug	4.10	18.10
12-Aug	4.10	17.85
13-Aug	4.10	17.43
14-Aug	4.10	17.55
15-Aug	4.10	17.14
16-Aug	4.10	16.05
17-Aug	4.10	15.80
18-Aug	4.10	15.55
19-Aug	4.10	15.50
20-Aug	4.10	15.13
21-Aug	4.10	15.52
22-Aug	4.10	14.86
23-Aug	4.10	14.63
24-Aug	4.10	13.98
25-Aug	4.10	13.99
26-Aug	4.10	13.42
27-Aug	4.10	13.24
28-Aug	4.10	13.00
29-Aug	4.10	12.73
30-Aug	4.10	12.45
31-Aug	4.10	12.65
1-Sep	2.50	12.17
2-Sep	2.50	11.75
3-Sep	2.50	11.56
4-Sep	2.50	11.46
5-Sep	2.50	10.98
6-Sep	2.50	11.03
7-Sep	2.50	10.96
8-Sep	2.50	11.01
9-Sep	2.50	11.27
10-Sep	2.50	11.08
11-Sep	2.50	11.33
12-Sep	2.50	11.18
13-Sep	2.50	11.68
14-Sep	2.50	11.61
15-Sep	2.50	11.50
16-Sep	2.50	11.15
17-Sep	2.50	10.85
18-Sep	2.50	10.84
19-Sep	2.50	10.90
20-Sep	2.50	10.85
21-Sep	2.50	10.66

22-Sep	2.50	10.81
23-Sep	2.50	10.94
24-Sep	2.50	10.92
25-Sep	2.50	10.83
26-Sep	2.50	10.59
27-Sep	2.50	10.51
28-Sep	2.50	10.21
29-Sep	2.50	10.19
30-Sep	2.50	10.26
1-Oct	2.50	10.02
2-Oct	2.50	10.03
3-Oct	2.50	9.97
4-Oct	2.50	9.95
5-Oct	2.50	9.90
6-Oct	2.50	9.81
7-Oct	2.50	9.76
8-Oct	2.50	9.80
9-Oct	2.50	9.72
10-Oct	2.50	9.68
11-Oct	2.50	9.51
12-Oct	2.50	9.41
13-Oct	2.50	9.47
14-Oct	2.50	9.52
15-Oct	2.50	9.59
16-Oct	2.50	9.62
17-Oct	2.50	9.52
18-Oct	2.50	9.49
19-Oct	2.50	9.43
20-Oct	2.50	9.40
21-Oct	2.50	9.40
22-Oct	2.50	9.36
23-Oct	2.50	9.28
24-Oct	2.50	9.13
25-Oct	2.50	9.04
26-Oct	2.50	8.90
27-Oct	2.50	8.85
28-Oct	2.50	8.73
29-Oct	2.50	8.78
30-Oct	2.50	8.66
31-Oct	2.50	8.59
1-Nov	1.50	8.06
2-Nov	1.50	8.14
3-Nov	1.50	8.19
4-Nov	1.50	8.06
5-Nov	1.50	7.91
6-Nov	1.50	7.96
7-Nov	1.50	7.80
8-Nov	1.50	7.74
9-Nov	1.50	7.71
10-Nov	1.50	7.63

11-Nov	1.50	7.45
12-Nov	1.50	7.43
13-Nov	1.50	7.33
14-Nov	1.50	7.28
15-Nov	1.50	7.30
16-Nov	1.50	7.35
17-Nov	1.50	7.24
18-Nov	1.50	7.24
19-Nov	1.50	7.15
20-Nov	1.50	7.19
21-Nov	1.50	7.04
22-Nov	1.50	7.15
23-Nov	1.50	7.13
24-Nov	1.50	7.20
25-Nov	1.50	7.21
26-Nov	1.50	7.21
27-Nov	1.50	7.09
28-Nov	1.50	6.82
29-Nov	1.50	6.85
30-Nov	1.50	6.79
1-Dec	1.50	6.20
2-Dec	1.50	6.32
3-Dec	1.50	6.34
4-Dec	1.50	6.34
5-Dec	1.50	6.24
6-Dec	1.50	6.14
7-Dec	1.50	6.14
8-Dec	1.50	6.06
9-Dec	1.50	6.00
10-Dec	1.50	6.04
11-Dec	1.50	5.95
12-Dec	1.50	5.86
13-Dec	1.50	5.87
14-Dec	1.50	5.84
15-Dec	1.50	5.80
16-Dec	1.50	5.82
17-Dec	1.50	5.79
18-Dec	1.50	5.88
19-Dec	1.50	5.83
20-Dec	1.50	5.81
21-Dec	1.50	5.83
22-Dec	1.50	5.85
23-Dec	1.50	5.77
24-Dec	1.50	5.77
25-Dec	1.50	5.77
26-Dec	1.50	5.74
27-Dec	1.50	5.77
28-Dec	1.50	5.73
29-Dec	1.50	5.71
30-Dec	1.50	5.71

31-Dec	1.50	5.63

Existing Water Right Information

Staff has analyzed the water rights tabulation and the Division Engineer Office (DEO) to identify any potential water availability problems. There are several small decreed springs within this reach of stream. Staff has determined that water is available for appropriation on Huerfano River, between the outlet of Lilly Lake and the confluence with the Central Branch of the Huerfano River, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation
Staff recommends the Board form its intent to appropriate on the following stream reach:

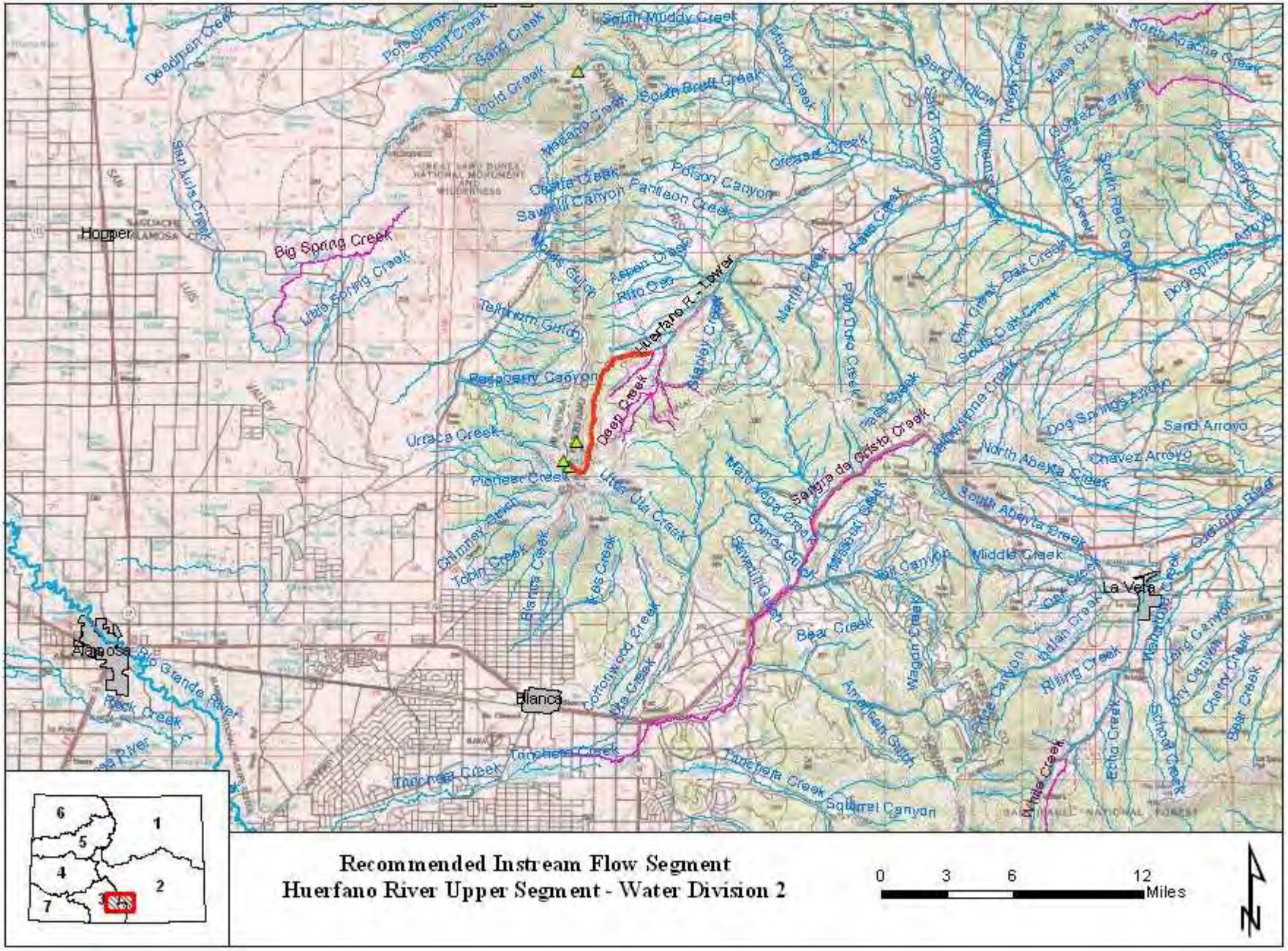
Segment: Outlet of Lilly Lake to the Confluence with the Central Branch of Huerfano Creek

Upper Terminus: OUTLET OF LILLY LAKE
(Latitude 37° 35' 40.21"N) (Longitude 105° 29' 21.93"W)
UTM North: 4160938.4 UTM East: 456794.0
S24 T28S R73W 6th PM
1452' West of the East Section Line; 1050' North of the South Section Line

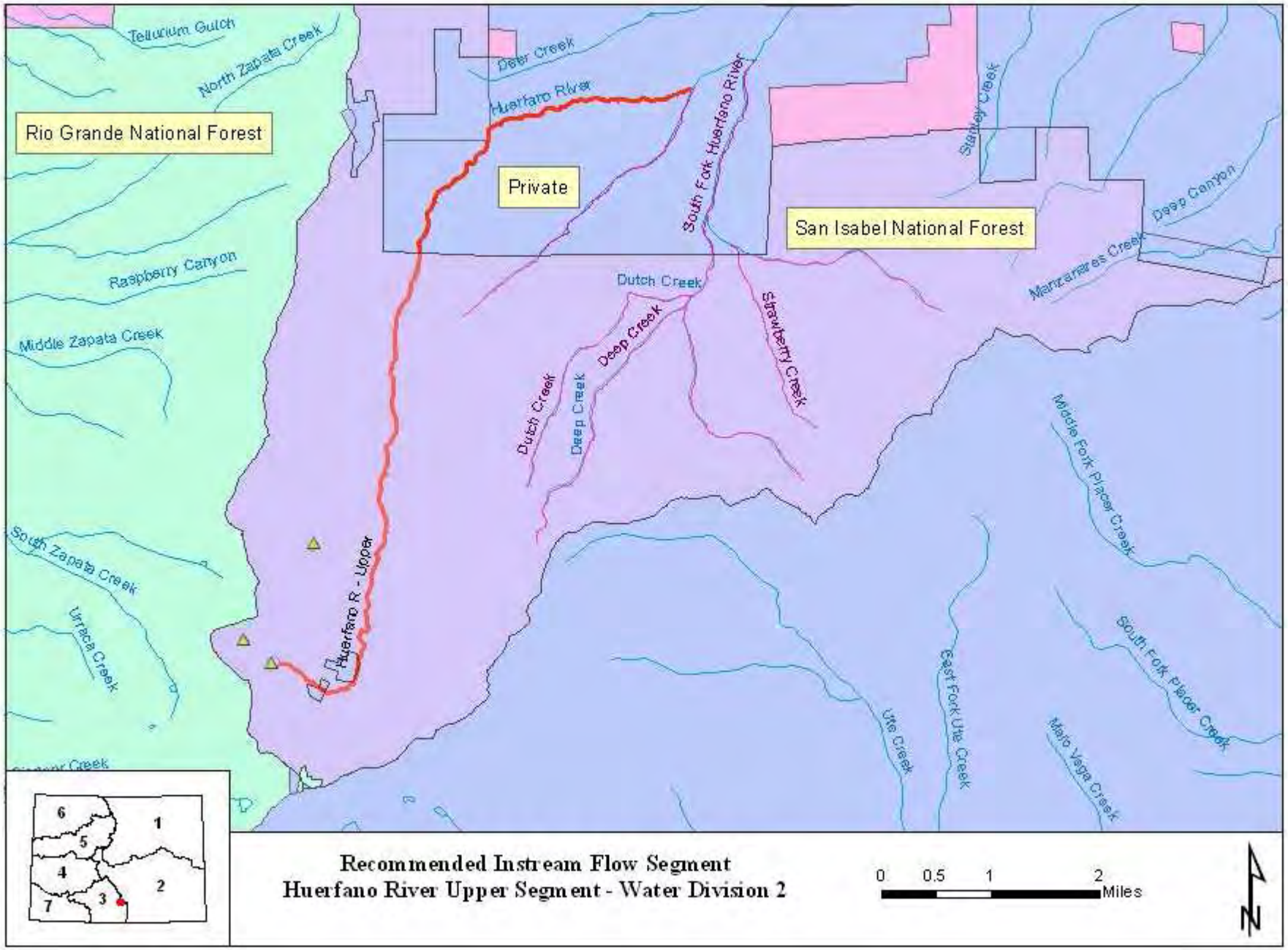
Lower Terminus: CONFLUENCE WITH CENTRAL BRANCH OF HUERFANO CREEK
(Latitude 37° 40' 15.95"N) (Longitude 105° 25' 16.32"W)
UTM North: 4169407.1 UTM East: 462855.0
SE NE S27 T27S R72W 6th PM
1238' West of the East Section Line; 2483' South of the North Section Line

Watershed: Little Snake (HUC#: 11020006)
Counties: Huerfano
Length: 8.2 miles
USGS Quad(s): Mosca Pass
Flow Recommendation: 4.10 cfs (May 1 – October 31)
2.70 cfs (November 1 – April 30)

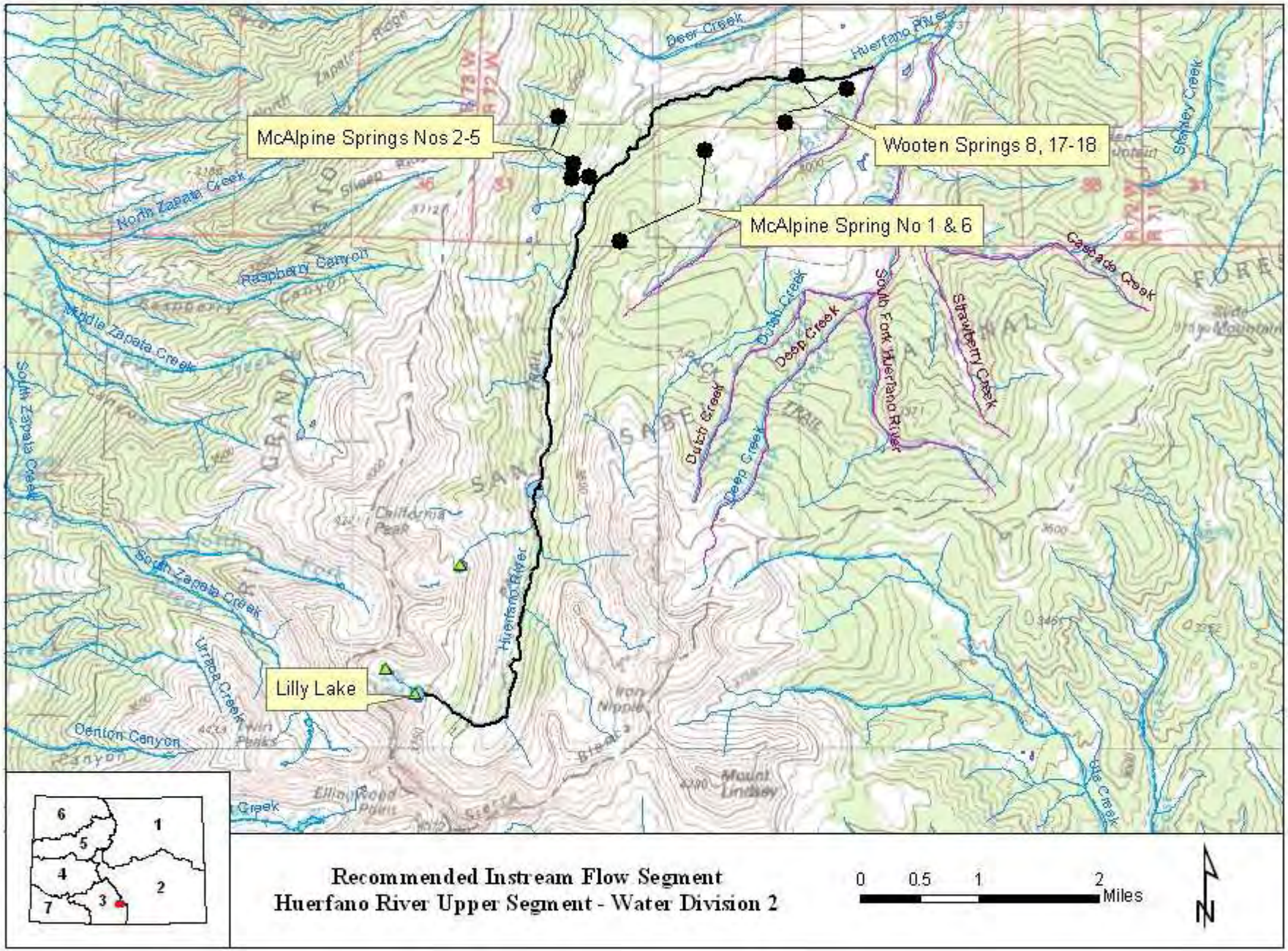
Vicinity Map



Land Use


Rio Grande National Forest
Private
San Isabel National Forest
Tellurium Gulch
North Zapata Creek
Deer Creek
Huerfano River
South Fork Huerfano River
Stanley Creek
Deep Canyon
Manzanares Creek
Raspberry Canyon
Middle Zapata Creek
Dutch Creek
Deep Creek
Strawberry Creek
Middle Fork Placer Creek
South Zapata Creek
Urraca Creek
Huerfano R - Upper
East Fork Ute Creek
Ute Creek
Mario Vega Creek
South Fork Placer Creek
Recommended Instream Flow Segment
Huerfano River Upper Segment - Water Division 2
0 0.5 1 2 Miles
N

Topographic and Water Rights Map



Stream: Huerfano River (Lower Segment)

Executive Summary

Water Division: 2
Water District: 79
CDOW#: 30130
CWCB ID: 09/2/A-004

Segment: Confluence with Unnamed Tributary to the Confluence with Stanley Creek

Upper Terminus: CONFLUENCE WITH UNNAMED TRIBUTARY
(Latitude 37° 41’ 2.04”N) (Longitude 105° 24’ 8.54”W)

Lower Terminus: CONFLUENCE WITH STANLEY CREEK
(Latitude 37° 42’ 33.49”N) (Longitude 105° 22’ 16.12”W)

Watershed: Huerfano (HUC#: 11020006)
Counties: Huerfano
Length: 2.6 miles
USGS Quad(s): Mosca Pass
Flow Recommendation: 5.75 cfs (April 1 to October 31)
2.75 cfs (November 1 to March 31)

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The Colorado Division of Wildlife (CDOW) recommended this segment of the Huerfano River to the CWCB for inclusion into the Instream Flow Program. Huerfano River is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

This segment of the Huerfano River is approximately 2.6 miles long. It begins at the confluence of an unnamed tributary at an elevation of approximately 8,875 feet and terminates at the confluence with Stanley Creek at an elevation of approximately 8,450 feet. Of the 2.6-mile segment addressed by this report, approximately 85% of the segment is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 55 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the confluence of an unnamed tributary and extending downstream to confluence with the Stanley Creek. The proposed segment is located near the Town of Redwing. The staff has received only one recommendation for this segment, from the CDOW. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending 5.75 cfs (April 1 to October 31), and 2.75 cfs (November 1 to March 31), based on their data collection efforts.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence with Unnamed Tributary	Confluence with Stanley Creek	2.6	15%	85%

93% of the public lands are State Wildlife area and 7% of the lands are BLM.

Biological Data

The CDOW, in 2006 & 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a medium stream (between 20 to 35 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

CDOW staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, four data sets were collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected (Date), the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
CDOW	7/19/2006	14.6	36.6 – 5.9	3.1^{OR}	2.1^{OR}
CDOW	7/19/2006	13.2	33.1 – 5.3	5.5	2.7^{OR}
CDOW	8/22/2007	30.1	75.2 – 12.0	5.5^{OR}	3.8^{OR}
CDOW	8/22/2007	26.0	65.1 – 10.4	2.3^{OR}	2.3^{OR}
CDOW	11/25/2008	10.9	27.2 – 4.4	6.0	3.0^{OR}

CDOW = Division of Wildlife OR= Outside of the R2X Accuracy Range

The summer flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS ranged from 6.0 cfs to 5.5 cfs. The flow recommendation of 5.75 cfs was derived by averaging the results of the two data sets. The winter flow recommendation, which met 2 of 3 criteria were all outside of the accuracy of the R2CROSS model. However, averaging all of the winter flow recommendations would result in a 2.75 cfs recommendation. In addition, comparing this value (2.75 cfs) to the "within range" value requested for the upstream segment of the Huerfano River (Lilly Lake to Central Branch Huerfano River segment) of 2.7 cfs, supports this wintertime recommendation.

Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Lower Huerfano River** there is a USGS gage record of discharge on the stream. However, the gage station is downstream from the LT. The USGS gage is HUERFANO R AT MANZANARES XING, NR REDWING, CO (USGS 07111000); it has a period of record (POR) of 58 years collected between 1923 and 1982. The gage is at an elevation of 8,270 ft above mean sea level (amsl) and has a drainage area of 73.0 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses of numerous diversions. However, the existence of these diversions does not preclude use of the data from the gage. To make the measured data transferable to Lower Huerfano River above the LT, the

consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Lower Huerfano River above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Lower Huerfano River above the LT (38.81 mi^2) to Huerfano River at Manzanares Crossing near Redwing, CO (73.0 mi^2). Next, the resulting proportioned "adjusted" hydrograph was itself "adjusted" (decreased) to reflect the numerous existing consumptive irrigation depletions on Lower Huerfano River upstream of the LT. The final hydrograph thus represents a distribution of flow over time that has been reduced to reflect existing human uses.

{The Following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

The next step in producing a representation of the discharge at Lower Huerfano River is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Huerfano River at Manzanares Crossing near Redwing hydrograph. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in figure 1 with an enlargement displayed in figure 2. The data displayed by this hydrograph follow in Table 1.

Fig. 1. Geometric Mean Daily Discharge Lower Huerfano R. abv LT (proportioned on Huerfano R. at Manzaneres-adj for irr), Adjusted for Irr, & ISFs

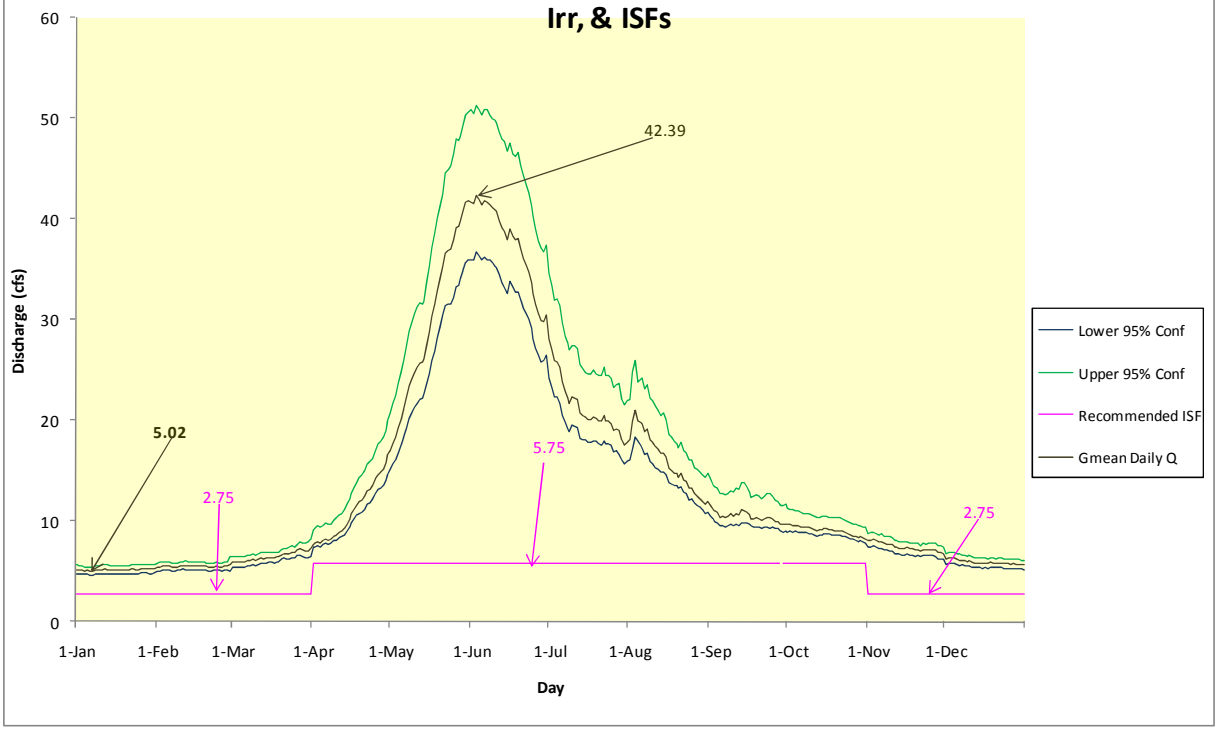


Fig. 2. Geometric Mean Daily Discharge Lower Huerfano R. abv LT (proportioned on Huerfano R. at Manzaneres-adj for irr), Adjusted for Irr, & ISFs

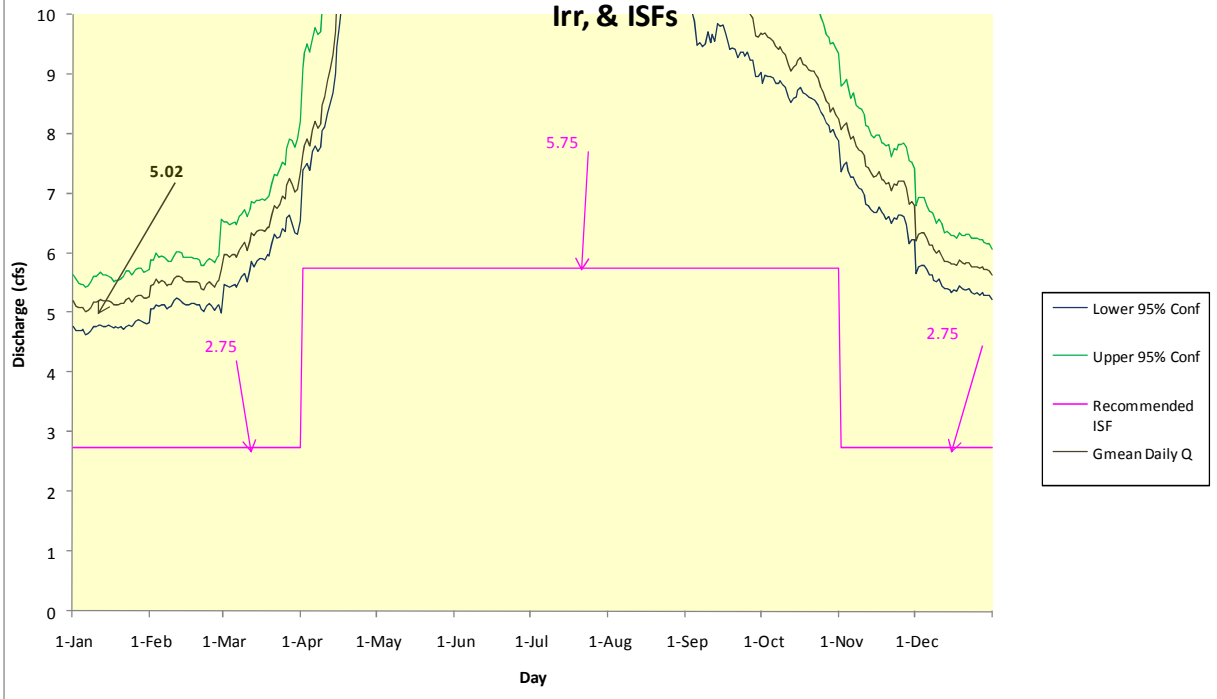


Table 1. Geometric Mean Discharge and Recommended Instream Flows		
Date	Recommended ISF	Proportioned Adjusted GM (abv gage) Adj (-) for Irr & OoB in Lower Huerfano R abv LT
1-Jan	1.5	5.19
2-Jan	1.5	5.11
3-Jan	1.5	5.09
4-Jan	1.5	5.07
5-Jan	1.5	5.08
6-Jan	1.5	5.02
7-Jan	1.5	5.03
8-Jan	1.5	5.09
9-Jan	1.5	5.17
10-Jan	1.5	5.18
11-Jan	1.5	5.20
12-Jan	1.5	5.22
13-Jan	1.5	5.19
14-Jan	1.5	5.19
15-Jan	1.5	5.19
16-Jan	1.5	5.17
17-Jan	1.5	5.13
18-Jan	1.5	5.13
19-Jan	1.5	5.13
20-Jan	1.5	5.15
21-Jan	1.5	5.15
22-Jan	1.5	5.22
23-Jan	1.5	5.23
24-Jan	1.5	5.18
25-Jan	1.5	5.20
26-Jan	1.5	5.27
27-Jan	1.5	5.29
28-Jan	1.5	5.29
29-Jan	1.5	5.24
30-Jan	1.5	5.25
31-Jan	1.5	5.27
1-Feb	1.5	5.45
2-Feb	1.5	5.47
3-Feb	1.5	5.55
4-Feb	1.5	5.50
5-Feb	1.5	5.54
6-Feb	1.5	5.51
7-Feb	1.5	5.46
8-Feb	1.5	5.46
9-Feb	1.5	5.47
10-Feb	1.5	5.56
11-Feb	1.5	5.62
12-Feb	1.5	5.61
13-Feb	1.5	5.57

14-Feb	1.5	5.53
15-Feb	1.5	5.51
16-Feb	1.5	5.52
17-Feb	1.5	5.53
18-Feb	1.5	5.52
19-Feb	1.5	5.51
20-Feb	1.5	5.49
21-Feb	1.5	5.41
22-Feb	1.5	5.39
23-Feb	1.5	5.47
24-Feb	1.5	5.52
25-Feb	1.5	5.48
26-Feb	1.5	5.44
27-Feb	1.5	5.51
28-Feb	1.5	5.54
29-Feb	1.5	5.73
1-Mar	1.5	5.97
2-Mar	1.5	5.97
3-Mar	1.5	5.94
4-Mar	1.5	5.96
5-Mar	1.5	5.98
6-Mar	1.5	5.93
7-Mar	1.5	6.04
8-Mar	1.5	6.11
9-Mar	1.5	6.18
10-Mar	1.5	6.04
11-Mar	1.5	6.20
12-Mar	1.5	6.34
13-Mar	1.5	6.28
14-Mar	1.5	6.36
15-Mar	1.5	6.38
16-Mar	1.5	6.39
17-Mar	1.5	6.37
18-Mar	1.5	6.44
19-Mar	1.5	6.43
20-Mar	1.5	6.64
21-Mar	1.5	6.80
22-Mar	1.5	6.75
23-Mar	1.5	6.82
24-Mar	1.5	6.95
25-Mar	1.5	6.90
26-Mar	1.5	7.14
27-Mar	1.5	7.25
28-Mar	1.5	7.17
29-Mar	1.5	7.03
30-Mar	1.5	7.07
31-Mar	1.5	7.33
1-Apr	2.7	7.67
2-Apr	2.7	7.80
3-Apr	2.7	7.92

4-Apr	2.7	7.79
5-Apr	2.7	8.07
6-Apr	2.7	8.20
7-Apr	2.7	8.10
8-Apr	2.7	8.17
9-Apr	2.7	8.47
10-Apr	2.7	8.61
11-Apr	2.7	8.89
12-Apr	2.7	9.06
13-Apr	2.7	9.31
14-Apr	2.7	9.70
15-Apr	2.7	10.22
16-Apr	2.7	10.70
17-Apr	2.7	11.12
18-Apr	2.7	11.61
19-Apr	2.7	11.95
20-Apr	2.7	12.07
21-Apr	2.7	12.44
22-Apr	2.7	13.00
23-Apr	2.7	13.15
24-Apr	2.7	13.57
25-Apr	2.7	14.19
26-Apr	2.7	14.67
27-Apr	2.7	14.86
28-Apr	2.7	15.21
29-Apr	2.7	15.85
30-Apr	2.7	16.57
1-May	4.1	17.04
2-May	4.1	17.74
3-May	4.1	18.33
4-May	4.1	19.28
5-May	4.1	20.15
6-May	4.1	21.12
7-May	4.1	22.17
8-May	4.1	23.43
9-May	4.1	24.07
10-May	4.1	24.83
11-May	4.1	25.32
12-May	4.1	25.76
13-May	4.1	25.82
14-May	4.1	26.15
15-May	4.1	27.48
16-May	4.1	28.77
17-May	4.1	30.31
18-May	4.1	31.52
19-May	4.1	32.88
20-May	4.1	34.05
21-May	4.1	35.25
22-May	4.1	36.68
23-May	4.1	36.91

24-May	4.1	37.08
25-May	4.1	37.93
26-May	4.1	39.23
27-May	4.1	39.27
28-May	4.1	39.81
29-May	4.1	40.79
30-May	4.1	41.68
31-May	4.1	41.91
1-Jun	4.1	41.76
2-Jun	4.1	41.57
3-Jun	4.1	42.39
4-Jun	4.1	42.01
5-Jun	4.1	41.48
6-Jun	4.1	41.91
7-Jun	4.1	41.74
8-Jun	4.1	41.49
9-Jun	4.1	41.14
10-Jun	4.1	40.91
11-Jun	4.1	40.72
12-Jun	4.1	39.91
13-Jun	4.1	39.19
14-Jun	4.1	38.73
15-Jun	4.1	38.03
16-Jun	4.1	39.08
17-Jun	4.1	38.33
18-Jun	4.1	37.93
19-Jun	4.1	38.06
20-Jun	4.1	37.04
21-Jun	4.1	36.18
22-Jun	4.1	35.40
23-Jun	4.1	34.78
24-Jun	4.1	33.66
25-Jun	4.1	32.65
26-Jun	4.1	31.56
27-Jun	4.1	30.68
28-Jun	4.1	29.93
29-Jun	4.1	29.86
30-Jun	4.1	30.50
1-Jul	4.1	28.05
2-Jul	4.1	27.06
3-Jul	4.1	25.91
4-Jul	4.1	25.88
5-Jul	4.1	25.28
6-Jul	4.1	23.81
7-Jul	4.1	22.90
8-Jul	4.1	22.19
9-Jul	4.1	21.75
10-Jul	4.1	22.34
11-Jul	4.1	22.23
12-Jul	4.1	22.07

13-Jul	4.1	20.76
14-Jul	4.1	20.52
15-Jul	4.1	20.35
16-Jul	4.1	20.10
17-Jul	4.1	20.15
18-Jul	4.1	20.41
19-Jul	4.1	20.19
20-Jul	4.1	19.95
21-Jul	4.1	19.93
22-Jul	4.1	20.47
23-Jul	4.1	19.95
24-Jul	4.1	19.99
25-Jul	4.1	19.76
26-Jul	4.1	19.01
27-Jul	4.1	19.19
28-Jul	4.1	19.00
29-Jul	4.1	18.05
30-Jul	4.1	17.59
31-Jul	4.1	17.83
1-Aug	4.1	18.06
2-Aug	4.1	19.93
3-Aug	4.1	21.04
4-Aug	4.1	19.94
5-Aug	4.1	19.80
6-Aug	4.1	19.74
7-Aug	4.1	18.84
8-Aug	4.1	19.14
9-Aug	4.1	18.04
10-Aug	4.1	17.78
11-Aug	4.1	17.37
12-Aug	4.1	17.12
13-Aug	4.1	16.70
14-Aug	4.1	16.82
15-Aug	4.1	16.41
16-Aug	4.1	15.32
17-Aug	4.1	15.07
18-Aug	4.1	14.82
19-Aug	4.1	14.77
20-Aug	4.1	14.40
21-Aug	4.1	14.79
22-Aug	4.1	14.13
23-Aug	4.1	13.90
24-Aug	4.1	13.25
25-Aug	4.1	13.26
26-Aug	4.1	12.69
27-Aug	4.1	12.51
28-Aug	4.1	12.27
29-Aug	4.1	12.00
30-Aug	4.1	11.72
31-Aug	4.1	11.92

1-Sep	2.5	11.59
2-Sep	2.5	11.18
3-Sep	2.5	10.99
4-Sep	2.5	10.89
5-Sep	2.5	10.40
6-Sep	2.5	10.46
7-Sep	2.5	10.38
8-Sep	2.5	10.44
9-Sep	2.5	10.69
10-Sep	2.5	10.50
11-Sep	2.5	10.76
12-Sep	2.5	10.61
13-Sep	2.5	11.11
14-Sep	2.5	11.04
15-Sep	2.5	10.92
16-Sep	2.5	10.58
17-Sep	2.5	10.27
18-Sep	2.5	10.27
19-Sep	2.5	10.33
20-Sep	2.5	10.27
21-Sep	2.5	10.09
22-Sep	2.5	10.24
23-Sep	2.5	10.37
24-Sep	2.5	10.35
25-Sep	2.5	10.26
26-Sep	2.5	10.02
27-Sep	2.5	9.93
28-Sep	2.5	9.63
29-Sep	2.5	9.62
30-Sep	2.5	9.69
1-Oct	2.5	9.66
2-Oct	2.5	9.68
3-Oct	2.5	9.62
4-Oct	2.5	9.60
5-Oct	2.5	9.55
6-Oct	2.5	9.46
7-Oct	2.5	9.41
8-Oct	2.5	9.45
9-Oct	2.5	9.36
10-Oct	2.5	9.33
11-Oct	2.5	9.16
12-Oct	2.5	9.05
13-Oct	2.5	9.12
14-Oct	2.5	9.16
15-Oct	2.5	9.24
16-Oct	2.5	9.27
17-Oct	2.5	9.17
18-Oct	2.5	9.14
19-Oct	2.5	9.08
20-Oct	2.5	9.05

21-Oct	2.5	9.05
22-Oct	2.5	9.01
23-Oct	2.5	8.92
24-Oct	2.5	8.78
25-Oct	2.5	8.68
26-Oct	2.5	8.55
27-Oct	2.5	8.50
28-Oct	2.5	8.38
29-Oct	2.5	8.42
30-Oct	2.5	8.31
31-Oct	2.5	8.24
1-Nov	1.5	8.06
2-Nov	1.5	8.14
3-Nov	1.5	8.19
4-Nov	1.5	8.06
5-Nov	1.5	7.91
6-Nov	1.5	7.96
7-Nov	1.5	7.80
8-Nov	1.5	7.74
9-Nov	1.5	7.71
10-Nov	1.5	7.63
11-Nov	1.5	7.45
12-Nov	1.5	7.43
13-Nov	1.5	7.33
14-Nov	1.5	7.28
15-Nov	1.5	7.30
16-Nov	1.5	7.35
17-Nov	1.5	7.24
18-Nov	1.5	7.24
19-Nov	1.5	7.15
20-Nov	1.5	7.19
21-Nov	1.5	7.04
22-Nov	1.5	7.15
23-Nov	1.5	7.13
24-Nov	1.5	7.20
25-Nov	1.5	7.21
26-Nov	1.5	7.21
27-Nov	1.5	7.09
28-Nov	1.5	6.82
29-Nov	1.5	6.85
30-Nov	1.5	6.79
1-Dec	1.5	6.20
2-Dec	1.5	6.32
3-Dec	1.5	6.34
4-Dec	1.5	6.34
5-Dec	1.5	6.24
6-Dec	1.5	6.14
7-Dec	1.5	6.14
8-Dec	1.5	6.06
9-Dec	1.5	6.00

10-Dec	1.5	6.04
11-Dec	1.5	5.95
12-Dec	1.5	5.86
13-Dec	1.5	5.87
14-Dec	1.5	5.84
15-Dec	1.5	5.80
16-Dec	1.5	5.82
17-Dec	1.5	5.79
18-Dec	1.5	5.88
19-Dec	1.5	5.83
20-Dec	1.5	5.81
21-Dec	1.5	5.83
22-Dec	1.5	5.85
23-Dec	1.5	5.77
24-Dec	1.5	5.77
25-Dec	1.5	5.77
26-Dec	1.5	5.74
27-Dec	1.5	5.77
28-Dec	1.5	5.73
29-Dec	1.5	5.71
30-Dec	1.5	5.71
31-Dec	1.5	5.63

Existing Water Right Information

Staff has analyzed the water rights tabulation and contacted the Division Engineer Office (DEO) to identify any potential water availability problems. There are two decreed surface diversion within this reach of stream, the Magnas Ditch (2 cfs with an 1901 appropriation) and the Pathfinder Ditch (0.5 cfs with an 1880 appropriation). Staff has determined that water is available for appropriation on the Huerfano River, between the confluence with an unnamed tributary and the confluence with Stanley Creek, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation
Staff recommends the Board form its intent to appropriate on the following stream reach:

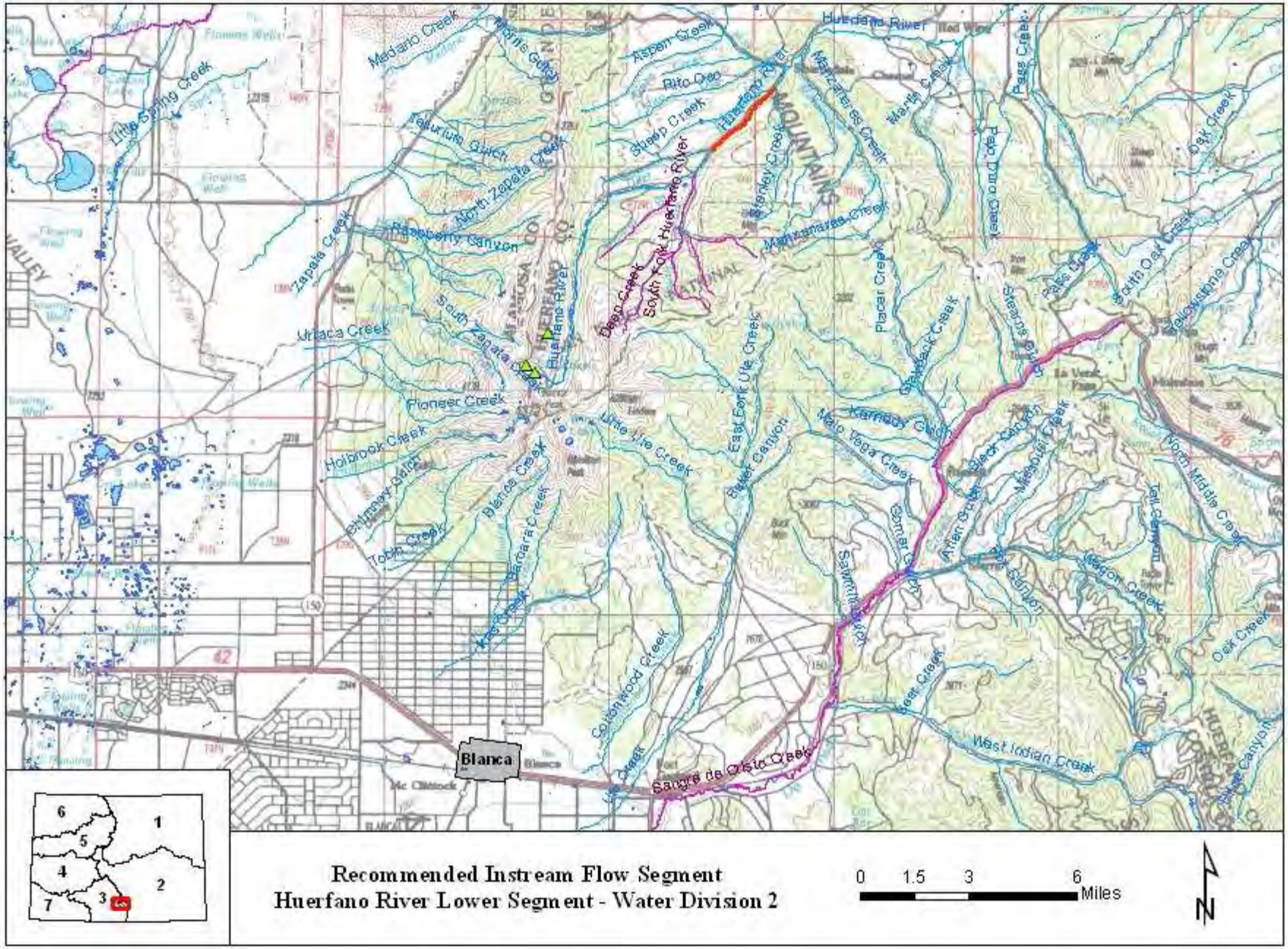
Segment: Confluence with Unnamed Tributary to the Confluence with Stanley Creek

Upper Terminus: CONFLUENCE WITH UNNAMED TRIBUTARY
(Latitude 37° 41' 2.04"N) (Longitude 105° 24' 8.54"W)
UTM North: 4170820.1 UTM East: 464521.6
NE SE S23 T27S R72W 6th PM
930' West of the East Section Line; 2041' North of the South Section Line

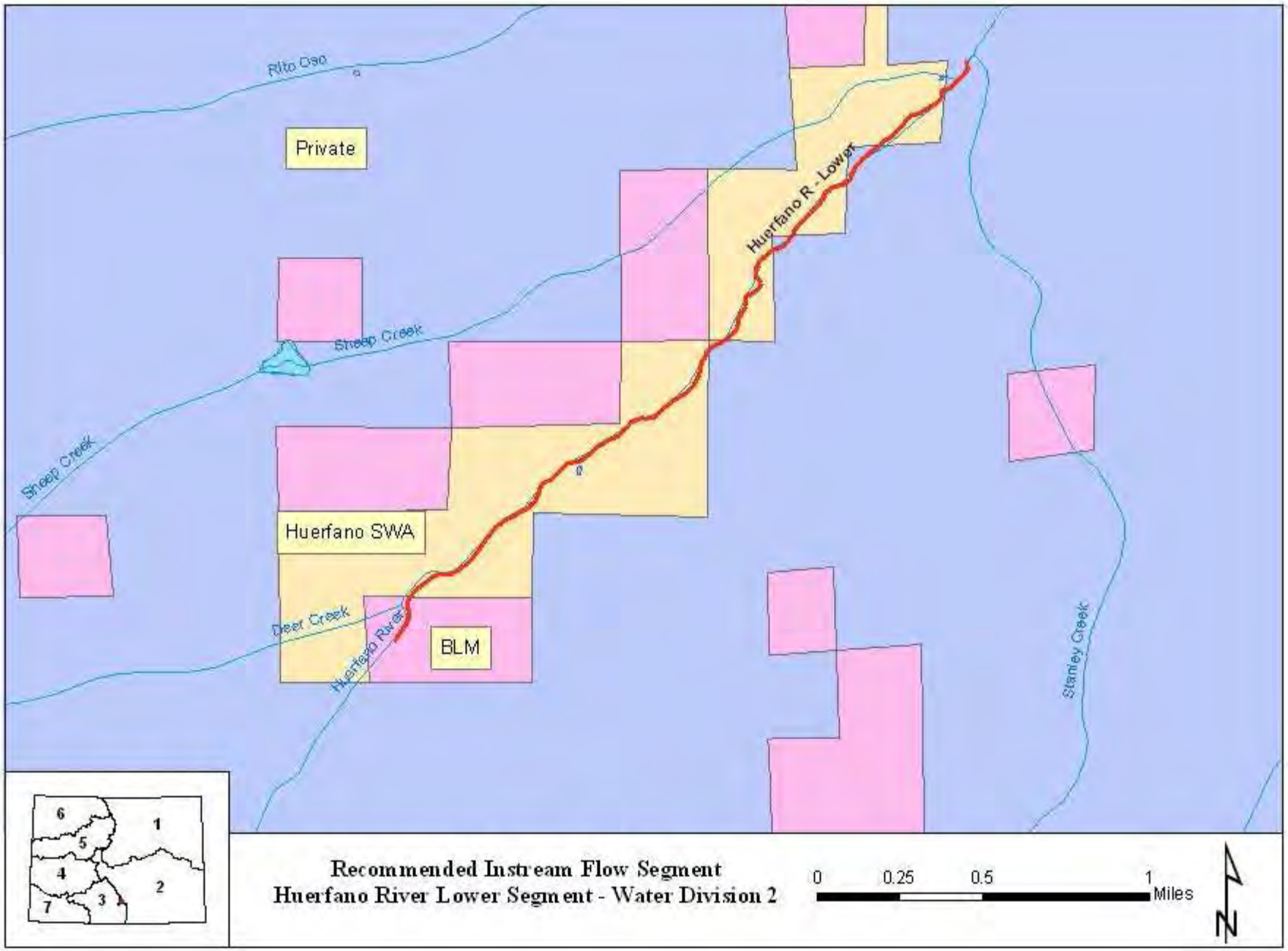
Lower Terminus: CONFLUENCE WITH STANLEY CREEK
(Latitude 37° 42' 33.49"N) (Longitude 105° 22' 16.12"W)
UTM North: 4173627.2 UTM East: 467286.3
SW SE S7 T27S R71W 6th PM
2326' West of the East Section Line; 109' North of the South Section Line

Watershed: Huerfano (HUC#: 11020006)
Counties: Huerfano
Length: 2.6 miles
USGS Quad(s): Mosca Pass
Flow Recommendation: 5.75 cfs (April 1 to October 31)
2.75 cfs (November 1 to March 31)

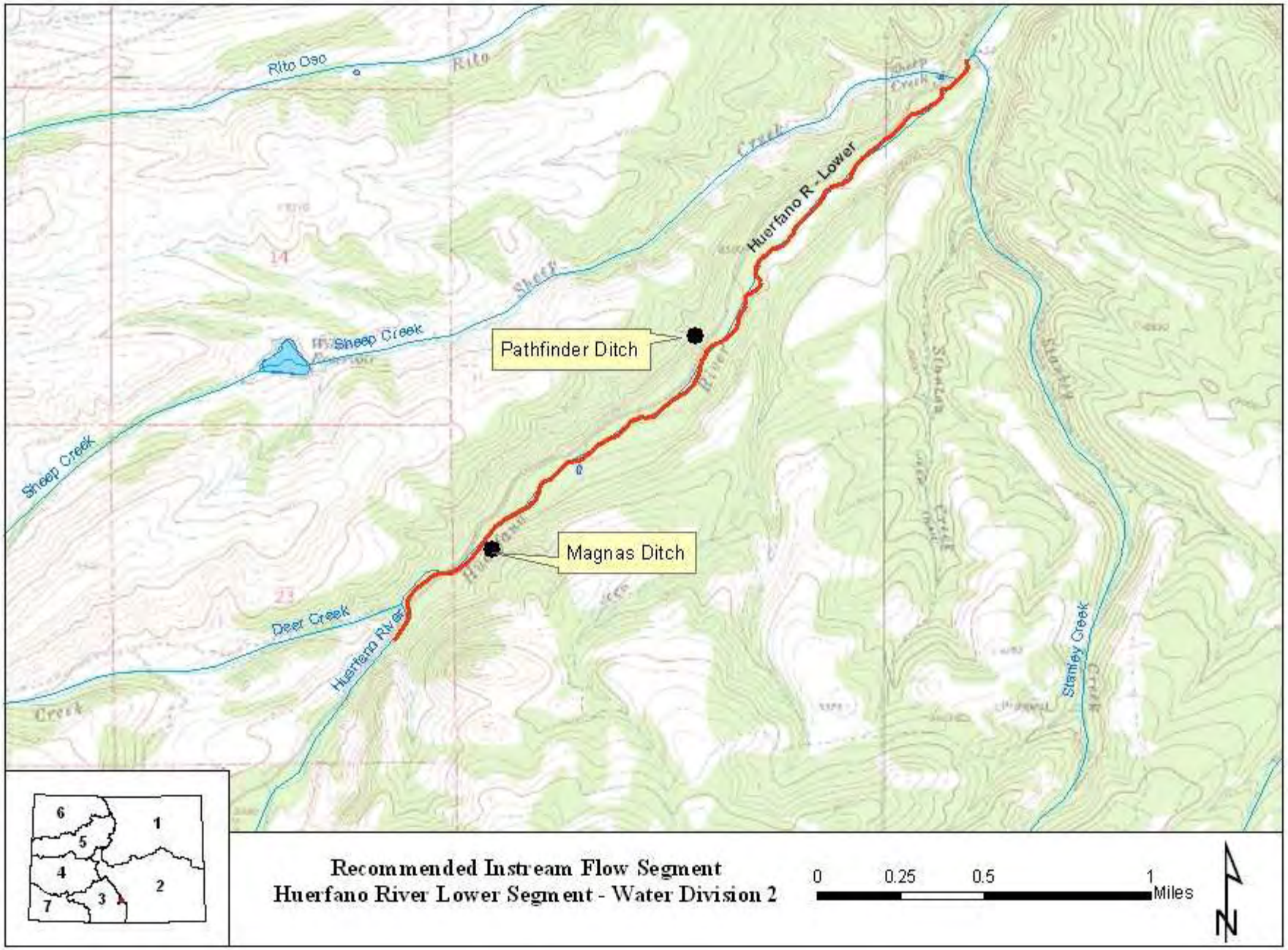
Vicinity Map



Land Use Map


Rito Oso
Private
Huerfano R - Lower
Sheep Creek
Sheep Creek
Huerfano SWA
Deer Creek
Huerfano River
BLM
Stanley Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Huerfano River Lower Segment - Water Division 2
0
0.25
0.5
1
Miles
N

Topographic & Water Rights Map



Development of Instream Flow Recommendations In Colorado Using

R2CROSS

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203

Water Rights Investigations Section

Exhibit 4

January 1996

Development of

Instream Flow Recommendations

In Colorado Using

R2CROSS

By Gregory D. Espegren
Senior Water Resource Specialist

For additional copies
write or call (303) 866-3441

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203

Water Rights Investigations Section

January 1996

Abstract

In 1973, the Colorado State Legislature vested the Colorado Water Conservation Board with the authority to appropriate instream flow water rights in the State of Colorado. Today, the Board holds 1,326 instream flow water rights covering approximately 7,982 miles of Colorado streams. Standardized field and office procedures help to ensure that instream flow recommendations reflect the amount of water required to "preserve the natural environment to a reasonable degree", as prescribed by state statute. R2CROSS is one of the standard techniques employed by state and federal agencies to model instream hydraulic parameters. R2CROSS was chosen because it is time and labor efficient and produces comparable results to more costly techniques, i.e., the Instream Flow Incremental Methodology. This manuscript provides an overview of Colorado's Instream Flow Program and documentation for the Board's R2CROSS Lotus macro. The R2CROSS macro runs efficiently on an IBM-compatible 80486 personal computer equipped with a hard disk drive, and DOS 6.O, Windows 3.1, and Lotus 1-2-3 Release 4 for Windows software.

Acknowledgments

The Colorado Water Conservation Board would like to thank everyone involved in the development of the Board's R2CROSS Lotus macro. In addition, the author wishes to acknowledge the persons involved in the review and testing of the R2CROSS macro including R. Barry Nehring and Jay Skinner of the Colorado Division of Wildlife, Dr. Eric P. Bergersen, Dr. Kurt Fausch, and Charles Gowan of Colorado State University, Dennis Murphy of the Bureau of Land Management, Dave Gerhardt of the United States Forest Service, Dan Merriman, Anne Janicki, and Margaret Langdon of the Colorado Water Conservation Board, and Steven O. Sims of the State Attorney General's Office. The Board is very grateful to all of those who participated in the development of the R2CROSS macro and this document.

Disclaimer

The R2CROSS macro is in the public domain, and the recipient may not assert any proprietary rights thereto nor represent it to anyone as other than a Colorado State Government-produced program. R2CROSS is provided "as-is" without warranty of any kind, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event will the Colorado Water Conservation Board or the Colorado Division of Wildlife be liable for any damages, including lost profits, lost savings, or other incidental or consequential damages arising from the use of or the inability to use this program.

The CWCB staff verified the calculations preformed in its R2CROSS program with hand-held calculators and by comparison with other Manning's equation-based hydraulic streamflow models. Based upon this verification process, the staff believes that the instream hydraulic parameters summarized in the R2CROSS staging table are accurate calculations of Manning's equation. However, the CWCB does not suggest that the predicted hydraulic parameters will necessarily be realized at any particular stream discharge.

On November 10, 1993, the Colorado Water Conservation Board adopted Rules and Regulations that codified the procedures the Board follows in appropriating instream flow water rights. This document is intended to conform to the procedures presented in the Rules and Regulations.

Table of Contents

List of Tables and Figures

Tables

Figures

Introduction

Colorado's Instream Flow Program originated in 1973 with the passage of Senate Bill 97 (SB 97). Under SB 97, the Colorado Water Conservation Board (CWCB) was vested with the authority to appropriate instream flow water rights in the State of Colorado (§ 37-92-102(3), C.R.S. (1990)). Instream flow water rights are held by the CWCB on behalf of the people of the State of Colorado to "preserve the natural environment to a reasonable degree." Today, the CWCB holds 1,326 instream flow water rights covering approximately 7,982 miles of Colorado streams.

Determining the quantity of water required to preserve the natural environment to a reasonable degree can be a difficult task. The CWCB, in cooperation with the Colorado Division of Wildlife (DOW), has developed standard field and office procedures to ensure that each instream flow appropriation is necessary and reasonable and that the amount of water recommended is available for appropriation.

The R2CROSS methodology described in this document is a valuable tool in developing these instream flow recommendations. The CWCB uses R2CROSS because it is time and labor efficient and produces results which are comparable to more data intensive techniques (Nehring 1979).

This manuscript is divided into two sections. The first section describes Colorado's Instream Flow Program, including some of the statutory guidelines that have shaped the program. It also describes the standard field techniques and office procedures that are used by the CWCB staff in the development of R2CROSS-based instream flow recommendations. This section is intended to provide an understanding of the procedural and technical aspects of Colorado's Instream Flow Program.

The second section of the manuscript is a users' manual for the CWCB's R2CROSS macro. The CWCB has received many requests for its R2CROSS macro from both the public and private sectors but has been hesitant to release the program without proper documentation. The second section of the manuscript is intended to provide that documentation.

Colorado's Instream Flow Program

Instream Flow Legislation

The CWCB was created in 1937 to serve as the State's chief water planning agency (§ 37-60-101 through 123, C.R.S. (1990)). Today, the CWCB is responsible for the administration of the State's Instream Flow Program, protection of endangered aquatic species, identification of flood plains, funding of new water development and water conservation projects, and negotiation of inter- and intra-state water planning issues.

The CWCB is a fourteen-member board. The board consists of one Governor-appointee from each of the eight major river drainages in the State and one from the City and County of Denver. Each Governor-appointee must also be confirmed by the Colorado State Senate. Ex-officio members of the board include the

Executive Director of the Department of Natural Resources, the Directors of the CWCB and DOW, the State Attorney General, and the State Engineer. The diverse backgrounds of its board members provides the CWCB with an excellent representation of Colorado's various water interests.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" through the passage of SB 97. Within SB 97, the definition of beneficial use was changed to include minimum stream flows and the CWCB was vested with the authority to appropriate "waters of natural streams and lakes ... as may be required ... to preserve the natural environment to a reasonable degree." SB 97 was amended by Senate Bill 414 in 1981, Senate Bill 91 in 1986, Senate Bill 212 in 1987, and Senate Bill 54 in 1994. These changes and amendments are consolidated within § 37-92-102(3), C.R.S. (1990), the Instream Flow statute.

The Instream Flow statute sets forth the guidelines for the administration of Colorado's Instream Flow Program. The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies prior to initiating an instream flow appropriation. The CWCB routinely requests instream flow recommendations from the DOW, Colorado Division of Parks and Outdoor Recreation, United States Department of Agriculture, and United States Department of Interior (the "cooperating agencies").

Prior to appropriating an instream flow water right, the statute requires the CWCB to: (1) "determine that the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made; (2) determine that there is a natural environment that can be preserved to a reasonable degree with the CWCB's water right, if granted; and (3) determine that such environment can exist without material injury to water rights" (§ 37-92-102(3c), C.R.S. (1990)). The CWCB makes these determinations based upon a review of the supporting technical data and a final instream flow recommendation prepared by the CWCB staff.

Standardized field and office procedures have been developed to help ensure that final instream flow recommendations meet statutory guidelines and are consistent. The standard field procedures that were established concern selection of transect sites and collection of hydraulic and biologic data. Standard office procedures have been established for determining biological instream flow recommendations using output from R2CROSS and for analyzing water availability.

Field Procedures

Instream flow recommendations are typically based on hydraulic and biologic data collected during a single field visit. Hydraulic data collection consists of setting up a transect, surveying stream channel geometry, and measuring stream discharge. Biologic data is gathered to document the existence of a natural environment. The biologic data usually consists of a fish sample, collected by electrofishing, and an aquatic invertebrate sample.

Field Data Site Selection

The R2CROSS method requires that stream discharge and channel profile data be collected in a riffle stream habitat-type. A riffle is a stream segment that is controlled by channel geometry rather than a downstream

flow control. Riffles are most easily visualized as the stream reaches which would dry up most quickly should streamflow cease.

Biologically, riffles are essential to the production of benthic invertebrates and the passage, spawning, egg incubation, feeding, and protective cover of fish. Riffles are also the stream habitat-type most sensitive to changes in hydraulic parameters with variation in discharge (Nehring 1979). Riffles are critical to a healthy aquatic environment because small reductions in streamflow may result in large reductions in water depth and the amount of wetted perimeter available for aquatic habitat. Maintaining adequate streamflow in riffles also preserves the natural environment in other important stream habitat-types such as pools and runs (Nehring 1979).

Hydraulic engineers have developed several mathematical models and equations to predict instream hydraulic parameters (Chow 1959). Manning's equation is one such model that is well-suited to the riffle stream habitat-type (Grant et al. 1992). In order to maximize the reliability of Manning's equation, transects are placed within a riffle so that streamflow is uniform across the transect (Grant et al. 1992). The transect represents the average stream width, depth, and cross-sectional area within the riffle being characterized. Transects should be located in areas that exhibit natural banks or grasslines and concentrated water flow, free from braiding. They should not be located on eroded or undercut streambanks.

Hydraulic Data Collection

Stream discharge is measured using standardized procedures established by the United States Geological Survey (USGS) (Buchanan and Somers 1969). On streams less than 50 feet in width, channel geometry is typically measured using sag-tape methodology (Silvey 1976; Ray and Megahan 1979). Larger streams typically require the use of a land survey level and stadia rod (Benson and Dalrymple 1967). A list of required field equipment for making streamflow measurements is provided in Table 1.

The sag-tape methodology consists of suspending a steel tape from bank to bank across the stream channel, perpendicular to the streamflow (Figure A). Metal cross section stakes are driven into the ground above the grassline. The steel tape is suspended by attaching the zero-end of the tape to one of the metal stakes, stretching the tape across the stream, and then attaching the other end to a tape clamp and spring scale fastened to the metal stake on the opposite streambank. A minimum of 15 pounds of tension is applied to the tape, as the tape is drawn up and clamped. A survey level and stadia rod are used to adjust the ends of the tape up or down until they are level, thereby producing a consistent datum from which vertical distance measurements can be read.

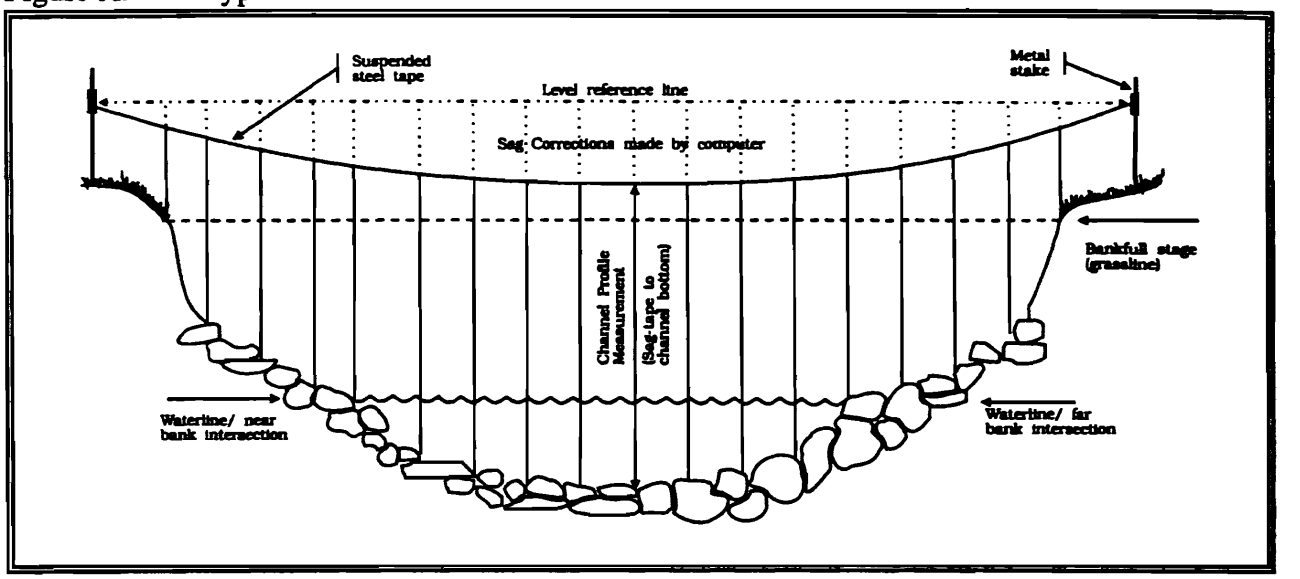
The R2CROSS program uses the standard weight of a one-foot section of the steel tape, tape tension, and the length of tape in suspension to correct horizontal distance and vertical depth measurements made from the sagging tape. The program adjusts the coordinates at each cross section vertical so that the corrected measurements correspond to a level datum from stake to stake and not the curved datum created by the sagging tape (Figure A).

On larger streams, vertical measurements between the suspended tape and the stream channel may be replaced with readings using a survey level and stadia rod. The suspended tape is then used to measure only the horizontal location of each cell vertical. There is no need to precisely level the ends of the suspended tape or to record the tape tension as no sag corrections are required.

Table 1. Field equipment list for making streamflow measurements

Equipment	Description
100' Steel Survey tape	Stretched between cross section stakes. (Obtain standard weight of a 1.0 foot section of tape from manufacturer)
Spring Tension Scale	Used to measure pounds of tension on steel tape when stretched between stakes.
Tape Clamp Handle	Holds tape in tension.
Cross Section Stakes	Two 24"-36" metal stakes used to maintain tape tension and to level steel tape. Must be strong enough to be driven into rocky stream bank.
Discharge Wading Rod (or Stadia Rod)	Used to measure vertical depths from suspended tape to stream channel.
Level, Tripod, and Stadia Rod	Used to level ends of suspended tape and to measure slope.
Current Meter	Pygmy, Price AA, Marsh-McBirney or similar devise used to measure stream velocity.
Hand Sledge Hammer	Used to drive cross section stakes into streambank.
Staging Pin	Used to detect changes in discharge during the streamflow measurement.
100' Fiberglass Tape	Used to measure horizontal distance from suspended tape to water-slope stadia rod readings.
Field Forms and Clipboard	Standardized form to ensure complete set of field data.
Miscellaneous Items	Camera, film, maps, waders, stopwatch and calculator.

Figure A. Typical stream cross section



Biologic Data Collection

Biologic sampling is conducted to document the existence of a natural environment. Coldwater fish species, particularly salmonids, have been used to indicate the existence of such a natural environment in the majority of the CWCB's instream flow appropriations to date. Warmwater fish species and other aquatic life forms may be used to document the existence of a natural environment in more downstream, low-elevation stream segments. In addition to salmonids, the CWCB has used amphibians, such as frogs and salamanders, and warmwater fish species, including the endangered fishes of the Colorado River basin, as the biologic basis for instream flow appropriations.

Biologic data typically consists of a fish sample, collected by electrofishing, and an aquatic invertebrate sample. Captured fish are identified and measured and a length-frequency distribution is constructed for each species. The sample is not tied directly to the R2CROSS hydraulic modeling but it may be used to refine the biologic instream flow recommendation to meet the specific habitat requirements of unique populations.

The Field Form

The CWCB and DOW use a standardized field form to record all field data. The use of this form helps to ensure that all instream flow recommendations are based upon a uniform set of field data. The front page of the form provides space for cross section "Location Information", "Supplemental Data", "Channel Profile Data", an "Aquatic Sampling Summary", and "Comments" (Figure B). The back page is dedicated to "Discharge/Cross Section Notes" (Figure C).

The "Location Information" section of the field form is used to describe the location of the cross section as well as the date and names of the members of the field crew. Geographic information can be obtained from either USGS or United States Forest Service (USFS) maps. Water divisions and DOW water codes can be obtained from the State Engineers' Office, the CWCB, or the DOW.

The "Supplemental Data" section is used to provide supporting documentation of the field data collection effort. Most importantly, this section is used to record the tape manufacturer's standard weight (lbs/ft) and tape tension (lbs). The R2CROSS program uses this information, together with the length of tape in suspension, to adjust vertical distances measured from the sagging tape to a level reference datum.

The "Channel Profile Data" section of the form is used to establish the relationship between the sag-tape cross section and the stream. Stadia rod readings are taken at each end of the suspended tape and at the water surface on the right and left streambanks. These readings are recorded within the "Rod Reading (ft)" column. They are used to assure that the ends of the tape are level and to quantify the vertical distance between the suspended tape and the water surface. Water surface readings and horizontal distances are also recorded upstream and downstream of the suspended tape. These observations are used to establish the water surface slope for input into Manning's equation.

The right side of the "Channel Profile Data" section is used to graphically depict the relative locations of the suspended tape and survey level, the direction of streamflow, and any photographic documentation of the field data collection effort. Photographs of the suspended tape are taken looking up, down, and across the stream.

Biologic sampling is summarized in the "Aquatic Sampling Summary" portion of the field form. Biologic data typically consists of a fish sample, collected by electrofishing, and an aquatic invertebrate sample. Captured fish are identified by species and measured to the nearest inch. A species-specific length-frequency distribution is created by placing a hashmark in the appropriate cell of the table as each fish is measured. Aquatic invertebrate sampling is summarized within the space provided at the bottom of this section.

All other pertinent field data is recorded in the "Comments" section of the field form. This section is often used to record weather conditions, water turbidity, or species-specific biomass estimates. This additional information helps characterize the field data when it is being analyzed in the office.

The "Discharge/Cross Section Notes" portion of the field form is used to record all of the hydraulic measurements associated with the discharge measurement (Figure C). A heading is provided to record the stream name, cross section number, date, edge of water looking downstream, the staging pin reading, and time at the beginning of the stream discharge measurement. The table below the heading is used to record "Features", "Distance From Initial Point", "Width", "Total Vertical Depth From Tape/Inst(rument)", and "Water Depth" channel geometry parameters at each cell vertical. Stream velocity measurements are recorded under the columns labeled "Depth of Observation", "Revolutions", "Time", and "Velocity" for each wet cell. All discharge measurement procedures are as outlined by Buchanan and Somers (1969).

The first and last channel geometry measurements are always taken at the cross section stakes. Channel geometry measurements should also be taken at the grassline-streambank and streambank-waterline intersections and at all distinguishable slope breaks between these two intersection points. The horizontal locations of the grassline-streambank and streambank-waterline intersections are also documented by placing a "G" and a "W" in the appropriate row of the "Features" column of the field form. Grassline is identified at the normal high water line, not flood stage, and is generally located below sedges and other plants that may survive submerged under high flows. The "Features"

column is also used to document the horizontal locations of the two cross section stakes ("S") and any rocks ("R") or other features that may have an impact on the discharge measurement.

In streams with uniform bottom profiles (i.e., sand, cobble, etc.), channel geometry and discharge measurements are taken at fixed intervals within the wetted portion of the channel. The interval is varied in streams with boulder substrates to more accurately reflect changes in the velocity distribution with changes in channel bottom profile. The stream discharge measurement is divided into a minimum of 20 to 30 discharge cells, depending upon wetted stream width, with a minimum cell width of 0.3 feet. Sufficient measurements are taken to ensure that no more than 10% of the total streamflow occurs within a single discharge cell. Horizontal and vertical distances are taken from the suspended tape and recorded to the nearest tenth of a foot. Stream velocity (ft/sec) within each cell is averaged and recorded.

The bottom of the "Discharge/Cross Section Notes" section is used to summarize the discharge measurement. Space is also provided to record the names of the persons responsible for the field data calculations, the staging pin reading, and time at the end of the stream discharge measurement.

Figure B. Field data input sheet (Front Page)

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME:					CROSS-SECTION NO.:
CROSS-SECTION LOCATION					
DATE	OBSERVERS:				
LEGAL DESCRIPTION	¼ SECTION:	SECTION	TOWNSHIP N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED	WATER DIVISION:	DOW WATER CODE		
MAPS:	USGS:				
	USFS:				

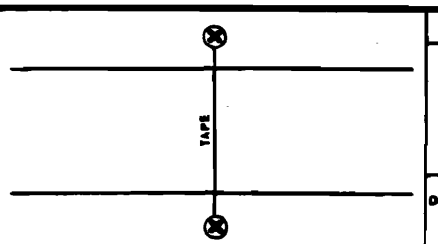
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE:			
METER NUMBER:	DATE RATED:	CALIB/SPIN ____ sec	TAPE WEIGHT ____ lbs/foot	TAPE TENSION ____ lbs
CHANNEL BED MATERIAL SIZE RANGE	PHOTOGRAPHS TAKEN YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE ft	ROD READING ft
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream		
③ WS Downstream		
SLOPE		

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

COMMENTS

FORM #ISF FD 1-85

Figure C. Field data input sheet (Back Page)

DISCHARGE/CROSS SECTION NOTES

STREAM NAME	CROSS-SECTION NO	DATE	SHEET ___ OF ___
BEGINNING OF MEASUREMENT — EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) LEFT / RIGHT	Gage Reading. ______ ft	TIME	

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)
TOTALS											

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

Office Procedures

The CWCB uses a Lotus 1-2-3 macro, called R2CROSS, to process the field data and model instream hydraulic parameters at streamflows above and below the field-measured discharge. The CWCB relies upon the biologic expertise of the cooperating agencies to interpret the output from R2CROSS and develop an initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. After receiving the cooperating agencies' biologic recommendation, the CWCB staff evaluates stream hydrology to determine whether water is physically available for an instream flow appropriation.

Background on the R2CROSS Methodology

Three instream hydraulic parameters, average depth ($\bar{x}_d$), average velocity ($\bar{x}_v$), and percent wetted perimeter (*%WP*), are used to develop biologic instream flow recommendations in Colorado. The DOW has determined that by maintaining these three hydraulic parameters at adequate levels across riffle habitat-types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979).

The R2CROSS methodology uses Manning's equation to predict $\bar{x}_d$, $\bar{x}_v$, *%WP*, and other instream hydraulic parameters, at discharges both above and below the field-measured stream discharge. The methodology is both time and labor efficient, requires data from only a single stream transect, and has been found to produce similar results to more data intensive techniques (Nehring 1979) such as the Instream Flow Incremental Methodology (IFIM) developed by the U.S. Fish and Wildlife Service (Bovee 1982).

In 1973, the CWCB staff performed all Manning's equation calculations with a hand-held calculator. In 1981, the USFS released "*Program Documentation for R2-CROSS-81*" (Weatherred et al. 1981). This Fortran-based, mainframe computer program automated the repetitive task of manipulating and recalculating Manning's equation by hand. The CWCB used the USFS version of R2CROSS on the Colorado State University mainframe computer until 1985.

In 1986, the CWCB staff began development of a personal computer version of R2CROSS using the macro capabilities of Lotus 1-2-3. The CWCB found the R2CROSS macro to be advantageous because it ran on a personal computer and it could be customized to the specific needs of the CWCB. The most recent version of R2CROSS is menu-driven (Figure D) and requires very little experience with Lotus 1-2-3. The macro formats the R2CROSS worksheet, initiates data entry, and performs all calculations and printing automatically.

Figures E through K provide an example of R2CROSS output from a typical Colorado stream. Figure E is a "Proof Sheet" that is printed and inspected for data entry errors prior to performing final R2CROSS calculations. Final output consists of a five page printout (Figures F through J). Page one summarizes most of the stream location information, supplemental data, and channel profile data from the field form (Figure F). Page two summarizes the channel geometry/discharge field data set and values computed from the raw field data, including an estimate of Manning's "n" (Figure G). Page three consists of a water line comparison table which the program uses to interpolate the single water surface elevation that results in a calculated cross-sectional area equal to the field-measured cross-sectional area (Figure H). Page four is the staging table that is used by the cooperating agency to develop an initial, biologic instream flow recommendation

(Figure I). The staging table provides estimates of modeled instream hydraulic parameters at stages above and below the measured discharge. Page five summarizes measured and calculated flows, waterlines, and depths (Figure J). It also presents estimates of mean velocity, Manning's "n", water slope, and upper and lower streamflow limits within which the instream flow recommendation should fall. In general, hydraulic models based upon Manning's equation are most accurate when predicted flows fall within a range of 0.4 to 2.5 times measured flow (Bovee and Milhous 1978; Bovee 1982). Space is also provided for a narrative describing the basis for the initial instream flow recommendation and for the signatures of the personnel involved in making the recommendation. The macro can also be used to generate a plot of the stream cross section (Figure K).

Figure D. The R2CROSS Menu

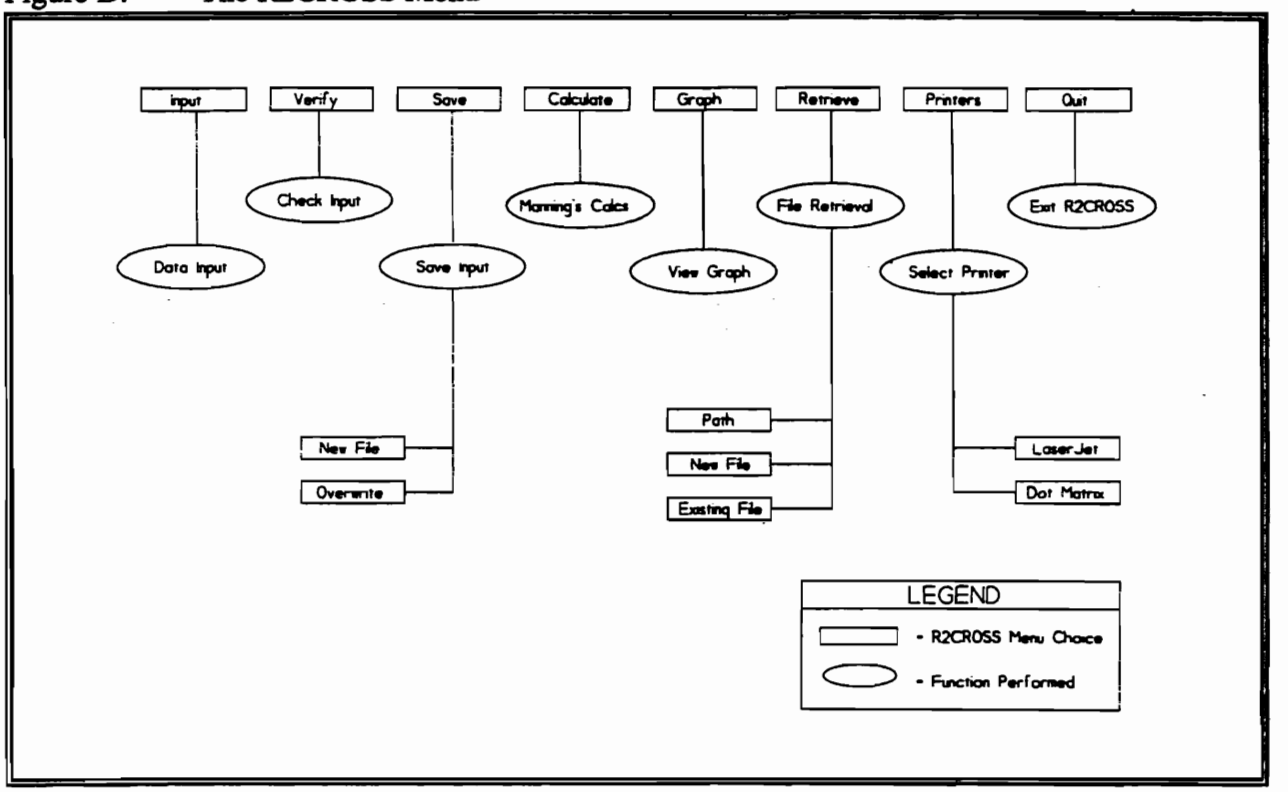


Figure E. R2CROSS proof sheet

PROOF SHEET

LOCATION INFORMATION

STREAM NAME:	IRON CREEK
XS LOCATION:	100 YDS U/S DWB DIVERSION
XS NUMBER:	1
DATE:	10/17/86
OBSERVERS:	SEAHOLM, PUTTMAN
1/4 SEC:	
SECTION:	20
TWP:	2S
RANGE:	76W
PM:	6TH
COUNTY:	GRAND
WATERSHED:	FRASER
DIVISION:	5
DOW CODE:	25482
USGS MAP:	BYERS PEAK
USFS MAP:	ARAPAHOE

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	28

CHANNEL PROFILE DATA

SLOPE:	0.0055

INPUT DATA # DATA POINTS= 34

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	TAPE TO WATER
	S	0.00	1.10	0.00	0.00	0.00	0.00	0.00
		0.50	1.30	0.00	0.00	0.00	0.00	0.00
1	G	1.00	1.40	0.00	0.00	0.00	0.00	0.00
		2.00	1.80	0.00	0.00	0.00	0.00	0.00
		2.50	1.95	0.00	0.00	0.00	0.00	0.00
		3.00	2.00	0.00	0.00	0.00	0.00	0.00
	R	3.50	1.90	0.00	0.00	0.00	0.00	0.00
		4.00	2.45	0.00	0.00	0.00	0.00	0.00
		4.50	2.45	0.00	0.00	0.00	0.00	0.00
	W	5.00	2.60	0.00	0.00	0.00	0.00	0.00
		5.70	3.00	0.40	0.80	0.20	0.16	2.61
		6.00	3.10	0.45	0.45	0.13	0.06	2.66
		6.30	3.00	0.40	1.10	0.12	0.13	2.61
		6.60	3.00	0.40	0.95	0.12	0.11	2.61
		6.90	2.95	0.35	0.95	0.11	0.10	2.61
		7.20	2.85	0.25	0.70	0.07	0.05	2.61
		7.50	3.10	0.50	0.75	0.15	0.11	2.61
		7.80	3.10	0.50	0.65	0.15	0.10	2.61
		8.10	3.10	0.50	0.85	0.15	0.13	2.61
		8.40	3.20	0.60	0.95	0.18	0.17	2.61
		8.70	3.20	0.60	1.10	0.18	0.20	2.61
		9.00	3.20	0.60	1.35	0.18	0.24	2.61
		9.30	3.15	0.55	1.40	0.16	0.23	2.61
		9.60	3.25	0.65	1.50	0.19	0.29	2.61
		9.90	3.30	0.70	1.55	0.21	0.33	2.61
		10.20	3.30	0.70	1.60	0.21	0.34	2.61
		10.50	3.30	0.70	1.25	0.12	0.15	2.61
	W	10.55	2.60	0.00	0.00	0.00	0.00	0.00
1	G	11.00	1.30	0.00	0.00	0.00	0.00	0.00
		11.50	0.85	0.00	0.00	0.00	0.00	0.00
		12.00	0.60	0.00	0.00	0.00	0.00	0.00
		12.50	0.55	0.00	0.00	0.00	0.00	0.00
		13.00	0.55	0.00	0.00	0.00	0.00	0.00
	S	13.50	0.50	0.00	0.00	0.00	0.00	0.00
					TOTALS	2.65	2.91	

Figure F. Final output from R2CROSS (Page 1)

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

LOCATION INFORMATION
====================

STREAM NAME:    IRON CREEK
XS LOCATION:    100 YDS U/S DWB DIVERSION
XS NUMBER:      1

DATE:           10/17/86
OBSERVERS:      SEAHOLM, PUTTMAN

1/4 SEC:
SECTION:        20
TWP:            2S
RANGE:          76W
PM:             6TH

COUNTY:         GRAND
WATERSHED:      FRASER
DIVISION:       5
DOW CODE:       25482

USGS MAP:       BYERS PEAK
USFS MAP:       ARAPAHOE

SUPPLEMENTAL DATA            *** NOTE ***
=================       Leave TAPE WT and TENSION
                      at defaults for data collected
TAPE WT:        0.0106  with a survey level and rod
TENSION:            28

CHANNEL PROFILE DATA
====================
SLOPE:          0.0055



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

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

Figure G. Final output from R2CROSS (Page 2)

STREAM NAME: IRON CREEK
XS LOCATION: 100 YDS U/S DWB DIVERSION
XS NUMBER: 1

INPUT DATA	# 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
S	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	0.50	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
1 G	1.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	2.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	2.50	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	3.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
R	3.50	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	4.00	2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	4.50	2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
W	5.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	5.70	3.00	0.40	0.80	0.81	0.40	0.20	0.16	5.5%
	6.00	3.10	0.45	0.45	0.32	0.45	0.13	0.06	2.1%
	6.30	3.00	0.40	1.10	0.32	0.40	0.12	0.13	4.5%
	6.60	3.00	0.40	0.95	0.30	0.40	0.12	0.11	3.9%
	6.90	2.95	0.35	0.95	0.30	0.35	0.11	0.10	3.4%
	7.20	2.85	0.25	0.70	0.32	0.25	0.07	0.05	1.8%
	7.50	3.10	0.50	0.75	0.39	0.50	0.15	0.11	3.9%
	7.80	3.10	0.50	0.65	0.30	0.50	0.15	0.10	3.4%
	8.10	3.10	0.50	0.85	0.30	0.50	0.15	0.13	4.4%
	8.40	3.20	0.60	0.95	0.32	0.60	0.18	0.17	5.9%
	8.70	3.20	0.60	1.10	0.30	0.60	0.18	0.20	6.8%
	9.00	3.20	0.60	1.35	0.30	0.60	0.18	0.24	8.4%
	9.30	3.15	0.55	1.40	0.30	0.55	0.16	0.23	7.9%
	9.60	3.25	0.65	1.50	0.32	0.65	0.19	0.29	10.1%
	9.90	3.30	0.70	1.55	0.30	0.70	0.21	0.33	11.2%
	10.20	3.30	0.70	1.60	0.30	0.70	0.21	0.34	11.6%
	10.50	3.30	0.70	1.25	0.30	0.70	0.12	0.15	5.3%
W	10.55	2.60	0.00	0.00	0.70	0.00	0.00	0.00	0.0%
1 G	11.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	11.50	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	12.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	12.50	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	13.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
S	13.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
TOTALS					6.49	0.7 (Max.)	2.65	2.91	100.0%

Manning's n = 0.0552

Figure H. Final output from R2CROSS (Page 3)

STREAM NAME: IRON CREEK
XS LOCATION: 100 YDS U/S DWB DIVERSION
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
2.36	2.65	4.21	59.0%
2.38	2.65	4.07	53.9%
2.40	2.65	3.94	48.8%
2.42	2.65	3.81	43.8%
2.44	2.65	3.67	38.8%
2.46	2.65	3.54	33.8%
2.48	2.65	3.42	29.2%
2.50	2.65	3.30	24.7%
2.52	2.65	3.18	20.2%
2.54	2.65	3.07	15.8%
2.56	2.65	2.95	11.4%
2.57	2.65	2.89	9.3%
2.58	2.65	2.84	7.1%
2.59	2.65	2.78	5.0%
2.60	2.65	2.72	2.9%
2.61	2.65	2.67	0.8%
2.62	2.65	2.61	-1.3%
2.63	2.65	2.56	-3.4%
2.64	2.65	2.50	-5.5%
2.65	2.65	2.45	-7.6%
2.66	2.65	2.39	-9.6%
2.68	2.65	2.28	-13.7%
2.70	2.65	2.18	-17.8%
2.72	2.65	2.07	-21.9%
2.74	2.65	1.96	-25.9%
2.76	2.65	1.86	-29.9%
2.78	2.65	1.75	-33.9%
2.80	2.65	1.65	-37.8%
2.82	2.65	1.54	-41.8%
2.84	2.65	1.44	-45.6%
2.86	2.65	1.34	-49.5%

WATERLINE AT ZERO
AREA ERROR = 2.611

Figure I. Final output from R2CROSS (Page 4)

STREAM NAME: IRON CREEK
XS LOCATION: 100 YDS U/S DWB DIVERSION
XS NUMBER: 1

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 PER (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	1.40	**9.97**	1.21	1.90	12.09	12.14	100.0%	1.00	24.07	1.99
	1.61	9.38	1.07	1.70	10.08	11.37	93.6%	0.89	18.57	1.84
	1.66	9.23	1.04	1.65	9.61	11.18	92.0%	0.86	17.36	1.81
	1.71	9.09	1.01	1.60	9.15	10.99	90.5%	0.83	16.18	1.77
	1.76	8.95	0.97	1.55	8.70	10.80	89.0%	0.81	15.04	1.73
	1.81	8.80	0.94	1.50	8.26	10.61	87.4%	0.78	13.95	1.69
	1.86	8.62	0.91	1.45	7.82	10.39	85.5%	0.75	12.93	1.65
	1.91	8.41	0.88	1.40	7.40	10.13	83.5%	0.73	11.97	1.62
	1.96	7.90	0.88	1.35	6.99	9.55	78.6%	0.73	11.33	1.62
	2.01	7.16	0.92	1.30	6.61	8.75	72.0%	0.76	10.96	1.66
	2.06	7.10	0.88	1.25	6.26	8.63	71.0%	0.73	10.08	1.61
	2.11	7.04	0.84	1.20	5.90	8.51	70.0%	0.69	9.24	1.57
	2.16	6.97	0.80	1.15	5.55	8.39	69.1%	0.66	8.42	1.52
	2.21	6.91	0.75	1.10	5.21	8.27	68.1%	0.63	7.64	1.47
	2.26	6.85	0.71	1.05	4.86	8.15	67.1%	0.60	6.88	1.42
	2.31	6.79	0.67	1.00	4.52	8.02	66.1%	0.56	6.16	1.36
	2.36	6.72	0.62	0.95	4.18	7.90	65.1%	0.53	5.47	1.31
	2.41	6.66	0.58	0.90	3.85	7.78	64.1%	0.49	4.81	1.25
	2.46	6.09	0.58	0.85	3.52	7.16	58.9%	0.49	4.38	1.24
	2.51	5.91	0.55	0.80	3.22	6.93	57.1%	0.46	3.86	1.20
	2.56	5.72	0.51	0.75	2.93	6.70	55.2%	0.44	3.37	1.15
WL	2.61	5.55	0.48	0.70	2.65	6.48	53.4%	0.41	2.91	1.10
	2.66	5.45	0.43	0.65	2.37	6.33	52.1%	0.37	**2.46**	**1.04**
	2.71	5.36	0.39	0.60	2.10	6.18	**50.9%**	0.34	**2.04**	**0.97**
	2.76	5.27	0.35	0.55	1.84	6.03	**49.7%**	0.30	**1.66**	0.90
	2.81	5.18	0.30	0.50	1.57	5.88	48.4%	0.27	1.31	0.83
	2.86	5.08	0.26	0.45	1.32	5.72	47.1%	0.23	0.99	0.75
	2.91	4.78	**0.22**	0.40	1.07	5.33	43.9%	0.20	**0.73**	0.68
	2.96	4.47	**0.19**	0.35	0.84	4.94	40.7%	0.17	**0.51**	0.61
	3.01	3.73	0.17	0.30	0.63	4.11	33.8%	0.15	0.36	0.57
	3.06	3.36	0.13	0.25	0.45	3.66	30.2%	0.12	0.22	0.49
	3.11	2.41	0.12	0.20	0.29	2.63	21.6%	0.11	0.14	0.46
	3.16	2.22	0.08	0.15	0.18	2.39	19.7%	0.07	0.06	0.35
	3.21	1.05	0.08	0.10	0.08	1.15	9.4%	0.07	0.03	0.34
	3.26	0.88	0.04	0.05	0.03	0.93	7.6%	0.04	0.01	0.22

** NOTE**: Bold and underlined text within the Iron Creek staging table was added to facilitate explanation of the procedure for developing biologic instream flow recommendations (see Pages 18-19). Standard R2CROSS staging table printouts will not contain these enhancements.

Figure J. Final output from R2CROSS (Page 5)

STREAM NAME: IRON CREEK
XS LOCATION: 100 YDS U/S DWB DIVERSION
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.91	cfs
CALCULATED FLOW (Qc)=	2.91	cfs
(Qm-Qc)/Qm * 100 =	-0.1	%
MEASURED WATERLINE (WLm)=	2.61	ft
CALCULATED WATERLINE (WLc)=	2.61	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.70	ft
MAX CALCULATED DEPTH (Dc)=	0.70	ft
(Dm-Dc)/Dm * 100	0.6	%
MEAN VELOCITY=	1.10	ft/sec
MANNING'S n=	0.055	
SLOPE=	0.0055	ft/ft
.4 * Qm =	1.2	cfs
2.5 * Qm=	7.3	cfs

RECOMMENDED INSTREAM FLOW:

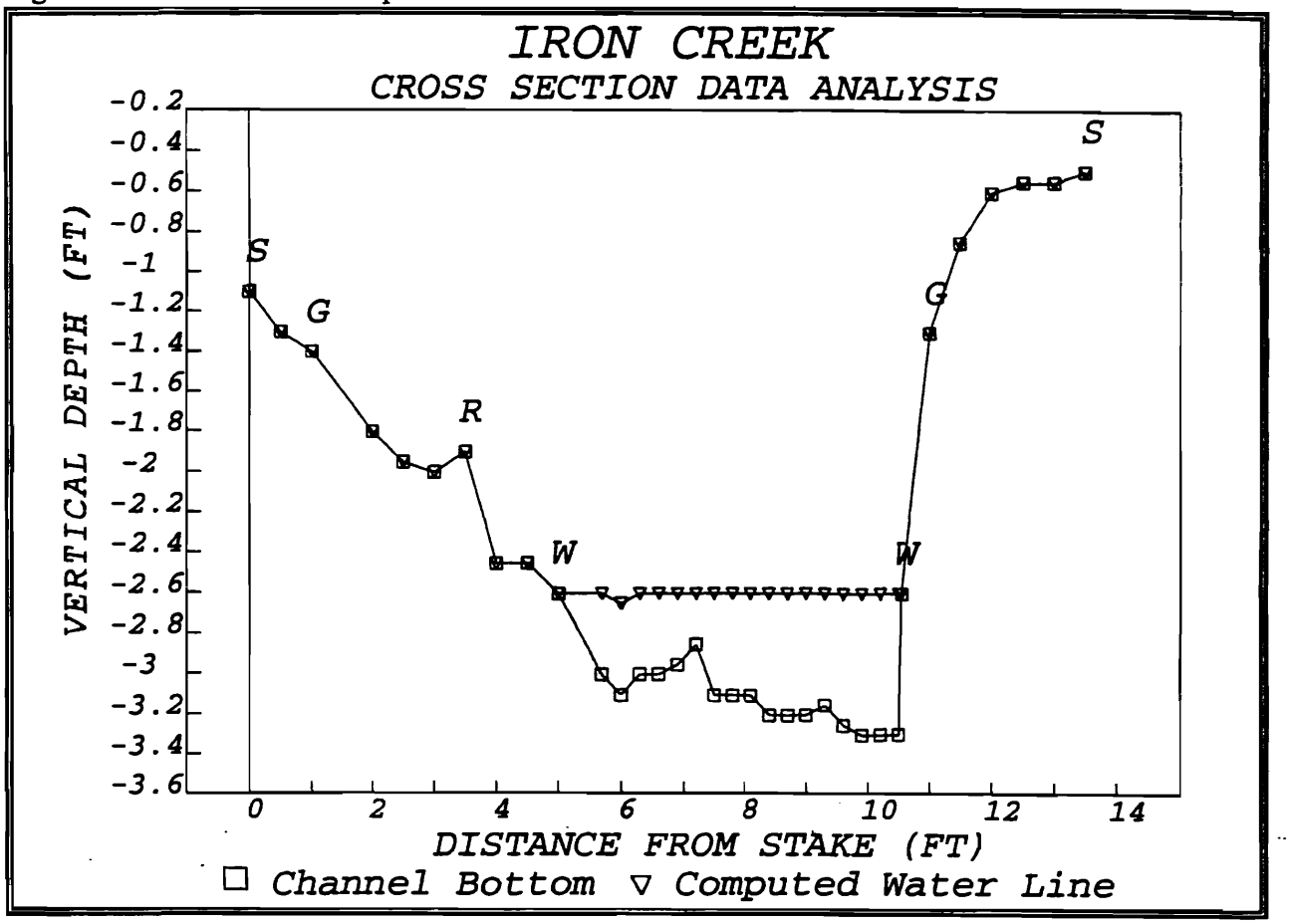
FLOW (CFS)	PERIOD
_____	_____
_____	_____
_____	_____
_____	_____

RATIONALE FOR RECOMMENDATION:

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

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

Figure K. Cross section plot from R2CROSS



Biologic Instream Flow Recommendations

When using R2CROSS, biologic instream flow recommendations are based on maintaining three principal hydraulic criteria, $\bar{x}_d$, $\bar{x}_v$, and *%WP*, at adequate levels across the stream transect (Table 2). The $\bar{x}_d$ and *%WP* criteria are functions of stream top width and grassline-to-grassline wetted perimeter, respectively. A constant $\bar{x}_v$ of 1 ft/sec is recommended for all streams. The DOW has determined that these three parameters are good indices of flow-related stream habitat quality and that maintenance of these parameters at adequate levels across riffle habitat-types will also result in maintenance of adequate aquatic habitat in pools and runs for most life stages of fish and aquatic invertebrates (Nehring 1979).

The three critical hydraulic parameters are estimated within the R2CROSS staging table at various levels of discharge (Figure I). Biologic instream flow recommendations are developed by locating the modeled streamflow(s) in the R2CROSS staging table that satisfy the three hydraulic criteria summarized in Table 2. The streamflow that meets two of the three criteria is considered as an initial winter flow recommendation. Initial summer flow recommendations are based upon satisfying all three criteria (Skinner, pers. comm). Aquatic biologists may modify summer and winter flow recommendations

Table 2. Criteria used to determine minimum flow requirements using the R2CROSS single transect method (Nehring 1979)

Stream Top Width (ft)[1]	Average Depth (ft)	Percent Wetted Perimeter (%)[1]	Average Velocity (ft/sec)
1-20	0.2	50	1.0
21-40	0.2-0.4	50	1.0
41-60	0.4-0.6	50-60	1.0
61-100	0.6-1.0	≥ 70	1.0

[1] At bankfull discharge.

based upon biologic considerations such as stream conditions, species composition, and aquatic habitat quality.

These hydraulic criteria can be applied to the R2CROSS staging table from the Iron Creek example (Figure I) to develop an initial biologic instream flow recommendation. In this example, the grassline top width of Iron Creek is 9.97 ft. Therefore, the DOW criteria for an $\bar{x}_d$ of 0.2 feet would be satisfied at a flow of approximately 0.6 cfs. The *%WP* criterion of 50% would be met at a flow of around 1.75 cfs and an $\bar{x}_v$ of 1 ft/sec at a flow of 2.25 cfs. Based upon this analysis, a winter flow recommendation of 1.75 cfs would meet the $\bar{x}_d$ and *%WP* criteria and a summer flow recommendation of 2.25 cfs would satisfy all three criteria. These initial recommendations may be adjusted up or down based upon biologic judgment and expertise.

Water Availability Requirements

Once an initial biologic instream flow recommendation has been developed, the CWCB staff must determine whether water is physically available to satisfy the biologic recommendation. The staff uses stream gaging records to analyze physical water availability whenever possible. In the absence of a gage record, the staff may use standardized hydrologic techniques, such as areal apportionment or synthetic streamflow modeling (Kircher et al. 1985), to estimate physical water availability. The staff may also conduct a review of the State Engineer's water rights tabulation and consult with Division Engineers and District Water Commissioners to determine the effect of senior diversions on a stream reach.

The water availability analyses may lead the CWCB staff to conclude that sufficient water is not available to meet the biologic recommendation. In that situation, the CWCB staff may request that the cooperating agency reconsider its biologic recommendation and determine whether the natural environment can be preserved with the amount of water available. If the natural environment can be preserved with the available water, the instream flow recommendation may be revised to reflect the lower available flow amounts. If the statutory water availability requirement cannot be satisfied, the CWCB must reject the instream flow recommendation.

Appropriating and Protecting an Instream Flow Water Right

On November 10, 1993, the CWCB adopted the "Statement of Basis and Purpose and Rules and Regulations Concerning the Colorado Instream Flow and Natural Lake Level Program." These Rules and Regulations codified existing CWCB procedures for implementing the Instream Flow Program and established procedures for handling acquisition of water, water rights, and interests in water including conditional rights, modification of instream flows, and inundation of instream flow water rights. The CWCB's procedural requirements for appropriating and protecting instream flow water rights are also described in great detail within these Rules and Regulations.

The procedural aspects of appropriating and protecting an instream flow water right are beyond the intended scope of this manuscript. Individuals who are interested in learning more about these procedures are encouraged to obtain a copy of the above-referenced Rules and Regulations from the CWCB.

Summary

In 1973, the Colorado State Legislature vested the CWCB with the authority to appropriate instream flow water rights to preserve the natural environment to a reasonable degree. Since that time, the CWCB has completed instream flow appropriations on approximately 7,982 miles of Colorado streams, and the Instream Flow Program is expanding.

The CWCB has adopted standardized field and office procedures for developing instream flow recommendations. This standardization helps to ensure that each instream flow recommendation is "necessary" and "reasonable", as required by state statute.

R2CROSS is one of the standard methodologies employed by the CWCB to model instream hydraulic parameters. The CWCB has chosen to use the R2CROSS methodology because it is both time and labor efficient, requiring data from only a single stream transect. It has also been found to produce similar results to more data intensive techniques like the IFIM. The R2CROSS macro is also easy to use and requires very little in the way of computer hardware or software.

Biologic instream flow recommendations based upon output from R2CROSS are designed to maintain $\bar{x}_v$, $\bar{x}_d$, and *%WP* at critical levels across riffle habitat-types. It is assumed that by maintaining these critical hydraulic parameters across riffles, aquatic habitat in pools and runs is also preserved. In addition to biologic considerations, water must be physically available for the CWCB to file for an instream flow water right.

An instream flow water right requires a coordinated effort between various state and federal agencies, the public, and the CWCB. The culmination of these efforts is a decreed instream flow water right that is held by the CWCB on behalf of the people of Colorado to "preserve the natural environment to a reasonable degree."

The Colorado State Legislature enacted SB 97 in 1973. By "recognizing the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (§ 37-92-102(3), C.R.S. (1990)), the Legislature sought to balance traditional water development with some reasonable protection of Colorado's natural environment. This is not a simple task in the semi-arid Western United States where water is a scarce, and extremely valuable resource. The ongoing success of Colorado's Instream Flow Program assures that coordination between water development and protection of the natural environment will continue -- both now and into the future.

R2CROSS Program Documentation

Program documentation for the R2CROSS macro is divided into four sections. The "Setup and Installation" section describes the hardware and software requirements of the R2CROSS macro and installation of the R2CROSS program on a hard disk drive. The "Iron Creek Example" provides an opportunity for the new user to learn the most common procedures for entering and analyzing typical R2CROSS data sets and to verify that a newly installed version of R2CROSS is operating properly. "The R2CROSS Menu" provides detailed program documentation for each of the menu choices within R2CROSS (Figure D). Instructions for "Terminating and reactivating the R2CROSS macro" are described in the final section.

Appendix A provides a brief description of the "Program Calculations" that are performed within the R2CROSS macro. Rather than emphasizing the technical aspects of these calculations, this appendix is intended to provide a fundamental understanding of the operations being performed within the macro.

Output from the R2CROSS macro was verified against several simple hand-calculated examples. More complex cross sections were verified by comparison with output from the MANSQ option of IFIM (Bovee 1982). Based on this verification process, it is our belief that the instream hydraulic parameters summarized in the R2CROSS staging table are accurate estimations based upon Manning's equation.

To date, the majority of the CWCB's instream flow water rights have been based upon recommendations from an R2CROSS analysis. The CWCB chose the R2CROSS methodology because it is both time and labor efficient. It has also been shown to produce similar results to more costly techniques for modeling streamflows (Nehring 1979).

The CWCB hopes that the release of the R2CROSS macro will foster a greater understanding of this technical aspect of Colorado's Instream Flow Program. It is intended to be user-friendly. If you have any problems running the macro or questions regarding its operation, please feel free to contact the CWCB staff.

Setup and Installation

The R2CROSS macro runs efficiently on an IBM-compatible 80486 personal computer equipped with a hard disk drive, and DOS 6.0, Windows 3.1, and Lotus 1-2-3 Release 4 for Windows software.

Copying R2CROSS to a Hard Disk Drive

To begin installation of the R2CROSS program, create an R2CROSS subdirectory on your computer's hard drive using the DOS command:

md c:\R2CROSS

and press <ENTER>.

Copy the files from the enclosed diskette into this subdirectory using the DOS command:

copy a:*.* c:\R2CROSS.

Press <ENTER> to execute the command.

Loading Lotus 1-2-3 and Retrieving the R2CROSS Macro

To run the R2CROSS macro, load your copy of Lotus 1-2-3 Version 4 for Windows and open the R2CROSS.WK4 file using the Lotus menu commands "File" and "Open". The R2CROSS macro begins with an introductory message screen. Press <ENTER> to continue.

The data entry and data editing routines of the R2CROSS macro were intended to be very user-friendly. In R2CROSS, the <ENTER> key is used to complete the entry of all data within the "Location Information", "Supplemental Data", and "Channel Profile Data" sections of the data input screen (see Figure E). After entering the stream "Slope", the macro moves into the "Input Data" table. The arrow keys are used to complete the entry of all data within the "Input Data" table. After using the arrow keys to complete the entry of all data within the "Input Data" table, simultaneously press "<Ctrl> G" to exit the data entry routine.

After initial data entry, the arrow keys are used to correct and edit all data entry errors, including corrections to the "Location Information", "Supplemental Data", and "Channel Profile Data" (which were initially entered using the <ENTER> key). Table 3 is intended to help clarify the proper use of the <ENTER> key and the arrow keys within the R2CROSS data entry and data editing routines.

Table 3. Data entry and data editing using the <ENTER> key and arrow keys

	Initial data entry	Data correction/ editing
Location Information Supplemental Data Channel Profile Data	<ENTER> key	Arrow keys
Input Data Table	Arrow keys	Arrow keys

The "Iron Creek Example" which follows is a useful exercise. It is intended to familiarize new users with the data entry nuances of the R2CROSS macro and to verify that the newly installed copy of the R2CROSS macro is operating properly. We recommend that new users take a couple of minutes to work through the "Iron Creek Example" in order to gain hands-on experience with the R2CROSS macro prior to entering individual data sets.

Iron Creek Example

Figure E depicts an actual set of R2CROSS field data collected on Iron Creek, a tributary to the Fraser River in Grand County, Colorado. Assuming that the R2CROSS macro has been installed and initiated as described above, highlight the "Printers" menu choice and select either the LaserJet or Dot Matrix menu choice. Other printer-types may require a customized setup (consult your Lotus 1-2-3 reference manual).

In order to ensure that all subsequent data files are stored in the R2CROSS subdirectory, select the "Retrieve" menu choice, choose the "Path" suboption, key-in:

c:\ R2CROSS

and press <ENTER>.

To initiate data entry, select the "Input" menu option. R2CROSS then prompts you to enter the number of data points collected in the stream cross section. Count the number of data points (Iron Creek has 34), key-in this number at the prompt, and press <ENTER>.

Enter the remainder of the data within the "Location Information", "Supplemental Data", and "Channel Profile Data" sections of the R2CROSS macro. Use the <ENTER> key to complete each data entry and move the cursor through each of the data input cells in sequential order. The final use of the <ENTER> key occurs after keying-in the stream "Slope".

After entering the stream "Slope", use the arrow keys to enter all of the "Feature", "Dist", "Vert Depth", "Water Depth", and "Vel" data from the Input Data table of Figure E. The grasslines on each streambank represent a very important piece of information in the R2CROSS analysis. In the Iron Creek example, these grasslines occur at distances of 1.00 and 11.00 feet. It is imperative that these grasslines be identified within R2CROSS by placing the number "1" in the appropriate cell of Column A in the R2CROSS worksheet. This designation is so important that the R2CROSS macro will not proceed until the two grasslines have been specified. After entering all of the data within the Input Data table, including the two grasslines, simultaneously press "<Ctrl> G" to terminate the data entry routine and return to the main R2CROSS menu.

Select the "Verify" option to print a "Proof Sheet" for comparison with Figure E. If data entry errors are found, return to the "Input" menu option and correct them. When editing data, use the arrow keys to move around the worksheet and correct mistakes. When all data entry errors have been corrected, exit the editing routine by pressing "<Ctrl> G". The data editing routine can be repeated until all data entry errors have been corrected.

Once all data entry errors have been corrected, use the "Save" menu choice to store the input data file to the R2CROSS directory on the hard disk drive. Select the "New File" menu option, type an appropriate eight letter file name for the data set, and press <ENTER>. The file will automatically be saved with a .WK4 file extension. **Caution: do not name the file "R2CROSS".**

Select the "Calculate" option and press <ENTER> to initiate staging table calculations and print the final output from R2CROSS. Verify that the printed output is identical to Figures F through J.

Select the "Graph" option to view the cross section plot. Press <ENTER> to exit the view and print the cross section plot.

Exit the R2CROSS macro by selecting the "Quit" option. Answer "No" to the Lotus prompt to exit R2CROSS and remain in Lotus 1-2-3.

This general procedure can be followed to enter, edit, and analyze almost all R2CROSS datasets. To begin data entry on your own R2CROSS data set, select "Retrieve" a "New file" from the R2CROSS menu.

The R2CROSS Menu

The R2CROSS menu consists of eight main menu choices arranged from left to right across the top of the computer screen (Figure D). Use the arrow keys to move between menu choices and the <ENTER> key to select a highlighted menu choice.

Input

The "Input" menu choice is used to enter data in a new R2CROSS.WK4 worksheet or to correct/edit data in an existing worksheet. As depicted in Table 3, the <ENTER> key is used for the initial entry of the information contained within the "Location Information", "Supplemental Data", and "Channel Profile Data" sections of the field form. The arrow keys are used for the initial entry of the "Discharge/Cross Section Notes" within the "Input Data" table. The arrow keys are also used for all subsequent editing of data. This procedure ensures that the cursor is always located within the appropriate cell of the worksheet during the initial entry of the "Location Information", "Supplemental data" and "Channel Profile Data" (not always a one cell movement) and also allows the greatest flexibility in the initial entry of the discharge notes and subsequent editing of data.

Entering data in a new file

To enter data in a new file:

1. *Select the "Input" menu choice.*
2. *Count the number of data points (cell verticals) collected across the stream channel. Key-in that number and press <ENTER>. R2CROSS automatically sizes the worksheet to the proper number of discharge cells.*
3. *Once the worksheet has been sized, the macro prompts for the entry of a "Stream Name". Key-in the "Stream Name" and press the <ENTER> key to complete the data entry. Follow this same procedure for all of the information contained within the "Location Information", "Supplemental Data", and "Channel Profile Data" data entry cells. The final use of the <ENTER> key occurs after the entry of a stream "Slope". The cursor then moves to the upper left corner of the "Input Data" table (cell C50).*
4. *Use the arrow keys to enter all channel geometry and stream velocity data within the "Input Data" table. Key-in the horizontal distance from the zero stake to the cell vertical in the "Dist" column, vertical distance from the suspended tape to the channel bottom in the "Vert Depth" column, water depth in the "Water Depth" column, and water velocity in the "Vel" column for each cell in the cross section. Use the "Feature" column (Column B) to indicate the horizontal locations of the cross section stakes (S), grasslines (G), waterlines (W), and other features such as rocks (R), etc. Finally, enter a "1" in the appropriate cell of Column A to indicate the location of the grassline/streambank intersection on each streambank. R2CROSS uses the grassline locations to determine bankfull wetted perimeter and top width. These grassline locations are integral to the development of biologic instream flow recommendations in Colorado. The R2CROSS macro will not proceed until the grassline/streambank intersection on each streambank has been depicted with a "1" in Column A of the worksheet.*

5. *When all of the field data has been entered in the "Input Data" table, simultaneously press "<Ctrl> G" to exit from the "Input" routine and return to the main R2CROSS menu.*

Editing data in the current worksheet

To correct data entry errors in the current worksheet:

1. *Select the "Input" option.*
2. *Use the arrow keys to edit data. Data editing begins at the top of the "Input Data" table in cell C50. Move the cursor up from cell C50 to edit "Location Information", Supplemental Data", or "Channel Profile Data". Move down to edit data within the "Input Data" table.*
3. *After correcting all data entry errors, simultaneously press "<Ctrl> G" to terminate the "Input" routine and return to the main R2CROSS menu.*

Editing data in an "Existing file"

Previously-saved files can be retrieved, edited and re-run. Use the R2CROSS menu to "Retrieve" an "Existing file" and then following the instructions under "Editing data in the current worksheet" to edit previously-saved data files.

Verify

The "Verify" option is used to initiate R2CROSS discharge calculations and print a proof sheet (Figure E). Prior to running "Verify", be sure that the proper printer has been initialized (see "Printer" menu option).

Printed output consists of the cross section input data, calculated cross-sectional area, and calculated discharge. The proof sheet should be reviewed to verify accurate entry of all field measurements before continuing to the "Save" option. If data entry errors are discovered, return to the instructions for "Editing data in the current worksheet" and correct the errors. Proceed to "Save" only after all field data has been entered correctly.

Save

Use "Save" to store data input files. Data input files should always be saved prior to running the "Calculate" option because they are generally smaller in size and they can be retrieved, edited, and rerun if necessary. The "Calculate" option can not be run twice on the same file!

Prior to saving data input files, be sure to run the "Retrieve" and "Path" menu options to specify the location of data storage.

There are two suboptions under the "Save" menu choice, "New file" and "Overwrite". Choose your option carefully and do not overwrite the original R2CROSS.WK4 file!

New file

The first suboption, "New file", is used to save a newly created R2CROSS data set. This is accomplished by the following procedure:

1. *Select "Save" and then "New file" from the R2CROSS menu. R2CROSS prompts for the name of a new file.*
2. *Enter a name of up to eight characters and press <ENTER>.*

If a filename is selected that already exists in the default directory, the computer will beep and the file will not be saved. Should this happen, either repeat the above procedure and save under a different file name or go to the "Overwrite" suboption.

Overwrite

The "Overwrite" suboption is designed to overwrite an existing data file. Use the following procedure to perform this task:

1. *Select "Save" and then "Overwrite" from the R2CROSS menu. R2CROSS will list the files in the current directory that you may chose to overwrite.*
2. *Select a file from the list using the arrow keys and overwrite it by pressing <ENTER>. The existing file will be replaced with the current file. Do not select the original R2CROSS.WK4 file!*

Calculate

"Calculate" initiates all staging table calculations and prints a five page data summary (Figures F through Figure J). Be sure that you have saved your input data set and that the proper printer type has been specified prior to running "Calculate". This operation may take several minutes depending upon the speed of your computer. A detailed explanation of the four major calculations performed within R2CROSS can be found in "Appendix A - Program Calculations".

Graph

The "Graph" option allows the user to view and print a cross-section plot of the stream transect (Figure K). The cross section plot is useful for revealing potential problems with the input data set or potential errors in data collection or data entry. Errors, such as misread rod readings on waterlines or ground profiles, are often easily detected on a cross section plot.

Retrieve

The "Retrieve" menu option has three suboptions, "Path", "New file", and "Existing file". These suboptions are used to change the current file storage path and to retrieve data files.

Path

The "Path" suboption changes the current data storage location. A valid storage path may be any drive and/or directory which is in existence on the computer's hard drive. To select a new path, follow these steps:

1. *Select "Retrieve" and then "Path" from the R2CROSS menu.*
2. *Type in the name of an existing directory on your hard drive and press <Enter>.*

Subsequent files will be stored and retrieved within this directory. In the event that a non-existent path is entered, the computer will beep and return to the main menu. The default directory will remain in effect until a valid path has been entered.

The "Path" suboption choice is not frequently used. It may be appropriate if you wish to organize R2CROSS data from different streams into separate subdirectories. However, file organization can also be accomplished by simply using descriptive file names. If you do decide to create separate directories for your R2CROSS output files, you should copy the files from the R2CROSS diskette into each of these subdirectories so that they can be retrieved when you want to create a new data set.

New file

The "New file" suboption is used to initiate data entry on a new cross section. It erases the current worksheet from the screen and replaces it with a blank R2CROSS.WK4 worksheet. Read the introductory message and press <ENTER> to initiate data entry.

Existing file

The final suboption, "Existing file", retrieves a previously-saved R2CROSS data set from storage. Simply select the file to be retrieved. Select the "Input" command on the R2CROSS menu to edit the dataset. Staging table calculations are initiated by selecting the "Calculate" option. Remember, the "Calculate" option cannot be run twice on the same file.

Printers

LaserJet

Dot Matrix

The "Printers" menu option is used to format R2CROSS output for either a LaserJet or Dot Matrix type printer. The proper printer-type should be selected prior to running the "Verify" or "Calculate" menu options. Use the arrow keys to highlight the proper printer and press the <ENTER> key. Experienced Lotus 1-2-3 users can setup additional printers prior to retrieving the R2CROSS.WK4 worksheet if necessary. Consult a Lotus manual for specific instructions on setting up other types of printers.

Quit

Select the "Quit" menu option and answer "No" to the Lotus prompt to de-activate the R2CROSS macro and return to normal Lotus 1-2-3 operations. De-activating the R2CROSS macro allows for the use of standard Lotus 1-2-3 commands on all unprotected cells within the current data file. The R2CROSS menu can be reactivated by simultaneously pressing "<Ctrl> M". Alternatively, a new R2CROSS worksheet can be brought up from within Lotus 1-2-3 by retrieving the original R2CROSS.WK4 file from the computer's hard disk drive (see "Installation" section).

Terminating and Reactivating the R2CROSS Macro

Situations may arise where the macro must be terminated during data entry or calculation routines. To terminate the R2CROSS macro and return to the standard Lotus 1-2-3 menu, press <Ctrl><Break>. Then press the <Esc> key several times to clear the Lotus error message screen.

If the R2CROSS macro was terminated due to a data entry error or a problem with the execution of the macro, the integrity of the worksheet may have been compromised. If so, the current worksheet should be erased and a fresh copy of the R2CROSS.WK4 file retrieved from the computer's hard disk drive. The data should definitely be re-entered if the macro failed during the "Calculate" option of R2CROSS. Trying to rerun a compromised dataset may result in additional problems and unreliable output. It is always safer, albeit more time consuming, to start over.

If you do not believe the data in the current worksheet has been compromised, the R2CROSS macro can be re-activated by simultaneously pressing "<Ctrl> M". Macro operation will begin with the standard R2CROSS menu and data entry or calculations may then resume within the existing file.

Literature Cited

Bovee, K.D. 1982. A guide to stream habitat analysis using the Instream Flow Incremental Methodology. Instream Flow Information Paper No. 12. Washington, DC: U.S. Fish and Wildlife Service (FWS/OBS-82/26). 248pp.

Bovee, K.D. and R. Milhous. 1978. Hydraulic simulation in instream flow studies: Theory and techniques. Instream Flow Information Paper No. 5. Washington, DC: U.S. Fish and Wildlife Service (FWS/OBS -78/33). 143pp.

Buchanan, T.J. and W.P. Somers. 1969. Discharge measurements at gaging stations. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Chapter A8. United States Government Printing Office, Washington, D.C. 20402.

Benson, M.A., and T. Dalrymple. 1967. General field and office procedures for indirect discharge measurements. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Chapter A1. United States Government Printing Office, Washington, D.C. 20402.

Chow, V.T. 1959. Open-channel hydraulics. McGraw-Hill Book Company, New York. 680p.

Colorado Water Conservation Board. 1993. Statement of Basis and Purpose and Rules and Regulations Concerning the Colorado Instream Flow and Natural Lake Level Program. Department of Natural Resources. Denver, CO. 80203.

Grant, G.E., J.E. Duval, G.J. Koerper and J.L. Fogg. 1992. XSPRO: A channel cross-section analyzer. Technical Note 387. Bureau of Land Management. Denver, CO. 80225-0047.

Kircher, J.E., A.F. Choquette and B.D. Richter. 1985. Estimation of natural streamflow characteristics in western Colorado. Water-Resources Investigations Report 85-4086. United States Geological Survey. Box 25425, Denver Federal Center. Lakewood, CO 80225.

Laursen, H.I. 1978. Structural analysis. Second edition. New York. McGraw-Hill Book Company.

Nehring, R.B. 1979. Evaluation of instream flow methods and determination of water quantity needs for streams in the State of Colorado. Colorado Division of Wildlife. Fort Collins, CO.

Ray, G.A. and W.F. Megahan. 1979. Measuring cross sections using a sag tape: a generalized procedure. USDA Forest Service General Technical Report INT-47. Intermountain Forest and Range Experiment Station. U.S. Department of Agriculture. Ogden, UT. 84401.

Silvey, L. 1976. R-2 Cross Program: A sag-tape method of channel cross section measurement for use with instream flow determinations. United States Department of Agriculture, Forest Service Region 2. 11177 W. 8th Avenue. Lakewood, CO 80225.

Skinner, J. Instream Flow Coordinator. Colorado Division of Wildlife. Personal communication.

Weatherred, J.D., H.L. Silvey and D.J. Pfankuch. 1981. Program documentation for R2-CROSS-81. Watershed Systems Development Group. United States Department of Agriculture, Forest Service. 3825 East Mulberry Street. Fort Collins, CO 80524.

Appendix A - Program Calculations

Some R2CROSS users may be interested in the operation and layout of the Lotus 1-2-3 macro. Figure L depicts the sequence of operations performed within each R2CROSS menu option. Figure M provides the layout of the R2CROSS macro within the Lotus 1-2-3 worksheet. The four major computations performed within the R2CROSS macro are sag-tape corrections, estimation of Manning's "n", calculation of a water line comparison table, and calculation of a staging table.

Sag-Tape Calculations.

Channel geometry measurements that are taken using the sag-tape methodology must be corrected to a level reference. R2CROSS uses catenary curve formulas to compute these corrections from a sagging tape that has been leveled at each end. The use of the catenary curve solution is based on the assumption that the suspended steel tape is analogous to a suspended cable placed under a unidirectionally distributed load (Laursen 1978).

The derivation of the catenary curve solution is beyond the scope of this manuscript. Basically, R2CROSS uses the length of tape in suspension, the tension applied to the tape, and the standard weight of one foot of tape to apply the necessary vertical distance corrections to each cell vertical within the cross section.

When using a level and stadia rod to survey channel geometry, the tape weight and tension defaults, supplied in the original R2CROSS.WK4 worksheet, will simulate an extremely light tape stretched at very high tension. This results in a sag correction of approximately zero at each cell vertical.

Use of Manning's Equation.

Manning's equation is defined as:

$$Q = \frac{1.486 * A * R^{2/3} * S^{1/2}}{n}$$

where;
Q = discharge (cfs);
A = cross-sectional area (ft^2);
R = hydraulic radius (ft);
S = slope (ft/ft); and
n = Manning's "n", a dimensionless coefficient of roughness.

Manning's equation is used in two separate R2CROSS calculations. It is first used within the "Verify" option to provide an initial estimate of Manning's "n" using the rearranged equation:

$$n = \frac{1.486 * A * R^{2/3} * S^{1/2}}{Q}$$

The parameters Q, A, R, and S are calculated from the raw field data and used to solve directly for "n" (Figures G and J). Once estimated, Manning's "n" remains constant throughout the remainder of the streamflow modeling.

Manning's equation is also used within the "Calculate" option to solve for Q at each simulated water surface elevation within the staging table (Table 4).

Calculation of the Water Line Comparison Table.

R2CROSS uses two techniques for estimating cross-sectional area. One estimate is obtained by summing the product of "measured" water depth and cell width for all cells in the cross section (A_m). This technique allows independent water surface elevations within each cell and provides the most accurate estimate of cross-sectional area at the time the field measurement was made. However, this technique cannot be used to simulate a single, flat water surface elevation at computer-modeled stream discharges.

The second technique used to estimate cross-sectional area involves projecting a single water surface elevation across the stream channel. Channel bottom elevations are subtracted from this projected water surface elevation to obtain a "computed" water depth at each cell vertical. Cross-sectional area is obtained by summing the product of the "computed" water depth and cell width at each cell vertical (A_c). This technique constrains the water surface to a flat plane and is useful for simulating discharges above and below the field-measured discharge.

The water line comparison table (Figure H) iteratively calculates 31 separate estimates of A_c, using projected waterlines ranging from 0.25 feet above to 0.25 feet below the mean waterline measured in the field. The single water surface elevation that results in A_c equal to A_m is interpolated from the water line comparison table and is used in the staging table as the best estimate of the waterline at the field-measured discharge.

Calculation of the Staging Table.

The final product of the R2CROSS macro is the staging table (Figure I). In addition to the three critical biologic criteria ($\bar{x}_d$, *%WP*, and $\bar{x}_v$), R2CROSS also calculates incremental estimates of top width (TW), maximum depth (D_{max}), cross-sectional area (A), wetted perimeter (WP), hydraulic radius (R), and flow (Q) at a number of waterline elevations. The upper limit of the model occurs at bankfull discharge which is defined as the lower of the two grassline elevations measured in the field. The lower limit is either 1.75 feet below the waterline calculated in the water line comparison table or stage of zero flow (the lowest field-measured channel profile), whichever is higher in elevation. The formulae for each of the parameters estimated in the staging table are summarized in Table 4.

Figure L. Sequence of operations performed by R2CROSS macro

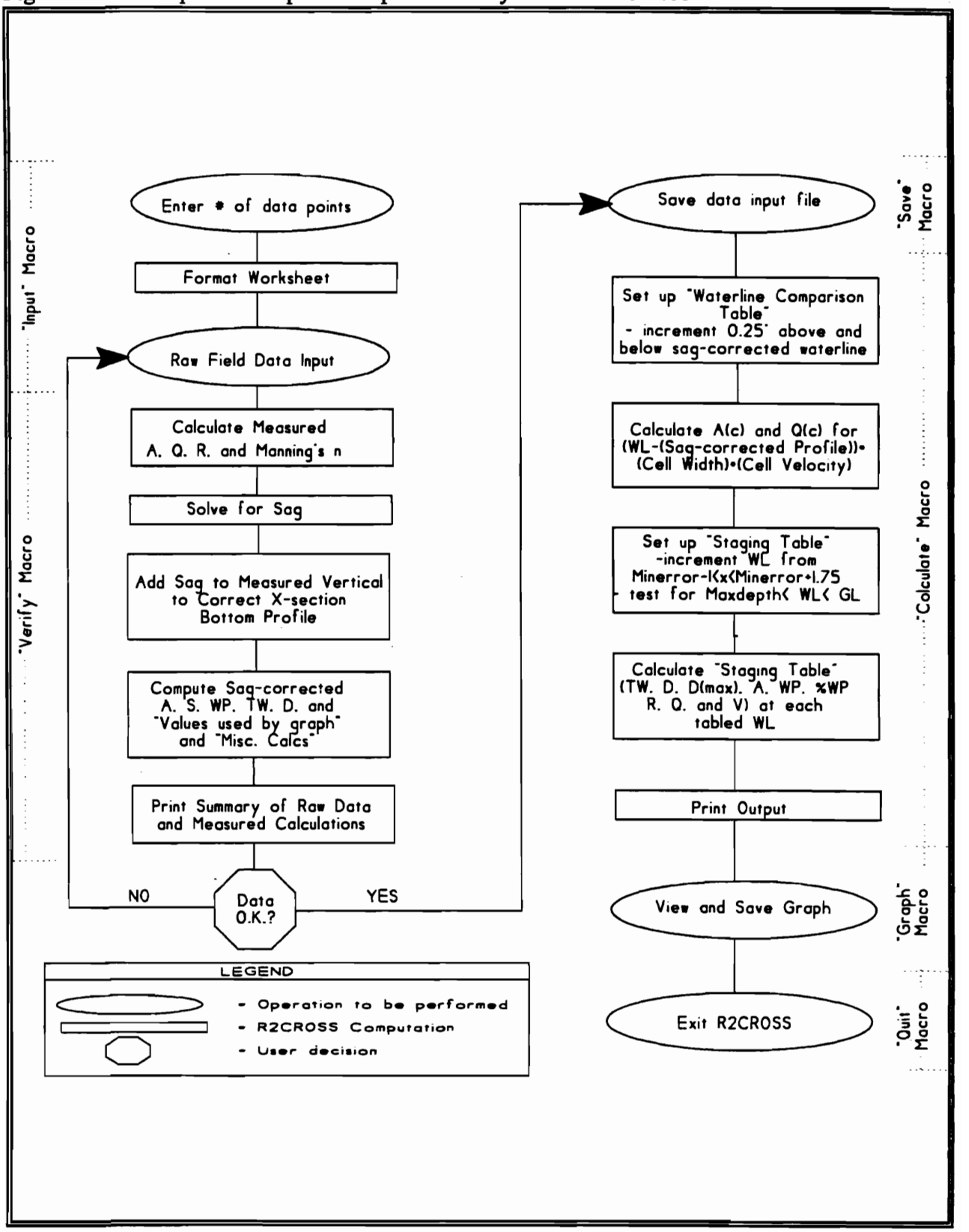


Figure M. Lotus 1-2-3 worksheet layout for R2CROSS macro

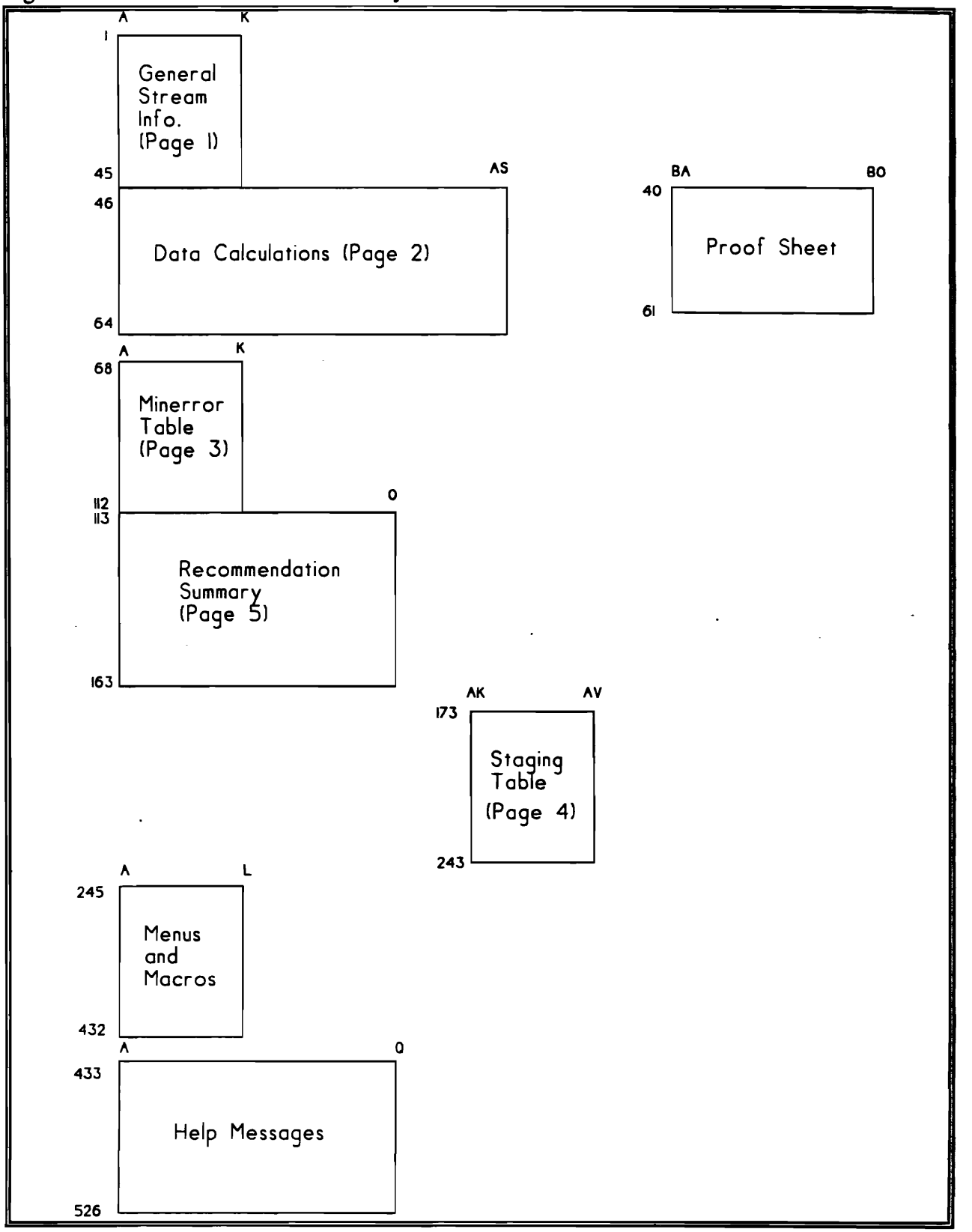


Table 4. Hydraulic Formulas used in R2CROSS staging table

Parameter	Formula
Top Width (TW)	$\sum_{i=1}^{n} TW_i$
Average Depth ($\bar{x}_d$)	$\frac{A}{TW}$
Maximum Depth (D_{max})	$\underset{i=1}{\overset{n}{MAX}}(D_i)$
Area (A)	$\sum_{i=1}^{n} A_i$
Wetted Perimeter (WP)	$\sum_{i=1}^{n} WP_i$
Percent Wetted Perimeter (%WP)	$\frac{WP}{Bankfull\ WP} * 100$
Hydraulic Radius (R)	$\frac{A}{WP}$
Flow (Q)	$\frac{1.486 * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}}{n}$
Average Velocity ($\bar{x}_v$)	$\frac{Q}{A}$

RULES
CONCERNING THE
COLORADO INSTREAM FLOW
AND NATURAL LAKE
LEVEL PROGRAM

Adopted by the
Colorado Water Conservation Board
January 27, 2009

Exhibit 5

Statement of Basis and Purpose

In 1973, the General Assembly enacted Senate Bill 97, creating the Colorado Instream Flow and Natural Lake Level Program ("ISF Program"), to be administered by the Colorado Water Conservation Board ("Board"). The statutory authority for these Rules is found at sections 37-60-108 and 37-92-102(3), C.R.S. (2008). The purpose of these Rules, initially adopted in 1993, is to codify and establish procedures for the Board to implement the ISF Program.

The Board has amended the Rules several times since 1993 to reflect changes in the statutes related to the ISF Program. Notably, in 1999, the Board repealed the existing Rule 5 in its entirety, and, among other things, adopted a new Rule 5 to establish a public notice and comment process for instream flow water right appropriations. In 2003, the Board amended Rule 6 to implement the provisions of Senate Bill 02-156 by identifying factors that the Board will consider when determining whether to acquire water, water rights, or interests in water, and by establishing procedures for notice, public input, and, if necessary, hearings. In 2004, the Board amended Rule 6 to implement House Bill 03-1320, codified at section 37-83-105, C.R.S. (2003), to allow for emergency loans of water for instream flows. The Board also amended Rule 6 to enable the Board to finalize an acquisition within a two-meeting time frame, if necessary. In 2005, the Board amended Rule 6 to implement House Bill 05-1039, establishing how the Board and its staff will respond to offers of water for temporary instream flow use and expedite use of loaned water for instream flow purposes.

In 2009, the Board amended Rule 6 to adopt criteria specified in House Bill 08-1280 (codified at sections 37-92-102(3), 37-92-103 and 37-92-305, C.R.S.) for evaluating proposed leases or loans of water, and to incorporate H.B. 1280's requirements for: (1) specific conditions that must be met as part of the CWCB's approval of a proposed loan or lease of water; (2) provisions that must be included in all agreements for loans or leases of water under section 37-92-102(3); and (3) actions that the Board must take in connection with loans or leases of water. Rule 6 does not incorporate those provisions of H.B. 1280 that direct the water courts or the Division of Water Resources to take certain actions in regard to water acquisitions by the Board for instream flow use.

Specifically, the 2009 Rules 6a., 6c., 6e, 6j., 6k., 6l., and 6m. clarify the Board's evaluation process, Board funding for water leases and purchases, and public input for proposed acquisitions of water, water rights or interests in water for instream flow use. Rule 6f. identifies additional factors for loans and leases of water, and Rules 6g. and 6h. describe recording requirements and water reuse provisions to be included in contracts or agreements for water acquisitions. Rule 6i. incorporates H.B 1280's requirements regarding water court applications filed by the Board to obtain a decreed right to use acquired water for instream flow purposes. Regarding the historical consumptive use quantification referred to in Rule 6i.(1), the Board will not object to a water rights owner requesting a term and condition from the water court that the historical consumptive use determination shall not apply to the water right at the expiration of the lease or loan.

In 2009, the Board also amended Rules 8e.—h. (De Minimis Rule) to recognize priority administration of the CWCB's instream flow water rights and clarify that the

decision not to file a statement of opposition under this Rule does not constitute: (1) acceptance by the CWCB of injury to any potentially affected instream flow water right; or (2) a waiver of the CWCB's right to place an administrative call for any instream flow water right. Rule 8e.(1) sets forth what type of notice the CWCB will provide to water court applicants and to the Division Engineer when it elects not to file a statement of opposition to a water court application under this Rule.

Finally, in 2009, the Board amended Rule 8i.(3) (Injury Accepted with Mitigation) to provide notice to water users of: (1) the information they must submit to the CWCB when requesting that the CWCB enter into a pretrial resolution under which it will accept injury with mitigation; (2) the factors the CWCB will consider in evaluating an injury with mitigation proposal; and (3) the terms and conditions the CWCB will require in decrees incorporating injury with mitigation.

In general, it is the policy of the CWCB to consider injury with mitigation proposals only when no other reasonable water supply alternatives can be implemented. Exceptions to the policy may be granted when the proponent can demonstrate that the proposed mitigation will result in significant and permanent enhancements to the natural environment of the subject stream or lake existing at the time the proponent proposes the injury with mitigation.

DEPARTMENT OF NATURAL RESOURCES

Colorado Water Conservation Board

RULES CONCERNING THE COLORADO INSTREAM FLOW AND NATURAL LAKE LEVEL PROGRAM

2 CCR 408-2

1. TITLE.

Rules Concerning the Colorado Instream Flow and Natural Lake Level Program, hereafter referred to as the Instream Flow ("ISF") Program as established in §37-92-102 (3) C.R.S., shall be hereinafter referred to as the "ISF Rules."

2. PURPOSE OF RULES.

The purpose of the ISF Rules is to set forth the procedures to be followed by the Board and Staff when implementing and administering the ISF Program. By this reference, the Board incorporates the Basis and Purpose statement prepared and adopted at the time of rulemaking. A copy of this document is on file at the Board office.

3. STATUTORY AUTHORITY.

The statutory authority for the ISF Rules is found at §37-60-108, C.R.S. and §37-92-102 (3), C.R.S. Nothing in these rules shall be construed as authorizing the Board to deprive the people of the state of Colorado of the beneficial use of those waters available by law and interstate compact.

4. DEFINITIONS.

4a. Agenda Mailing List.

The agenda mailing list consists of all Persons who have sent a notice to the Board Office that they wish to be included on such list. These Persons will be mailed a Board meeting agenda prior to each scheduled Board meeting.

4b. Board.

Means the Colorado Water Conservation Board as defined in §§37-60-101, 103 and 104, C.R.S.

4c. Board Office.

The Colorado Water Conservation Board's office is located at 1313 Sherman Street, 7th Floor, Denver, CO 80203. The phone number is (303) 866-3441. The facsimile number is (303) 866-4474. The Board's website is http://www.cwcb.state.co.us.

4d. Contested Hearing Mailing List.

The Contested Hearing Mailing List shall consist of all Persons who have received Party status or Contested Hearing Participant status pursuant to Rules 5l. or 5m. This mailing list is specific to a contested appropriation.

4e. Contested Hearing Participant.

Any Person who desires to participate in the contested ISF process, but not as a Party, may obtain Contested Hearing Participant status pursuant to Rule 5m. A Person with such status will receive all Party documents. Contested Hearing Participants may comment on their own behalf, but may not submit for the record technical evidence, technical witnesses or legal memoranda.

4f. CWCB Hearing Officer.

The Hearing Officer is appointed by the Board and is responsible for managing and coordinating proceedings related to contested ISF appropriations, acquisitions or modifications, such as setting prehearing conferences and adjusting deadlines and schedules to further the Parties' settlement efforts or for other good cause shown. The Hearing Officer does not have the authority to rule on substantive issues.

4g. Final Action.

For purposes of Rule 5, final action means a Board decision to (1) file a water right application, (2) not file a water right application or (3) table action on an ISF appropriation; however, tabling an action shall not be construed as abandonment of its intent to appropriate.

4h. Final Staff ISF Recommendation.

Staff's ISF recommendation to the Board is based on Staff's data and report, and public comments and data contained in the official record.

4i. ISF.

Means any water, or water rights appropriated by the Board for preservation of the natural environment to a reasonable degree, or any water, water rights or interests in water acquired by the Board for preservation or improvement of the natural environment to a reasonable degree. “ISF” includes both instream flows between specific points on a stream and natural surface water levels or volumes for natural lakes.

4j. ISF Subscription Mailing List(s).

The ISF Subscription Mailing List(s) are specific to each water division. The ISF Subscription Mailing List(s) shall consist of all Persons who have subscribed to the list(s) by sending notice(s) to the Board Office that they wish to be included on such list for a particular water division. The Staff shall, at such times as it deems appropriate, mail to all Persons on the water court resume mailing list in each water division an invitation to be included on the ISF Subscription Mailing List for that water division. Persons on the list are responsible for keeping Staff apprised of address changes. Persons on the ISF Subscription Mailing List(s) shall receive agendas and other notices describing activities related to ISF recommendations, appropriations and acquisitions in the particular water division. Persons may be required to pay a fee in order to be on the ISF Subscription Mailing List(s).

4k. Mail.

For the purposes of the ISF Rules, mail refers to regular or special delivery by the U.S. Postal Service or other such services, electronic delivery (e-mail), or delivery by FAX transmission.

4l. Party.

Any Person may obtain Party status pursuant to Rule 5l. Only a Person who has obtained Party status may submit, for the record, technical evidence, technical witnesses or legal memoranda. Each Party is responsible for mailing copies of all documents to all other Parties and Contested Hearing Participants.

4m. Person.

Means any human being, partnership, association, corporation, special district, water conservancy district, water conservation district, municipal entity, county government, state government or agency thereof, and federal government or agency thereof.

4n. Proper Notice.

Means the customary public notice procedure that is provided each year by the Board in the preamble to the Board's January Board meeting agenda. This customary public notice procedure may include posting of the agenda at the Board office, filing legal notices when required, mailing to Persons on the Board mailing lists and posting notices on the Board's website.

4o. Stacking.

As used in Rule 6, the terms “stack” or “stacking” refer to an instance in which the Board holds more than one water right for the same lake or reach of stream and exercises the rights independently according to their decrees.

4p. Staff.

Means the Director of the Colorado Water Conservation Board (“CWCB Director”) and other personnel employed by the Board.

5. ORIGINAL APPROPRIATION PROCEDURE.

5a. Recommendation of Streams and Lakes for Protection.

All Persons interested in recommending certain stream reaches or natural lakes for inclusion in the ISF Program may make recommendations to the Board or Staff at any time. Staff will provide a preliminary response to any Person making such a recommendation within 30 working days after receipt of the recommendation at the Board Office. Staff will collaborate with State and Federal agencies and other interested Persons to plan and coordinate collection of field data necessary for development of ISF recommendations. The Staff shall advise the Board, at least annually, of all new recommendations received and of streams and lakes being studied for inclusion in the ISF Program.

5b. Method of Making Recommendations.

All recommendations transmitted to the Board or Staff for water to be retained in streams or lakes to preserve the natural environment to a reasonable degree must be made with specificity and in writing.

5c. Board Approval Process.

Periodically, after studying streams and lakes for inclusion in the ISF Program, Staff will recommend that the Board appropriate ISF rights. The Board and Staff will use the following annual schedule for initiating, processing and appropriating ISF water rights:

January

- The January Board meeting agenda will list proposed ISF appropriations to be appropriated that year.

- Staff will provide data, engineering and other information supporting each proposed ISF appropriation to the Board prior to or at the January Board meeting.

- Staff will present its information and recommendation for each proposed ISF appropriation at the January Board meeting.

- The Board will take public comment on the proposed ISF appropriations at the January Board meeting.

- The Board may declare its intent to appropriate for each proposed ISF appropriation at the January Board meeting, provided that the particular ISF appropriation has been listed as being under consideration in a notice, mailed at least 60 days prior to the January Board meeting, to the ISF Subscription Mailing List for the relevant water division(s).

- Notice of the Board having declared its intent to appropriate will be distributed through the ISF Subscription Mailing List for the relevant water division(s).

March

- The Board will take public comment on all ISF appropriations at the March Board meeting.

- Notice to Contest an ISF appropriation, pursuant to Rule 5k, must be submitted to the Board Office by March 31st, or the first business day thereafter.

April

- Staff will notify all Persons on the ISF Subscription Mailing List(s) of contested ISF appropriations by April 10th, or the first business day thereafter.

- Notice of Party status or Contested Hearing Participant status, pursuant to Rules 5l. or 5m., must be submitted to the Board Office by April 30th, or the first business day thereafter.

May

- Staff will report to the Board which ISF appropriations are being contested.

- The Board may set hearing dates for contested ISF appropriations.

- At the May Board meeting, the Board may take final action on all uncontested ISF appropriations.

July

- A prehearing conference will be held prior to the July Board meeting for all contested ISF appropriations (Date specific to be determined by the Hearing Officer).

- Five working days before the prehearing conference, all Parties shall file at the Board office, for the record, any and all legal memoranda, engineering data, biological data and reports or other information upon which the Party will rely.

August

- All Parties must submit written rebuttal statements, including testimony and exhibits, by August 15th, or the first business day thereafter. Except for such rebuttal and testimony provided at the hearing pursuant to Rule 5p.(2), the Board will not accept any statements,

related documentation or exhibits submitted by any Party after the prehearing conference, except for good cause shown or as agreed upon by the Parties.

September

- Staff will make its final recommendations to the Board, based upon its original report, all public comments, documents submitted by the Parties and all data contained in the official record, at the September Board meeting.
- Notice of the Final Staff ISF Recommendations will be sent to all Persons on the Contested Hearing Mailing List prior to the September Board meeting.
- Parties may choose to continue or withdraw their Notice to Contest an ISF appropriation at or before the September Board Meeting.
- The Board will hold hearings on all contested ISF appropriations.

November

- The Board shall update the public on the results of any hearings through its agenda and may take final action on contested ISF appropriations.

When necessary, the Board may modify or delay this schedule or any part thereof as it deems appropriate.

5d. Board's Intent to Appropriate.

Notice of the Board's potential action to declare its intent to appropriate shall be given in the January Board meeting agenda and the Board will take public comment regarding its intent to appropriate at the January meeting.

(1) After reviewing Staff's recommendations for proposed ISF appropriations, the Board may declare its intent to appropriate specific ISF water rights. At that time, the Board shall direct the Staff to publicly notice the Board's declaration of its intent to appropriate.

(2) After the Board declares its intent to appropriate, notice shall be published in a mailing to the ISF Subscription Mailing Lists for the relevant water divisions and shall include:

(a) A description of the appropriation (e.g. stream reach, lake location, amounts, etc.);

(b) Availability (time and place) for review of Summary Reports and Investigations Files for each appropriation; and,

(c) Summary identification of any data, exhibits, testimony or other information in addition to the Summary Reports and Investigations Files supporting the appropriation.

(3) Published notice shall also contain the following information:

(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.

(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all Persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any Person

desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.

(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to Persons on the ISF Subscription Mailing List(s).

(d) Any Notice to Contest must be received at the Board office no later than March 31st, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant status must be received at the Board office no later than April 30th, or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September Board meeting and will send notice of the Final Staff ISF Recommendations to all Persons on the Contested Hearing Mailing List.

(f) The Board may take final action on any uncontested ISF appropriations at the May Board meeting.

(4) After the Board declares its intent to appropriate, notice of the Board's action shall be mailed within five working days to the County Commissioners of the county(ies) in which the proposed reach or lake is located.

(5) Final action by the Board on ISF appropriations will occur no earlier than the May Board meeting.

5e. Public Comment.

(1) The Board will hear comment on the recommended action to declare its intent to appropriate at the January Board Meeting.

(2) ISF appropriations will be noticed in the Board agenda for each regularly scheduled subsequent meeting until the Board takes final action. Prior to March 31st, at each regularly scheduled Board meeting, time will be allocated for public comment. Subsequent to March 31st, the Board will accept public comment on any contested ISF appropriations or lake levels only at the hearings held on those appropriations pursuant to Rule 5j.

(3) Staff will maintain an ISF Subscription Mailing List for each water division. Any Person desiring to receive information concerning proposed ISF appropriations for that water division must contact the Board Office to request inclusion on that ISF Subscription Mailing List.

5f. Date of Appropriation.

The Board may select an appropriation date that may be no earlier than the date the Board declares its intent to appropriate. The Board may declare its intent to appropriate when it concludes that it has received sufficient information that reasonably supports the findings required in Rule 5i.

5g. Notice.

Agenda and ISF Subscription Mailing List(s) notice shall be given pursuant to Rule 5d. and the public shall be afforded an opportunity to comment pursuant to Rule 5e. Notice of the date of final action on uncontested ISF appropriations shall be mailed to Persons on the ISF Subscription Mailing Lists for the relevant water divisions, maintained pursuant to Rule 5e.(3).

5h. Final Board Action on an ISF Appropriation.

The Board may take final action on any uncontested ISF appropriation(s) at the May Board meeting or any Board meeting thereafter. If a Notice to Contest has been filed, the Board shall proceed under Rules 5j. - 5q.

5i. Required Findings.

Before initiating a water right filing to confirm its appropriation, the Board must make the following determinations:

(1) Natural Environment.

That there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted.

(2) Water Availability.

That the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made.

(3) Material Injury.

That such environment can exist without material injury to water rights.

These determinations shall be subject to judicial review in the water court application and decree proceedings initiated by the Board, based on the Board's administrative record and utilizing the criteria of §§24-4-106(6) and (7), C.R.S.

5j. Procedural Rules for Contested ISF Appropriations.

(1) Whenever an ISF appropriation is contested, the Board shall hold a hearing at which any Party may present evidence, witnesses and arguments for or against the appropriation and any Contested Hearing Participant or member of the public may comment. The hearing shall be a notice and comment hearing as authorized in §37-92-102(4)(a), C.R.S., and shall not be a formal agency adjudication under §24-4-105, C.R.S.

(2) These rules are intended to assure that information is received by the Board in a timely manner. Where these rules do not address a procedure or issue, the Board shall determine the procedures to be followed on a case-by-case basis. The Board may waive the requirements of these rules whenever the Board determines that strict adherence to the rules is not in the best interests of fairness, unless such waiver would violate applicable statutes. For any such waiver, the Board shall provide appropriate justification, in writing, to Persons who have Party or Contested Hearing Participant status.

(3) In a hearing on a contested ISF appropriation, a Party may raise only those issues relevant to the statutory determinations required by §37-92-102(3)(c), C.R.S. and the required findings in Rule 5i.

5k. Notice to Contest.

(1) To contest an ISF appropriation, a Person must comply with the provisions of this section. The Board must receive a Notice to Contest the ISF appropriation by March 31st, or the first business day thereafter.

(2) A Notice to Contest an ISF appropriation shall be made in writing and contain the following information:

(a) Identification of the Person(s) requesting the hearing;

(b) Identification of the ISF appropriation(s) at issue; and,

(c) The contested facts and a general description of the data upon which the Person will rely to the extent known at that time.

(3) After a Party has filed a Notice to Contest an ISF appropriation, any other Person may participate as a Party or a Contested Hearing Participant pursuant to Rules 5l. or 5m.

(4) Staff will notify all Persons on the relevant ISF Subscription Mailing List(s) of contested ISF appropriations by April 10th, or the first business day thereafter.

5l. Party Status.

(1) Party status will be granted to any Person who timely files a Notice of Party Status with the Staff. Any Person filing a Notice to Contest shall be granted Party status and need not also file a Notice of Party Status. A Notice of Party status must be received by April 30th, or the first business day thereafter. A Notice of Party status shall set forth a brief and plain statement of the reasons for obtaining Party status, the contested facts, the matters that the Person claims should be decided and a general description of the data to be presented to the Board. The Board will have discretion to grant or deny Party status to any Person who files a Notice of Party Status after April 30th or the first business day thereafter, for good cause shown.

(2) Only a Party may submit for the record technical evidence, technical witnesses or file legal memoranda. Each Party is responsible for mailing copies of all documents submitted for Board consideration to all other Parties and Contested Hearing Participants.

(3) The Staff shall automatically be a Party in all proceedings concerning contested ISF appropriations.

(4) Where a contested ISF appropriation is based fully or in part on another agency's recommendation pursuant to Rule 5a., that agency shall automatically be a Party in any proceeding.

(5) All Parties, whether they achieved such status by filing a Notice to Contest or a Notice of Party Status, shall be afforded the same rights in the contested ISF appropriation proceedings. Specifically, but without limiting the generality of the foregoing sentence, any Person who filed a Notice of Party Status is entitled to raise issues not raised by any Person who filed a Notice to Contest.

5m. Contested Hearing Participant Status.

(1) Any Person who desires to participate in the process, but not as a Party, may obtain Contested Hearing Participant status by filing a notice thereof at the Board Office prior to April 30th. A Person with such status will receive all Party documents specific to the contested appropriation. Contested Hearing Participants may comment on their own behalf, but may not submit for the record technical evidence, technical witnesses or legal memoranda. The Board will have discretion to grant or deny Contested Hearing Participant status to any Person who filed a Notice of Contested Hearing Participant Status after April 30th or the first business day thereafter, for good cause shown.

(2) The request for Contested Hearing Participant status must be received by April 30th, or the first business day thereafter.

(3) Staff shall notify all Parties and Contested Hearing Participants of the list of Contested Hearing Participants prior to May 31st. Thereafter, Parties shall also mail their prehearing statements and any other documents to Contested Hearing Participants.

5n. <u>Prehearing Conference.</u>

(1) The Board will designate a Hearing Officer, who shall schedule and preside over prehearing conferences and assist the Parties with procedural matters, such as setting prehearing conferences and adjusting deadlines and schedules to further the Parties' settlement efforts or for other good cause shown. All prehearing conferences will be scheduled and held prior to the July Board meeting.

(2) On or before five working days before the prehearing conference, each Party shall file 25 copies of its prehearing statement with the Board, and provide an electronic version when possible. The prehearing statement shall identify all exhibits, engineering data, biological data and reports or other information that the Party will rely upon at the hearing and shall contain:

(a) A specific statement of the factual and legal claims asserted (issues to be resolved) and the legal basis upon which the Party will rely;

(b) Copies of all exhibits to be introduced at the hearing;

(c) A list of witnesses to be called and a brief description of their testimony;

(d) Any alternative proposal to the proposed ISF appropriation;

(e) All written testimony to be offered into evidence at the hearing;

and

(f) Any legal memoranda.

Each Party shall deliver a copy of its prehearing statement to all other Parties, Contested Hearing Participants, the Hearing Officer and directly to the Assistant Attorneys General representing Staff and the Board five working days before the prehearing conference. The Board will not consider information, other than rebuttal statements and testimony provided at the hearing pursuant to Rule 5p.(2), submitted by the Parties after this deadline except for good cause shown or as agreed upon by the Parties.

(3) Any Contested Hearing Participant may also submit written comments 5 working days prior to the prehearing conference. Contested Hearing Participants who submit written comments for the Board's consideration shall provide 25 copies to the Board, and a copy to all other Contested Hearing Participants, Parties, the Hearing Officer and the Assistant Attorneys General representing Staff and Board, and provide an electronic version when possible.

(4) The prehearing conference will afford the Parties the opportunity to address such issues as time available for each Party at the hearing, avoiding presentation of duplicative information, consolidation of concerns, etc. The Parties may formulate stipulations respecting the issues to be raised, witnesses and exhibits to be presented, and/or any other matters which may be agreed to or admitted by the Parties. At the prehearing conference, the Parties shall make known any objections to the procedures or evidence that they may raise at the hearing unless such objections could not have been reasonably determined at that time.

(5) August 15th, or the first business day thereafter, is the last day for submission of written rebuttal statements, including testimony, legal memoranda, and exhibits. Twenty-five copies of such

materials must be provided to the Board, and an electronic version also provided, when possible. Except for such rebuttal and testimony provided at the hearing pursuant to Rule 5p.(2), the Board will not accept any statements, related documentation or exhibits submitted by any Party after the deadline set forth in Rules 5n.(2) and 5n.(3), except for good cause shown or as agreed upon by the Parties. The scope of rebuttal is limited to issues and evidence presented in the prehearing statements. Any documentation to be submitted pursuant to this subsection (5) shall be delivered to the Board and mailed to all Parties and Contested Hearing Participants by August 15th, or the first business day thereafter, unless the Parties agree otherwise.

5o. Notice of Hearings on Contested ISF Appropriations.

(1) Staff shall mail notice of prehearing conference(s) on contested ISF appropriations to all Persons on the Contested Hearing Mailing List for the particular ISF appropriation. The notice shall specify the time and place of the prehearing conference and any procedural requirements that the Board deems appropriate.

(2) The Board may postpone a hearing to another date by issuing written notice of the postponement no later than 7 calendar days prior to the original hearing date.

5p. Conduct of Hearings.

(1) In conducting any hearing, the Board shall have authority to: administer oaths and affirmations; regulate the course of the hearing; set the time and place for continued hearing; limit the number of technical witnesses; issue appropriate orders controlling the subsequent course of the proceedings; and take any other action authorized by these Rules.

(2) At the hearing, the Board shall hear arguments, concerns or rebuttals from Parties, Contested Hearing Participants and interested members of the public. The Board may limit testimony at the hearing. Without good cause, the Board will not permit Parties or Contested Hearing Participants to introduce written material at the hearing not previously submitted pursuant to these Rules. The Board, in making its determinations, need not consider any written material not timely presented.

(3) Only the Board may question witnesses at the hearing except where the Board determines that, for good cause shown, allowing the parties to question witnesses may materially aid the Board in reaching its decision, or where such questioning by the Parties relates to the statutory findings required by §37-92-102(3)(c), C.R.S. The Board may terminate questioning where the Board determines that such questioning is irrelevant or redundant or may terminate such questioning for other good cause.

(4) The hearing shall be recorded by a reporter or by an electronic recording device. Any Party requesting a transcription of the hearing shall be responsible for the cost of the transcription.

5q. Final Board Action.

The Board may take final action at the hearing or at a later date.

5r. Statement of Opposition.

In the event that any Person files a Statement of Opposition to an ISF water right application in Water Court, the Staff may agree to terms and conditions that would prevent injury. Where the resolution of the Statement of Opposition does not involve a change regarding the Board's determinations under Rule 5i. (including but not limited to the amount, reach, and season), the Board is not required to review and ratify the resolution. Staff may authorize its counsel to sign any court documents necessary to finalize this type of pretrial resolution without Board ratification.

5s. Withdrawal of Filing.

If the Board elects to withdraw a Water Court filing, notice shall be given in the agenda of the Board meeting at which the action is expected to occur.

6. ACQUISITION OF WATER, WATER RIGHTS OR INTERESTS IN WATER FOR INSTREAM FLOW PURPOSES.

The Board may acquire water, water rights, or interests in water for ISF purposes by the following procedures:

6a. Means of Acquisition.

The Board may acquire, by grant, purchase, donation, bequest, devise, lease, exchange, or other contractual agreement, from or with any Person, including any governmental entity, such water, water rights, or interests in water that are not on the Division Engineer's abandonment list in such amounts as the Board determines are appropriate for stream flows or for natural surface water levels or volumes for natural lakes to preserve or improve the natural environment to a reasonable degree.

6b. 120 Day Rule.

At the request of any Person, including any governmental entity, the Board shall determine in a timely manner, not to exceed one hundred twenty days, unless further time is granted by the requesting Person, what terms and conditions the Board will accept in a contract or agreement for the acquisition. The 120-day period begins on the day the Board first considers the proposed contract or agreement at a regularly scheduled or special Board meeting.

6c. Stacking Evaluation.

The Board shall evaluate whether to combine or stack the acquired water right with any other ISF appropriation or acquisition, based upon the extent to which the acquired water will provide flows or lake levels to preserve or improve the natural environment to a reasonable degree.

If the Board elects to combine or stack the acquired water right, the details of how the water rights are to be combined or stacked with other existing ISF appropriations or acquisitions must be set forth in the application for a decree to use the acquired right for instream flow purposes.

6d. Enforcement of Acquisition Agreement.

Pursuant to section 37-92-102(3), C.R.S., any contract or agreement executed between the Board and any Person which provides water, water rights, or interests in water to the Board shall be enforceable by either party thereto as a water matter in the water court having jurisdiction over the water right according to the terms of the contract or agreement.

6e. Appropriateness of an Acquisition.

The Board shall evaluate the appropriateness of any acquisition of water, water rights, or interests in water to preserve or improve the natural environment. Such evaluation shall include, but need not be limited to consideration of the following factors:

(1) The reach of stream or lake level for which the use of the acquired water is proposed, which may be based upon any one or a combination of the following: the historical location of return flow; the length of the existing instream flow reach, where applicable; whether an existing instream flow water right relies on return flows from the water right proposed for acquisition; the environment to

be preserved or improved by the proposed acquisition; or such other factors the Board may identify;

(2) The natural flow regime;

(3) Any potential material injury to existing decreed water rights;

(4) The historical consumptive use and historical return flows of the water right proposed for acquisition that may be available for instream flow use;

(5) The natural environment that may be preserved or improved by the proposed acquisition, and whether the natural environment will be preserved or improved to a reasonable degree by the water available from the proposed acquisition;

(6) The location of other water rights on the subject stream(s);

(7) The effect of the proposed acquisition on any relevant interstate compact issue, including whether the acquisition would assist in meeting or result in the delivery of more water than required under compact obligations;

(8) The effect of the proposed acquisition on the maximum utilization of the waters of the state;

(9) Whether the water acquired will be available for subsequent use or reuse downstream;

(10) The cost to complete the transaction or any other associated costs; and

(11) The administrability of the acquired water right when used for instream flow purposes.

The Board shall determine how to best utilize the acquired water, water rights or interest in water to preserve or improve the natural environment.

6f. <u>Factors Related to Loans and Leases.</u>

In addition to considering the factors listed above, for loans and leases of water, water rights and interests in water for ISF purposes under section 37-92-102(3),

(1) The Board shall consider the extent to which the leased or loaned water will preserve or improve the natural environment to a reasonable degree, including but not limited to:

  (a) Whether the amount of water available for acquisition is needed to provide flows to meet a decreed ISF amount in below average years; and

  (b) Whether the amount of water available for acquisition could be used to and would improve the natural environment to a reasonable degree, either alone or in combination with existing decreed ISF water rights.

(2) In considering the extent to which the leased or loaned water will preserve or improve the natural environment to a reasonable degree, the Board will request and review a biological analysis from the Colorado Division of Wildlife, and will review any other biological or scientific evidence presented to the Board.

(3) If other sources of water are available for acquisition on the subject stream reach(es) by purchase or donation, the Board shall fully consider each proposed acquisition and give preference first to the donation and then to a reasonable acquisition by purchase.

(4) The Board shall obtain confirmation from the Division Engineer that the proposed lease or loan is administrable and is capable of meeting all applicable statutory requirements.

(5) The Board shall determine, through negotiation and discussion with the lessor, the amount of compensation to be paid to the lessor of the water based, in part, upon the anticipated use of the water during and after the term of the lease.

(6) The Board shall consider evidence of water availability based upon the historical record(s) of diversion, the beneficial use of the subject water right, the location and timing of where return flows have historically returned to the stream, and the reason(s) the water is available for lease or loan.

6g. Recording Requirements.

(1) All contracts or agreements for leases or loans of water, water rights or interests in water under section 37-92-102(3) shall require the Board to:

(a) Maintain records of how much water the Board uses under the contract or agreement each year it is in effect; and

(b) Install any measuring device(s) deemed necessary by the Division Engineer (1) to administer the lease or loan of water, (2) to measure and record how much water flows out of the reach after use by the Board under the lease or loan; and (3) to meet any other applicable statutory requirements.

(2) All contracts or agreements for leases or loans of water shall provide for the recording of the actual amount of water legally available and capable of being diverted under the leased or loaned water right during the term of the lease or loan, with such records provided to the Division of Water Resources for review and publication.

6h. Water Reuse.

All contracts or agreements for the acquisition of water, water rights or interests in water under section 37-92-102(3) shall provide that the Board or the seller, lessor, lender or donor of the water may bring about beneficial use of the historical consumptive use of the acquired water right downstream of the ISF reach as fully consumable reusable water, pursuant to the water court decree authorizing the Board to use the acquired water.

(1) The bringing about of beneficial use of the historical consumptive use of the water may be achieved by direct use, sale, lease, loan or other contractual arrangement by the Board or the seller, lessor, lender or donor.

(2) The contract or agreement also shall provide that the Division Engineer must be notified of any agreement for such beneficial use downstream of the ISF reach prior to the use.

(3) Prior to any beneficial use by the Board of the historical consumptive use of the acquired water right downstream of the ISF reach, the Board shall find that such use:

(a) Will be consistent with the Board's statutory authority and with duly adopted Board policies and objectives; and

(b) Will not injure vested water rights or decreed conditional water rights.

6i. Applications for a Decreed Right to Use Water for ISF Purposes.

The Board shall file a change of water right application or other applications as needed or required with the water court to obtain a decreed right to use water for ISF purposes under all contracts or agreements for acquisitions of water, water rights or interests in water under section 37-92-102(3), including leases and loans of water. The Board shall file a joint application with the Person from whom the Board has acquired the water or a Person who has facilitated the acquisition, if requested by such Person. The Water Court shall determine matters that are within the scope of section 37-92-305, C.R.S. In a change of water right proceeding, the Board shall request the Water Court to:

(1) Verify the quantification of the historical consumptive use of the acquired water right;

(2) Verify the identification, quantification and location of return flows to ensure that no injury will result to vested water rights and decreed conditional water rights;

(3) Include terms and conditions providing that:

(a) The Board or the seller, lessor, lender, or donor of the water may bring about the beneficial use of the historical consumptive use of the changed water right downstream of the ISF reach as fully consumable reusable water, subject to such terms and conditions as the water court deems necessary to prevent injury to vested water rights and decreed conditional water rights; and

(b) When the Board has not identified such downstream beneficial use at the time of the change of water right, the Board may amend the subject change decree, if required by the Division Engineer, to add such beneficial use(s) of the historical consumptive use downstream of the ISF reach at the time the Board is able to bring about such use or reuse, without requiring requantification of the original historical consumptive use calculation;

and

(4) Decree the method by which the historical consumptive use should be quantified and credited during the term of the agreement for the lease or loan of the water right pursuant to section 37-92-102(3), C.R.S.

6j. Limitation on Acquisitions.

The Board may not accept a donation of water rights that were acquired by condemnation, or that would require the removal of existing infrastructure without approval of the current owner of such infrastructure.

6k. Temporary Loans of Water to the Board.

The Board may accept temporary loans of water for instream flow use for a period not to exceed 120 days in any one year, in accordance with the procedures and subject to the limitations set forth in section 37-83-105, C.R.S.

(1) Within 5 working days after receiving an offer of a temporary loan of water to the Board for temporary instream flow use, the Director will provide a response to the proponent and, unless the proposed loan has no potential value for instream flow use, staff will coordinate with the proponent on preparing and submitting the necessary documentation to the State and Division Engineers required by sections 37-83-105(2)(a)(I) and (2)(b)(I), C.R.S., and providing the public notice required by section 37-83-105(2)(b)(II), C.R.S.

(2) Provided that the State Engineer has made a determination of no injury pursuant to section 37-83-105(2)(a)(III), C.R.S., the Board hereby delegates authority to the CWCB Director to accept temporary loans of water for instream flow use in accordance with the procedures and subject to

the limitations set forth in section 37-83-105 and to take any administrative action necessary to put the loaned water to instream flow use.

(3) Provided that the State Engineer's determination of non-injury is still in effect, the Director shall notify the proponent and the State Engineer whether the temporary loan is to be exercised in subsequent years. Such notification shall be provided within 5 working days of the Director being notified by the proponent that the water is available for use under the temporary loan. The CWCB's use of loaned water for instream flows shall not exceed the CWCB's decreed instream flow amount or extend beyond the CWCB's decreed instream flow reach at any time during the loan term, and shall comply with any terms and conditions imposed by the State Engineer to prevent injury. The purpose of this delegation is to expedite use of temporarily loaned water for instream flows by the Board.

(4) At the first regular or special Board meeting after the Director accepts or rejects an offer of a loan of water to the Board for temporary instream flow use under (1) or (2) above, the Board shall vote either to ratify or overturn the Director's decision.

(5) The Board, Director and staff will expedite all actions necessary to implement Rule 6k.

6l. Funds for Water Right Acquisitions.

The Board may use any funds available to it for costs of the acquisition of water rights and their conversion to ISF use. The Board shall spend available funds for such costs in accordance with section 37-60-123.7, C.R.S. and any other applicable statutory authority, and with applicable Board policies and procedures.

6m. Public Input on Proposed Acquisitions.

The Board shall follow the public review process in Rules 11a. - 11c. when acquiring water, water rights or interests in water, except for temporary loans or leases as provided in Rule 6k. above and except as provided below.

(1) Prior to Board consideration of any proposed acquisition, Staff shall mail notice of the proposed acquisition to all Persons on the ISF Subscription Mailing List and the State Engineer's Substitute Supply Plan Notification List for the relevant water division, and shall provide Proper Notice. Such notice shall include:

(a) The case number adjudicating the water right proposed to be acquired, and the appropriation date, adjudication date, priority, decreed use(s), and flow amount of the water right proposed to be acquired, and approximately how much of the water right the Board will consider acquiring;

(b) The location of the stream reach or lake that is the subject of the proposal, including, when available, the specific length of stream reach to benefit from the proposed acquisition;

(c) Any available information on the purpose of the acquisition, including the degree of preservation or improvement of the natural environment to be achieved;

(d) Any available scientific data specifically supporting the position that the acquisition will achieve the goal of preserving or improving the natural environment to a reasonable degree; and

(e) In addition to (a) - (d) above, for leases and loans of water, water rights or interests in water under section 37-92-102(3), such notice shall include the proposed term of the lease or loan and the proposed season of use of the water under the lease or loan.

(2) At every regularly scheduled Board meeting subsequent to the mailing of notice, and prior to final Board action, Staff will report on the status of the proposed acquisition and time will be reserved for public comment.

(3) Any Person may address the Board regarding the proposed acquisition prior to final Board action. Staff shall provide any written comments it receives regarding the proposed acquisition directly to the Board.

(4) Any Person may request the Board to hold a hearing on a proposed acquisition. Such a request must be submitted to the Board in writing within twenty days after the first Board meeting at which the Board considers the proposed acquisition, and must include a brief statement, with as much specificity as possible, of why a hearing is being requested.

(5) At its next regularly scheduled meeting after receipt of the request for a hearing, or at a special meeting, the Board will consider the request and may, in its sole discretion, grant or deny such a request. All hearings scheduled by the Board shall be governed by the following procedures:

(a) A hearing on a proposed acquisition must be held within the 120 day period allowed for Board consideration of an acquisition pursuant to Rule 6b., unless the Person requesting the Board to consider the proposed acquisition agrees to an extension of time.

(b) The Board shall appoint a Hearing Officer to establish the procedures by which evidence will be offered.

(c) At least thirty days prior to the hearing date(s), the Board shall provide written notice of the hearing(s) to the Person proposing the acquisition, all interested parties known to the Board, and all Persons on the ISF Subscription Mailing List and the State Engineer's Substitute Supply Plan Notification List for the relevant water division. The Board also shall provide Proper Notice, as defined in ISF Rule 4n.

(d) Any Person who desires party status shall become a Party upon submission of a written Notice of Party Status to the Board Office. The Notice shall include the name and mailing address of the Person and a brief statement of the reasons the Person desires party status. The Board Office must receive Notice of Party Status within seven days after notice of the hearing is issued.

(e) The Hearing Officer shall set timelines and deadlines for all written submissions. Prehearing statements will be required, and shall include, but not be limited to, the following: 1) a list of all disputed factual and legal issues; 2) the position of the Party regarding the factual and legal issues; 3) a list identifying all of the witnesses that will testify for the Party, and a summary of the testimony that those witnesses will provide; and 4) copies of all exhibits that the Party will introduce at the hearing(s).

(f) Any Party may present testimony or offer evidence identified in its prehearing statement regarding the proposed acquisition.

(g) The Hearing Officer shall determine the order of testimony for the hearing(s), and shall decide other procedural matters related to the hearing(s). The Hearing Officer does not have authority to rule on substantive issues, which authority rests solely with the Board.

(h) The Board will not apply the Colorado Rules of Evidence at hearings on proposed acquisitions.

(i) The Board may permit general comments from any Person who is not a Party; however, the Board may limit these public comments to five minutes per Person.

(j) The Board may take final action at the hearing(s) or continue the hearing and/or deliberations to a date certain.

(k) Board hearings may be recorded by a reporter or by an electronic recording device. Any Party requesting a transcription of the hearing(s) shall be responsible for the cost of the transcription.

(l) When necessary, the Board may modify this hearing procedure schedule or any part thereof as it deems appropriate.

6n. Board Action to Acquire Water, Water Rights or Interests in Water.

The Board shall consider the acquisition during any regular or special meeting of the Board. At the Board meeting, the Board shall consider all presentations or comments of Staff or any other Person. After such consideration, the Board may acquire, acquire with limitations, or reject the proposed acquisition.

7. INUNDATION OF ISF RIGHTS.

Inundation of all or a portion of an ISF stream reach or lake may be an interference with the Board's usufructuary rights that have been acquired by Board action. “Inundation” as used in this section is the artificial impoundment of water within an ISF or natural lake; “inundation” does not refer to the use of a natural stream as a conveyance channel as long as such use does not raise the waters of the stream above the ordinary high watermark as defined in §37-87-102 (1)(e), C.R.S.

7a. Small Inundations.

Staff may file a Statement of Opposition to inundations described in this section if it determines that the ISF right or natural environment will be adversely affected by the inundation. The Staff shall not be required to file a Statement of Opposition to applications proposing small inundations. Small inundations are those in which the impoundment is 100 acre-feet or less, or the surface acreage of the impoundment is 20 acres or less, or the dam height of the structure is 10 feet or less. The dam height shall be measured vertically from the elevation of the lowest point of the natural surface of the ground, where that point occurs along the longitudinal centerline of the dam up to the flowline crest of the spillway of the dam.

(1) All structures proposed by any applicant on a stream reach shall be accumulated for the purpose of determining whether the inundations proposed by the applicant are small inundations. In the event the cumulative surface acreage, volume impounded, or dam height of all impoundments exceed the definition of a small inundation, Staff may file a Statement of Opposition to that application.

(2) In the event that no Statement of Opposition is filed pursuant to the terms of this section, the Board shall be deemed to have approved the inundation proposed without a request by the applicant.

7b. Application of Rule 7.

The provisions of this rule will not be applied to the following water rights:

(1) any absolute or conditional water right that is senior to an ISF right;

(2) any senior conditional water right that seeks a finding of reasonable diligence;

(3) any junior absolute or conditional water right which was decreed prior to July 10, 1990, or had an application for decree pending prior to July 10, 1990, unless the Board had filed a Statement of Opposition to the absolute or conditional water right application prior to July 10, 1990; or

(4) any inundation of an ISF reach by water that does not have an absolute or conditional water right if the inundation occurred prior to July 10, 1990.

7c. Request to Inundate.

Any Person seeking permission to inundate shall timely submit a written request for permission to inundate to the Board Office. No requests for inundation will be considered or approved until the Person seeking permission to inundate files a water court application outlining their storage plans or files plans and specifications with the State Engineer for a jurisdictional dam pursuant to §37-87-105, C.R.S. The Board will consider the request to inundate in a timely manner.

7d. Staff Investigation.

After receiving the request to inundate, the Staff may seek the recommendations from the Division of Wildlife, Division of Parks and Outdoor Recreation, Division of Water Resources, United States Department of Agriculture and United States Department of Interior.

7e. Required Information.

In any written request to inundate, the requesting Person shall at a minimum include information on the following factors: the location of the inundation, the size of the inundation, impact of the inundation on the natural environment, any unique or rare characteristics of the ISF water right to be inundated, any regulatory requirements or conditions imposed upon the applicant by federal, state and/or local governments, all terms and conditions included in applicant's water court decree, and any compensation or mitigation offered by the Person proposing the inundation.

7f. Determination of Interference.

In response to the request to inundate, the Board shall determine whether the proposed inundation interferes with an ISF right. When making this determination, the Board shall consider, without limitation, the extent of inundation proposed and the impact of the proposed inundation on the natural environment existing prior to the inundation.

7g. Consideration of Request to Inundate.

If the Board determines that a proposed inundation interferes with an ISF right, the Board may then approve, approve with conditions, defer, or deny the request to inundate. In making this decision, the Board shall consider all relevant factors, including, but not limited to (1) the extent of inundation proposed; (2) the impact of the proposed inundation on the natural environment existing prior to the inundation; (3) the degree to which the beds and banks adjacent to the ISF right subject to the inundation are publicly or privately owned; (4) the economic benefits arising from the inundation; (5) the benefits to recreation and downstream ISF segments arising from the inundation; (6) the degree to which the proposed inundation will allow development of Colorado's allotment of interstate waters as determined by compact or adjudication; and, (7) any mitigation or compensation offered to offset adverse impacts on the ISF right. After considering all relevant factors, the Board shall take one of the actions set forth in Rules 7h. - 7k. below.

7h. Approval.

If the Board approves the request to inundate, any Statement of Opposition filed by the Board shall be withdrawn.

7i. Conditional Approval.

The Board may require certain conditions to be performed prior to approval. Failure to perform any condition will be a reason for denial.

7j. Deferral.

When it appears that other governmental agencies may impose terms and conditions upon the issuance of a permit to construct a facility which will cause an inundation, the Board may defer consideration of the request to inundate until all other governmental bodies have finalized the permit or approval conditions.

7k. Denial of Request to Inundate.

Requests for permission to inundate may be denied if in the discretion of the Board the request is inconsistent with the goals of the ISF Program. The Board may decide to deny a request for permission to inundate if it finds:

(1) No compensation or mitigation would be adequate for the injury caused by the inundation; or

(2) No compensation or mitigation acceptable to the Board has been proposed by applicant; or

(3) The proposed inundation is inconsistent with the goals of the ISF Program.

7l. Remedies.

The Board may seek any administrative, legal or equitable remedy through state courts (including water courts), federal courts, city, county, state or federal administrative proceedings to resolve actual or proposed inundation of its ISF rights.

7m. Board Has Sole Right to Protect ISF Rights from Interference.

Only the Board may seek to prevent interference with an ISF right by inundation and only the Board may seek compensation or mitigation for such interference.

7n. Public Review Process.

The Board shall follow the public review process in Rules 11a. - 11c. prior to any Board decision on a request to inundate an ISF right.

8. PROTECTION OF ISF APPROPRIATIONS.

The Board delegates the day-to-day management and administration of the ISF Program to Staff. Staff shall seek ratification of its decisions as set forth in Rules 8c., 8e.(2), 8i., and 8j.

8a. Resume Review.

Staff shall review the monthly resumes of all water divisions. The Staff shall evaluate each resume entry for the possibility of injury or interference to an ISF right.

8b. Statement of Opposition.

In the event Staff identifies a water right application in the resume that may injure an ISF right, Staff shall file a Statement of Opposition to that application. In the event Staff identifies a water right application in the resume that may interfere with an ISF right as contemplated in Rule 7, Staff may file a Statement of Opposition to that application.

8c. Ratification of Statements of Opposition.

At a Board meeting following the filing of the Statement of Opposition, Staff shall apprise the Board of the filing of a Statement of Opposition and the factual basis for the Staff action. At that time, the Board shall ratify the filing, disapprove the filing, or table the decision to a future meeting if more information is needed prior to making a decision.

8d. Notice.

Prior to ratification of a Statement of Opposition, the Staff shall mail the applicant a copy of the Board memorandum concerning the ratification and a copy of the agenda of the meeting in which the ratification will be considered. Following a Board action considering a Statement of Opposition, the Staff shall notify the applicant and/or its attorney in writing of the Board's action.

8e. De Minimis Rule.

In the event that Staff determines a water court application would result in a 1 percent depletive effect or less on the stream reach or lake subject of the ISF right, and the stream reach or lake has not been excluded from this rule pursuant to Rules 8f. or 8h., Staff shall determine whether to file a Statement of Opposition. Staff's decision not to file a Statement of Opposition does not constitute: (1) acceptance by the Board of injury to any potentially affected ISF water right; or (2) a waiver of the Board's right to place an administrative call for any ISF water right.

(1) If Staff does not file a Statement of Opposition, Staff shall notify the Division Engineer for the relevant water division that it has not filed a Statement of Opposition, but that it may place an administrative call for the potentially affected ISF water right(s). Such a call could be enforced against the water right(s) subject of the application by the Division Engineer in his or her enforcement discretion. Staff also shall mail a letter to the applicant at the address provided on the application notifying the applicant: (a) of Staff's decision not to file a Statement of Opposition pursuant to this Rule; (b) that the CWCB may place a call for its ISF water rights to be administered within the prior appropriation system; and (c) that the Division Engineer's enforcement of the call could result in curtailment or other administration of the subject water right(s).

(2) If Staff files a Statement of Opposition, Staff shall seek Board ratification by identifying and summarizing the Statement of Opposition on the Board meeting consent agenda pursuant to Rule 8c.

8f. Cumulative Impact.

In determining existence of a de minimis impact, Staff shall consider the existence of all previous de minimis impacts on the same stream reach or lake. If the combined total of all such impacts exceeds 1 percent, then Staff will file a Statement of Opposition regardless of the individual depletive effect of an application.

8g. Notification of Staff Action.

At a Board meeting following a Staff determination to apply the De Minimis rule, the Staff shall notify the Board about the factual basis leading to its application of the De Minimis rule.

8h. Exclusion from De Minimis Rule.

The Board may at any time exclude any stream reach or lake, or any portion thereof, from application of the De Minimis rule.

8i. Pretrial Resolution.

Staff may negotiate a pretrial resolution of any injury or interference issue that is the subject of a Statement of Opposition. The Board shall review the pretrial resolution pursuant to the following procedures:

(1) No Injury.

In the event the pretrial resolution includes terms and conditions preventing injury or interference and does not involve a modification, or acceptance of injury or interference with mitigation, the Board is not required to review and ratify the pretrial resolution. Staff may authorize its counsel to sign any court documents necessary to finalize this type of pretrial resolution without Board ratification.

(2) No Injury/Modification.

In the event the pretrial resolution addresses injury or interference through modification of the existing ISF decree, the process set forth in Rule 9 shall be followed prior to any Board decision to ratify the pretrial resolution.

(3) Injury Accepted with Mitigation.

In the event a proposed pretrial resolution will allow injury to or interference with an ISF or natural lake level (NLL) water right, but mitigation offered by the applicant could enable the Board to accept the injury or interference while continuing to preserve or improve the natural environment to a reasonable degree, and if the proposed pretrial resolution does not include a modification under ISF Rule 9, the Board shall:

(a) Conduct a preliminary review of the proposed pretrial resolution during any regular or special meeting to determine whether the natural environment could be preserved or improved to a reasonable degree with the proposed injury or interference if applicant provided mitigation; and

(b) At a later regular or special meeting, take final action to ratify, refuse to ratify or ratify with additional conditions.

(c) No proposed pretrial resolution considered pursuant to this Rule 8i.(3) may receive preliminary review and final ratification at the same Board meeting.

(d) The Board shall not enter into any stipulation or agree to any decretal terms and conditions under this Rule that would result in the Division of Water Resources being unable to administer the affected ISF or NLL water right(s) in accordance with the priority system or with Colorado water law.

(e) To initiate CWCB staff review of an Injury with Mitigation proposal, the proponent must provide the following information in writing:

i. Location of injury to ISF or NLL water right(s) (stream(s) or lake(s) affected, and length of affected reach(es));

ii. Quantification of injury (amount, timing and frequency);

iii. Type of water use that would cause the injury;

iv. Analysis showing why full ISF or NLL protection is not possible;

v. Detailed description of the proposed mitigation, including all measures taken to reduce or minimize the injury;

vi. Detailed description of how the proposed mitigation will enable the Board to continue to preserve or improve the natural environment of the affected stream of lake to a reasonable degree despite the injury;

vii. Identification and feasibility analysis of: (1) all water supply alternatives considered by the proponent in the context of this proposal; (2) all alternatives evaluated by the proponent to fully protect the potentially affected ISF or NLL water right, but rejected as infeasible; and (3) all alternatives evaluated by the proponent and designed to mitigate the injury to or interference with the affected ISF or NLL water right. This information shall address the environmental and economic benefits and consequences of each alternative; and

viii. A discussion of the reasonableness of each alternative considered.

(f) After receipt and review of the required information, staff will consult with the DOW and with the entity that originally recommended the affected ISF or NLL water rights(s) (if other than DOW) to determine whether additional field work is necessary and to identify any scheduling concerns. Staff will request a recommendation from the DOW as to whether the proposed mitigation will enable the Board to continue to preserve or improve the natural environment of the affected stream or lake to a reasonable degree despite the injury, including a discussion of the reasonableness of the alternatives considered. CWCB staff will use best efforts to consult with affected land owners and managers regarding the proposal.

(g) Prior to bringing the proposal to the Board for preliminary consideration, staff will consult with the Division of Water Resources on whether the proposal would result in the Division of Water Resources being unable to administer the affected ISF or NLL water right(s) in accordance with the priority system or with Colorado water law.

(h) At the first meeting of the two-meeting process required by this Rule, staff will bring the proposal to the Board for preliminary consideration after completing its review of the proposal and its consultation with DOW. Staff will work with the proponent and interested parties to address any preliminary concerns prior to bringing a proposal to the Board. Preliminary consideration by the Board may result in requests for more information or for changes to the proposal. Staff will work with the proponent and interested parties to finalize the proposal and bring it back to the Board for final action at a subsequent Board meeting.

(i) The Board will consider the following factors when evaluating Injury with Mitigation proposals. Because Injury with Mitigation proposals may involve unique factual situations, the Board may consider additional factors in specific cases. Further, evaluation of each Injury with Mitigation proposal will require the exercise of professional judgment regarding the specific facts of the proposal.

i. Extent of the proposed injury:

1. Location of injury – affected stream(s) or lake and length of affected reach(es);

2. Amount, timing and frequency of shortage(s) or impacts to the affected ISF of NLL water right(s); and

3. Potential impact to the natural environment of the affected stream reach(es) or lake from the proposed injury.

ii. Benefits of the mitigation to the natural environment:

1. The nature and extent of the benefits the mitigation will provide to the existing natural environment of the affected stream or lake;

2. The scientific justification for accepting the mitigation; and

3. Whether the mitigation will enable the Board to continue to preserve or improve the natural environment of the subject stream or lake to a reasonable degree.

(j) Evaluation of proposed alternatives. The Board shall evaluate: (1) all water supply alternatives considered by the proponent in the context of this proposal; (2) all alternatives evaluated by the proponent to fully protect the potentially affected ISF or NLL water right, but rejected as infeasible; and (3) all alternatives evaluated by the proponent and designed to mitigate the injury to or interference with the affected ISF or NLL water right. In its evaluation, the Board shall consider the following factors:

i. Availability of on-site mitigation alternatives;

ii. Technical feasibility of each alternative;

iii. Environmental benefits and consequences of each alternative;

iv. Economic benefits and consequences of each alternative;

v. Reasonableness of alternatives;

vi. Administrability of proposed alternatives by the Board and the Division Engineer; and

vi. For mitigation alternatives, whether the mitigation was or will be put in place to satisfy a requirement or need unrelated to the Injury with Mitigation proposal.

(k) The Board will consider mitigation on a different reach of stream or another stream ("off-site mitigation") as a last resort and will only consider mitigation in an area other than the affected stream reach if no reasonable alternative exists for mitigation on the affected stream reach. The Board only will consider off-site mitigation on stream(s) located in the same drainage as the affected stream. Factors that the Board may consider in looking at such a proposal include, but are not limited to, the degree and frequency of impact to the affected stream; the environmental benefits provided to the off-site stream by the mitigation; whether the proposal could, in effect, constitute a modification of the ISF water right on the affected stream; or whether the proposal could result in the Division of Water Resources being unable to administer the affected ISF water right(s) in accordance with the priority system or with Colorado water law.

(l) Stipulations and water court decrees that incorporate Injury with Mitigation shall include, but not be limited to inclusion of, the following terms and conditions:

i. A provision that the proponent will not divert water or take any other action that would reduce flows in the affected stream or levels in the affected lake below the decreed ISF or NLL amount until the agreed-upon mitigation measures are in place and fully operational;

ii. A requirement that the structural components of the mitigation be maintained permanently;

iii. A provision allowing CWCB or DOW staff access to the property on which structural components of the mitigation are located to inspect the structures at certain time intervals, and, if necessary, to perform biological stream or lake monitoring. This provision shall clearly define the reasonable nature, extent and timing of such access (i.e, advance notice, dates, times or season of access, coordination with proponent, and location and routes of access);

iv. A term providing that if the proponent ceases to provide the agreed upon mitigation (such as removing structural components or failing to maintain them to a specified level, or ceasing to implement non-structural components), that the proponent will not divert water or take any other action that would reduce flows in the affected stream or levels in the affected lake below the decreed ISF or NLL amount because the Board will no longer accept the injury based upon the mitigation no longer being in effect -- in such case, if the Board places a call for the affected ISF or NLL water right, the Board will notify the Division Engineer that this provision of the decree now is in effect and that the Board is not accepting the injury;

v. A requirement that the proponent install and pay operation and maintenance costs of (or commit to pay operation and maintenance costs if the CWCB installs) any measuring devices deemed necessary by the Division Engineer to administer the terms of the stipulation and decree implementing the Injury with Mitigation pretrial resolution; and

vi. A term providing that the water court will retain jurisdiction to enforce the terms and conditions set forth above in subsections (i) - (vi), and any other terms and conditions specific to the Injury with Mitigation pretrial resolution, as a water matter.

8j. Authorization to Proceed to Trial.

In the event that a Statement of Opposition filed by the Board is not settled prior to the last regularly scheduled Board meeting prior to the trial date, Staff shall seek Board authorization to proceed to trial. In the event that Staff is authorized to proceed to trial, the Board may adjourn to executive session to discuss settlement parameters with its counsel. Staff is authorized to settle any litigation without Board ratification if the settlement terms are consistent with instructions given by the Board to its counsel.

8k. Public Review Process.

The Board shall follow the public review process in Rules 11a. - 11c. prior to consideration of a request to ratify a pretrial resolution pursuant to Rule 8i.(3).

8l. Notice.

At any time Staff verifies that an ISF water right is not being fulfilled as a result of water use against which the ISF water right is entitled to protection, the Staff shall provide Proper Notice, including a description of what the Board is doing in response to the situation.

9. MODIFICATION OF ISF RIGHTS.

The Board may modify any existing decreed ISF right according to the procedures set forth in this Rule. "Modification" of an ISF right within the meaning of this Rule includes a decrease in the rate of flow described in the existing ISF decree, segmenting an existing ISF reach into shorter reaches with the result of decreasing the rate of flow in any portion of an ISF reach, or subtracting water from an ISF right during any particular time period or season.

9a. Need for Modification.

Modification may be requested by the Staff or by any Person who has filed a water right application on an ISF reach or who has applied for any governmental permit for facilities located in or near an ISF reach and who complies with Rules 9b. and 9c. Any request for modification, except by staff, shall be made in writing, submitted to Staff and such writing shall contain the following information:

(1) name, address and telephone number of the Person seeking modification;

(2) stream or lake subject of request;

(3) modification requested;

(4) reason for modification; and

(5) the scientific data supporting the request.

9b. Need for Water.

Any Person who requests a modification of an ISF right must, as a precondition to the Board's consideration of the request, establish a need for the water made available by the modification. Staff does not have to comply with this rule and any governmental entity seeking to implement the terms of an agreement specified in Rule 9f. does not have to comply with this section.

9c. Grounds for Modification.

No request for modification may be considered until the applicant establishes that one of the following reasons for modification exists:

(1) Mistake.

An ISF right may be considered for modification if the requesting Person establishes that an error was made in the calculations upon which the original or supplemental appropriation or enlargement to an original appropriation was made.

(2) Excessive Flow.

An ISF right may be considered for modification if the requesting Person establishes that the ISF flow rate is in excess of the amount of water necessary to accomplish the purpose of the original, supplemental or enlarged ISF right when that right was appropriated.

9d. Recovery Implementation or Other Intergovernmental Agreement.

An ISF right may be modified if such modification was agreed upon by the Board as part of the Recovery Implementation Program for the Endangered Fishes of the Colorado River Basin or any other agreement between the Board and another governmental entity. Modifications made as a part of the Recovery Implementation Program for the Endangered Fishes of the Colorado River Basin need not be subject to the public review process in Rule 9e. Criteria for modifications made in the ISF rights decreed as part of the Recovery Implementation Program for the Endangered Fishes of the Colorado River Basin will be established in the decrees governing such appropriations.

9e. Public Review Process of Requests for Modification.

The Board shall adhere to the following public review process when considering requests for modification:

(1) Notice.

Notice of the proposed modification and the date of the public meeting at which it will first be considered shall be printed in the resume in the Water Court having jurisdiction over the decree that is the subject of the modification. The first public meeting of the Board at which the modification is to be considered shall occur at least sixty days after the month in which the resume is published. Notice shall also be published in a newspaper of statewide distribution within thirty to forty-five days prior to such first public meeting.

(2) Public Meeting.

If the Board decides at such first public meeting to give further consideration to the proposed modification, the Board shall announce publicly the date of a subsequent public meeting for such purpose. If the Board decides that it will not give further consideration to the proposed modification, it shall state, in writing, the basis for its decision.

(3) Request for Delay.

On the written request of any Person made within thirty days after the date of the first public meeting, the Board shall delay the subsequent public meeting for up to one year to allow such Person the opportunity for the collection of scientific data material to the proposed modification. The Board need not grant the request if it determines that the request is made solely to delay the proceedings.

(4) Procedures.

On the written request of any Person made within thirty days after the date of the first public meeting, the Board shall, within sixty days after such request, establish fair and formal procedures for the subsequent public meeting, including the opportunity for reasonable disclosure, discovery, subpoenas, direct examination, and cross examination. Subject to these rights and requirements, where a meeting will be expedited and the interests of the participants will not be substantially prejudiced thereby, the Board may choose to receive all or part of the evidence in written form.

(5) Final Determination.

The Board shall issue a final written determination regarding the modification that shall state its effective date, be mailed promptly to the Persons who appeared by written or oral comment at the Board's proceeding, and be filed promptly with the water court.

10. ENFORCEMENT AGREEMENTS.

The Board may attach conditions to an appropriation, decreased appropriation, or acquisition, and may enter into any enforcement agreements that it determines will preserve or improve the natural environment to a reasonable degree. The Board may enter into enforcement agreements that limit the

Board's discretion in the protection, approval of inundation, modification or disposal of ISF right, and/or may delegate limited authority to act on the Board's behalf.

10a. Ratification of Enforcement Agreements.

No enforcement agreement shall be effective to limit the discretion of the Board until that agreement and all of its terms are reviewed and ratified by the Board. Upon ratification, the Director may execute the agreement and the agreement shall be binding upon the Board for the term set forth in the enforcement agreement.

10b. Public Review Process.

The Board shall follow the public review process set forth in Rules 11a. - 11c. prior to any Board decision to ratify an Enforcement Agreement.

11. PUBLIC REVIEW PROCESS.

Except as otherwise provided in the ISF Rules, the Board shall follow the public review process set forth below prior to any Board decision requiring public review.

11a. Public Notice.

Public notice of all Board actions under these Rules shall be provided through the agenda of each regular or special Board meeting.

11b. Public Comment.

Except as otherwise provided in Rules 5k. and 6m., at a regular or special meeting, the Board shall consider public comment on the recommended ISF action prior to the Board action on the recommendation in any or all of the following manners:

(1) Oral and/or written comments may be directed to Staff. When such comments are made, Staff may summarize these comments to the Board.

(2) Oral and/or written comments, subject to reasonable limitations established by the Board, may be made directly to the Board during the public meeting.

11c. Public Agency Recommendations.

Prior to taking an ISF action pursuant to Rules 5 or 6, the Board shall request recommendations from the Division of Wildlife and the Division of Parks and Outdoor Recreation. The Board shall also request recommendations from the United States Department of Agriculture and the United States Department of Interior. The Board may also request comments from other interested Persons or agencies as it deems appropriate.

Prior to taking an ISF action pursuant to Rules 7, 8, 9, or 10, the Board may request recommendations from the Division of Wildlife, the Division of Parks and Outdoor Recreation, the Division of Water Resources, the United States Department of Agriculture, the United States Department of Interior or other Persons as it deems appropriate.

11d. Board Procedures.

At a regular or special Board meeting, the Board may, as necessary, adopt or amend procedures to supplement these rules.

12. SEVERABILITY.

In the event that any section or subsection of these Rules are judged to be invalid by a court of law or are allowed to expire by the General Assembly, the remaining Rules shall remain in full force and effect.

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

Public Notice

Subject: Proposed Instream Flow Appropriations Water Divisions 2, 4 and 5

Date: February 3, 2009

At its January 27 – 28, 2009 regular meeting, the Colorado Water Conservation Board (CWCB) declared its intent to appropriate instream flow water rights for the streams listed on the attached Instream Flow Appropriation List. The attached list contains a description of the Instream Flow (ISF) Recommendations including stream name, water division, watershed, county, upper terminus, lower terminus, length, USGS quad sheet name(s) and recommended instream flow amounts. Copies of the Instream Flow Recommendation Summary Reports and Appendices submitted into the Official CWCB Record are available for review by the public during regular business hours (8:00 a.m. - 5:00 p.m.) at the Colorado Water Conservation Board's Office, located at 1313 Sherman Street, Room 723, Denver, Colorado, 80203. In addition to the CWCB office, copies of the Instream Flow and Natural Lake Level Recommendation Summary Reports are available on the CWCB website at:
http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2009ProposedAppropriations/

In addition to the above Instream Flow Recommendation Summary Reports and Appendices, staff may rely on any additional data, exhibits, testimony, or other information submitted by any party as part of the Official CWCB Record to support its Instream Flow Recommendations.

It should also be noted that:
(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.
(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any person desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.
(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to persons on the ISF Subscription Mailing List(s).
(d) Any Notice to Contest must be received at the Board office no later than March 31, 2009, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant

status must be received at the Board office no later than April 30, 2009, or the first business day thereafter.
(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September 2009 Board meeting and, prior to that meeting, will send notice of the Final Staff Recommendation to all persons on the Contested Hearing Mailing List.
(f) The Board may take final action on any uncontested ISF appropriations at the May 2009 Board meeting.
Should you wish to comment on the proposed Instream Flow Recommendations, you may do so by writing Jeff Baessler of the Board's staff at the address given above or by sending your comments by email to (jeffrey.baessler@state.co.us and owen.williams@state.co.us). It should be noted that while your appearance at any meeting is welcome, such an appearance is not necessary for your concerns to be recognized. Staff will take your comments into account and, if you so request, will present them to the Board in your absence. If you are not currently on the Board's Instream Flow Subscription Mailing List and you would like to be, please contact the Board's Office at the address given above.

Stream	Water Division	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS Quad(s)	Flow (cfs)
Cucharas Creek	2	Huerfano	Huerfano	Headwaters	State Highway 12	4.7	Cucharas Reservoir, Trinchera Peak	3 (4/15-5/14), 4.9 (5/15-6/30), 2.5 (7/1-8/14), 1.6 (8/15-9/15), 1.2 (9/16-4/14)
Huerfano River (upper segment)	2	Huerfano	Huerfano	Outlet of Lilly Lake	Confl. Central Branch of Huerfano Creek	8.2	Mosca Pass	2.7 (11/1-4/30), 4.1 (5/1-10/31)
Huerfano River (lower segment)	2	Huerfano	Huerfano	Confl. w/ unnamed Trib.	Confl. w/ Stanley Creek	2.6	Mosca Pass, Red Wing	2.75 (11/1-3/31), 5.75 (4/1-10/31)
Maxwell Creek	2	Arkansas Headwaters	Chaffee	Headwaters	Hdgt., O.W. Friskey Ditch	4.0	Buena Vista West	1 (10/1-10/31), 0.4 (11/1-5/31), 3.3 (6/1-7/31), 1.5 (8/1-9/30)
Purgatoire River	2	Purgatoire	Las Animas	Confl. w/ M/N Fork Purgatoire River	Confl. Lopez Canyon	4.80	Vigil	7 (12/1-4/14), 8.4 (4/15-5/14), 21 (5/15-8/15), 15 (8/16-9/15), 8.4 (9/16-11/30)
Rock Creek	2	Arkansas Headwaters	Lake	Outlet of Native Lake	Confl. w/ Willow Creek	5.0	Mount Massive	1.7 (11/1-5/14), 11 (5/15-8/31), 5 (9/1-10/31)
South Fork Purgatoire River	2	Purgatoire	Las Animas	Confl. w/ Unnamed Trib.	Confl. w/ Torres Canyon	8.20	Terico	3 (10/16-4/30), 9.6 (5/1-5/31), 18 (6/1-6/30), 13 (7/1-8/15), 5 (8/16-10/15)
Bent Creek (ISF Increase) Existing ISF: 4-80CW101	4	Upper Gunnison	Hinsdale	Headwaters	Confl. w/ Lake Fork Gunnison River	3.0	Redcloud Peak	1.55 (4/1-10/31) Note: Existing ISF 2.0 (1/1-12/31)
Clear Fork East Muddy Creek	4	North Fork Gunnison	Gunnison	Headwaters	Forest Service Boundary	8.7	Elk Knob, Quaker Mesa	13 (4/1-8/15), 5 (8/16-3/31)
East Elk Creek (ISF Increase) Existing ISF: 4-84CW378	4	Upper Gunnison	Gunnison	Confl. w/ Bear Wallow Gulch	Confl. w/ Blue Mesa Reservoir	4.50	Carpenter Ridge, West Elk Peak SW	0.7 (4/1-10/31) Note: Existing ISF 1.5 (1/1-12/31)
Grizzly Gulch	4	Upper Gunnison	Hinsdale	Outlet of Grizzly Lake	Confl. w/ Lake Fork Gunnison River	2.10	Redcloud Peak	2.9 (4/15-9/15), 0.6 (9/16-4/14)
Henson Creek (ISF Increase) Existing ISF: 4-82CW386	4	Upper Gunnison	Hinsdale	Confl. w/ North Fork Henson Creek	Confl. w/ Nellie Creek	3.40	Uncompahgre Peak	11 (4/1-10/31) Note: Existing ISF 12 (1/1-12/31)
Little Spring Creek (upper segment)	4	North Fork Gunnison	Gunnison	Crystal Springs	Inlet of Ragged Res. # 1	0.40	Chair Mountain	1.25 (1/1-12/31)
Little Spring Creek (lower segment)	4	North Fork Gunnison	Gunnison	Outlet of Ragged Res. # 1	Crystal Ditch Hdgt.	0.70	Chair Mountain	1.25 (1/1-12/31)
Schafer Gulch (ISF Increase) Existing ISF: 4-84CW383	4	Upper Gunnison	Hinsdale	Headwaters	Confl. w/ Henson Creek	1.70	Handies Peak	1.3 (4/1-10/31) Note: Existing ISF 1 (1/1-12/31)
Buzzard Creek	5	Colorado Headwaters – Plateau	Mesa	Confl. w/ Willow Creek	Confl. w/ Owens Creek	3.40	Porter Mountain, Spruce Mountain	4.25 (4/1-8/31), 1.5 (9/1-3/31)
Corral Creek (ISF Increase) Existing ISF: 5-86CW214	5	Colorado Headwaters	Grand	Confl. w/ Smith Creek	Hdgt. of Home # 1 Ditch	2.7	Parshall	0.9 (11/1-3/31), 2.75 (4/1-10/31) Note: Existing ISF 1.5 (1/1-12/31)
Troublesome Creek (upper segment)	5	Colorado Headwaters	Grand	Confl. w/ Glomerate Creek	Confl. w/ Rabbit Ears Creek	2.2	Hyannis Peak	2.8 (11/1-3/31), 5.1 (4/1-10/31)

Troublesome Creek (lower segment)	5	Colorado Headwaters	Grand	Confl. w/ Rabbit Ears Creek	Hdgt Pickering Ditch	3.0	Hyannis Peak	5.9 (11/1-3/31), 9.3 (4/1-10/31)

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

NOTICE

To: Instream Flow Subscription Mailing Lists

Subject: Proposed 2009 Instream Flow Appropriations Water Divisions 2, 4, 5, and 6 (Complementary Notice)

Date: November 13, 2008

This notice complements previous notice, made pursuant to ISF Rule 5c, which identified the streams to be considered for instream flow appropriations in 2009. At the January 2009 meeting of the Colorado Water Conservation Board (CWCB), staff may request that the Board form its intent to appropriate instream flow water rights for the streams listed on the attached Instream Flow Appropriation List. The attached list contains a description of the Instream Flow (ISF) Recommendations including stream name, county, recommending entity, and water district.

Copies of the Instream Flow Stakeholder Recommendation Summary Reports and Appendices submitted into the Official CWCB Record are available for review by the public during regular business hours (8:00 a.m. - 5:00 p.m.) at the Colorado Water Conservation Board's Office, located at 1313 Sherman Street, Room 723, Denver, Colorado, 80203. In addition to the CWCB office, copies of the Instream Flow and Natural Lake Level Stakeholder Recommendation Summary Reports are available on the CWCB website at http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2009ProposedAppropriations/2009Appropriations.htm

In addition to the above Instream Flow Stakeholder Recommendation Summary Reports and Appendices, staff may rely on any additional data, exhibits, testimony, or other information submitted by any party as part of the Official CWCB Record to support its Instream Flow Recommendations.

It should also be noted that:

(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.

Exhibit 7

(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any person desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.

(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to persons on the ISF Subscription Mailing List(s).

(d) Any Notice to Contest must be received at the Board office no later than March 31, 2009, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant status must be received at the Board office no later than April 30, 2009 or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the November Board meeting and will send notice of the Final Staff Recommendation to all persons on the Contested Hearing Mailing List.

(f) The Board may take final action on any uncontested ISF appropriations at the May Board meeting.

Should you wish to comment on the proposed Instream Flow Recommendations, you may do so by writing Jeff Baessler of the Board's staff at the address given above or by sending your comments by email to (jeffrey.baessler@state.co.us and owen.williams@state.co.us). It should be noted that while your appearance at any meeting is welcome, such an appearance is not necessary for your concerns to be recognized. Staff will take your comments into account and, if you so request, will present them to the Board in your absence. If you are not currently on the Board's Instream Flow Subscription Mailing List and you would like to be, please contact the Board's Office at the address given above.

2009 Instream Flow Appropriation Flow (ISF) Recommendations (November 13, 2008)

Division	Stream	County(ies)	Recommender(s)	Water District
2	Maxwell Creek	Chaffee	CDoW	11
2	Gibson Creek	Custer	CDoW	13
2	Cucharas Creek	Huerfano	CDoW	16
2	Huerfano River (lower)	Huerfano	CDoW	79
2	Huerfano River (upper)	Huerfano	CDoW	79
2	Rock Creek	Lake	CDoW	11
2	Purgatoire River	Las Animas	CDoW	19
2	South Fork Purgatoire River	Las Animas	CDoW	19
4	Clear Fork East Muddy Creek	Gunnison	CDoW, TU	40
4	East Elk Creek – *increase*	Gunnison	BLM, CDoW	59
4	Little Spring Creek	Gunnison	BLM	40
4	Bent Creek - *increase*	Hinsdale	BLM	62
4	Grizzly Gulch	Hinsdale	BLM, TU	62

4	Henson Creek - *increase*	Hinsdale	BLM	62
4	Schafer Gulch – *increase*	Hinsdale	BLM	62
4	Tabeguache Creek	Montrose	BLM	60
5	Corral Creek	Grand	BLM	50
5	Troublesome Creek (lower)	Grand	BLM	50
5	Troublesome Creek (upper)	Grand	BLM	50
5	Buzzard Creek	Mesa	CDoW, TU	72
6	Moeller Creek	Rio Blanco	CDoW	43
6	Grizzly Creek	Routt	CDoW, TU	54
6	South Fork Slater Creek	Routt, Moffat	CDoW, TU	54
6	West Prong South Fork Slater Cr	Routt, Moffat	CDoW, TU	54

BLM (Bureau of Land Management), CDoW (Colorado Division of Wildlife), and TU (Trout Unlimited)

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

NOTICE

To: Instream Flow Subscription Mailing Lists

Subject: Proposed 2009 Instream Flow Appropriations
Water Divisions 1, 2, 4, 5, and 6

Date: March 14, 2008

Pursuant to ISF Rule 5c, this notice identifies the streams to be considered for instream flow appropriations in 2009. At the January 2009 meeting of the Colorado Water Conservation Board (CWCB), staff may request that the Board form its intent to appropriate instream flow water rights for the streams listed on the attached Instream Flow Appropriation List. The attached list contains a description of the Instream Flow (ISF) Recommendations including stream name, watershed, county, upper terminus, lower terminus, length, and USGS quad sheet name(s).

Copies of the Instream Flow Recommendations and Appendices of data submitted into the Official CWCB Record are available for review by the public during regular business hours (8:00 a.m. - 5:00 p.m.) at the Colorado Water Conservation Board's Office, located at 1313 Sherman Street, Room 723, Denver, Colorado, 80203. In addition to the CWCB office, copies of the Instream Flow and Natural Lake Level Recommendations are available on the CWCB website by going to the Stream and Lake Protection Tab, followed by New Appropriations, Instream Flow Appropriation Notices, then 2009 Proposed Appropriations.

In addition to the above Instream Flow Recommendations and Appendices, staff may rely on any additional data, exhibits, testimony, or other information submitted by any party as part of the Official CWCB Record to support its Instream Flow Recommendations.

It should also be noted that:

(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.

(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any person desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.

(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to persons on the ISF Subscription Mailing List(s).

(d) Any Notice to Contest must be received at the Board office no later than March 31, 2009, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant status must be received at the Board office no later than April 30, 2009 or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the November Board meeting and will send notice of the Final Staff Recommendation to all persons on the Contested Hearing Mailing List.

(f) The Board may take final action on any uncontested ISF appropriations at the May Board meeting.

Should you wish to comment on the proposed Instream Flow Recommendations, you may do so by writing Jeff Baessler of the Board's staff at the address given above or by sending your comments by email to jeffrey.baessler@state.co.us, owen.williams@state.co.us, or rob.viehl@state.co.us. It should be noted that while your appearance at any meeting is welcome, such an appearance is not necessary for your concerns to be recognized. Staff will take your comments into account and, if you so request, will present them to the Board in your absence. If you are not currently on the Board's Instream Flow Subscription Mailing List and you would like to be, please contact the Board's Office at the address given above.

2009 Instream Flow Appropriation Flow (ISF) Recommendations (February 13, 2008)

Div	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length	Quad Sheet(s)
1	Coal Cr. - Upper	St Vrain	Boulder	Boulder County Open Space boundary	Louisville Wastewater Treatment Outfall	6.1 mi	Louisville
1	Coal Cr.- Lower	St Vrain	Boulder	Louisville Wastewater Treatment Outfall	Lafayette Pumping Station #2	1.7 mi	Lafayette
2	Maxwell Cr	Arkansas Headwaters	Chaffee	Headwaters	Upstream of O.W.Friskey Ditch	4.0 mi	Buena Vista West
2	Gibson Cr.	Arkansas Headwaters	Custer	Headwaters	Confluence with Verde Creek	2.5 mi	Beckwith Mountain
2	Cucharas Cr.	Huerfano	Huerfano	Headwaters	Confluence w/ Deadman Creek	5.3 mi	Trinchera Peak, Cucharas Pass
2	Huerfano R - Upper	Huerfano	Huerfano	Lily Lake	Confluence with Central Branch Huerfano R	8.2 mi	Blanca Peak, Mosca Pass
2	Huerfano R - Lower	Huerfano	Huerfano	Unnamed Tributary	Confluence with Stanley Creek	2.6 mi	Red Wing, Mosca Pass
2	Rock Cr	Arkansas Headwaters	Lake	Native Lake	Confluence with Willow Cr	5.0 mi	Fawn Cr, Lost Park
2	Purgatoire R	North Platte Headwaters Purgatoire	Las Animas	Confluence with Middle & North Fks Purgatoire R	Confluence with Lopez Cany	4.8 mi	Vigil
2	S Fk Purgatoire R	North Platte Headwaters Purgatoire	Las Animas	Unnamed Trib	Confluence with Tores Cany	8.2 mi	Tercio
4	Clear Frk E. Muddy Cr.	North Fork Gunnison	Gunnison	Headwaters	0.4 mi upstream of Confluence with Little Muddy Cr	9.1 mi	Elk Knob, Quaker Mesa

4	E. Elk Cr. (ISF Increase) Existing ISF: 4-84CW378	Upper Gunnison	Gunnison	Confluence with Bear Wallow Gul	Confluence with Blue Mesa Reservoir	4.5 mi	Carpenter Ridge, West Elk Peak SW
4	Gunnison R.	Upper Gunnison	Gunnison	At Almont, CO	Curecanti National Recreation Area	18.0 mi	McIntosh Mntn, Gunnison,Signal Peak, Almont
4	Little Spring Cr	N Fk Gunnison	Gunnison	Crystal Springs	Upstream of Crystal Ditch Headgate	0.4 mi	Chair Mountain
4	Bent Cr. (ISF Increase) Existing ISF: 4-80CW101	Upper Gunnison	Hinsdale	Headwaters	Confluence with Lake Fork of the Gunnison R	3.0 mi	Redcloud Peak
4	Grizzly Gulch	Upper Gunnison	Hinsdale	Unnamed Lake	Confluence with Lake Fork Gunnison R	2.1 mi	Redcloud Peak
4	Henson Cr	Upper Gunnison	Hinsdale	Confluence with North Fork Henson Creek	Confluence with Nellie Creek	3.4 mi	Uncompahgre Peak
4	Schafer Gul (ISF Increase) Existing ISF: 4-84CW383	Upper Gunnison	Hinsdale	Headwaters	Confluence with Henson Cr	1.7 mi	Handies Peak
4	San Miguel R	San Miguel	Montrose	Confluence with Calamity Draw	Dolores R	16.5 mi	Davis Mesa, Red Canyon, Uravan, Nucla, Atkinson Cr
4	Tabeguache Cr	San Miguel	Montrose	Confluence with Fortyseven Cr	Confluence with San Miguel R	11.7 mi	Uravan, Nucla
5	Colorado R.	Colorado Headwaters	Eagle	Eagle-Grand County Line	Confluence with Eagle R	40 mi	Dotsero, Sugarloaf Mntn, Burns South, Burns North, Blue Hill, McCoy, State Bridge, Radium
5	Eagle R (ISF Increase) Existing ISF: 5-78W3796	Eagle	Eagle	Confluence with Gore Cr	Confluence with Cross Cr	3.77 mi	Minturn
5	Corral Cr (ISF Increase) Existing ISF: 5-86CW214	Upper Colorado River	Grand	Confluence with Smith Creek	Confluence with Colorado River	2.75 mi	Parshall
5	Troublesome Cr	Colorado Headwaters	Grand	Outlet Matheson Reservoir	Confluence with Rabbit Ears Cr	3.0 mi	Hyannis Peak
5	Troublesome Cr	Colorado Headwaters	Grand	Confluence with Rabbit Ears Cr	Headgate Pickering Ditch	3.0 mi	Hyannis Peak, Gunsight Pass
5	Buzzard Cr.	Colorado Headwaters - Plateau	Mesa	Confluence with Willow Cr	Confluence with Owens Cr	3.4 mi	Porter Mntn, Spruce Mntn
6	Grizzly Cr.	Little Snake	Routt	Conf w/ Unnamed trib	USFS Boundary	2.9 mi	Bears Ears Peaks
6	Indian Cr	North Platte Headwaters	Jackson	Headwaters	Headgate W Arapaho Feeder Ditch 2	7.7 mi	Spicer Peak, Whiteley Peak
6	N Fk North Platte R	North Platte Headwaters	Jackson	Headwaters	Headgate Little Nellie Ditch	7.5 mi	Boettcher Lake, Pearl, Davis Peak
6	S Fk Big Cr	Upper North Platte	Jackson	Confluence with Wheeler Creek	Colorado-Wyoming Border	1.88	Pearl
6	Moeller Cr	Upper White River	Rio Blanco	Headwaters	Confluence with Fawn Cr	3.5 mi	Fawn Creek
6	Piceance Cr	Piceance-Yellow	Rio Blanco	Confluence with Dry Fork	Confluence with White R	7.72 mi	Barcus Cr SE, White River City
6	Yellow Cr	Piceance-Yellow	Rio Blanco	Springs in NWNE S12, T1N R98W, 6PM	Confluence with White R	11.8	Barcus Cr, Barcus Cr SE, Rough Gulch,
6	S Fk Slater Cr	Little Snake	Routt	Headwaters	Confluence with	4.6 mi	Buck Point

					Slater Cr		
6	W Prong S Fk Slater Cr	Little Snake	Routt	Headwaters	Confluence with S Fk Slater Cr	5.5 mi	Buck Point

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler
Stream and Lake Protection Section

DATE: November 6, 2008

SUBJECT: **Agenda Item 5, November 18-19, 2008 Board Meeting**
Stream and Lake Protection – Notice of 2009 Instream Flow Recommendations in Water Divisions 2, 4, 5 and 6.

Discussion

Pursuant to ISF Rule 5c., the Colorado Water Conservation Board is providing notice that the following 24 stream segments are being considered for instream flow appropriations in 2009. At the January 2009 CWCB meeting, Staff may request that the Board form its intent to appropriate ISF water rights on these streams. These streams were previously noticed at the Board's March 2008 meeting.

Division	Stream	County(ies)	Recommender(s)
2	Gibson Creek	Custer	CDoW
2	Huerfano River (lower)	Huerfano	CDoW
2	Huerfano River (upper)	Huerfano	CDoW
2	Maxwell Creek	Chaffee	CDoW
2	Rock Creek	Lake	CDoW
2	Cucharas River	Huerfano	CDoW
2	Purgatoire River	Las Animas	CDoW
2	South Fork Purgatoire River	Las Animas	CDoW
4	Bent Creek - *increase*	Hinsdale	BLM
4	Clear Fork, E. Muddy Creek	Gunnison	CDoW, TU
4	East Elk Creek – *increase*	Gunnison	BLM, CDoW
4	Grizzly Gulch	Hinsdale	BLM, TU
4	Henson Creek - *increase*	Hinsdale	BLM
4	Little Spring Creek	Gunnison	BLM

4	Schafer Gulch – *increase*	Hinsdale	BLM
4	Tabeguache Creek	Montrose	BLM
5	Buzzard Creek	Mesa	CDoW, TU
5	Corral Creek	Grand	BLM
5	Troublesome Creek (lower)	Grand	BLM
5	Troublesome Creek (upper)	Grand	BLM
6	Grizzly Creek	Routt	CDoW, TU
6	Moeller Creek	Rio Blanco	CDoW
6	South Fork Slater Creek	Routt	CDoW, TU
6	West Prong South Fork Slater Creek	Routt	CDoW, TU

* CDoW (Colorado Division of Wildlife), TU (Trout Unlimited) and BLM (Bureau of Land Management)

The detailed recommendations and appendices for these streams can be found on the CWCB website at:
http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2009ProposedAppropriations/2009Appropriations.htm

Please note that Staff is still working on the following streams, which were previously recommended in 2006, 2007 and/or 2008. Staff has been unable to move forward on these streams as a result of the need for additional stakeholder discourse and/or the need for additional data collection and analysis. As issues are resolved, staff will move the recommendations forward at a later Board meeting in 2009 or delay the recommendations to 2010.

Division	Stream	County(ies)	Recommender(s)
1	Coal Creek (lower)	Boulder	City of Louisville
1	Coal Creek (upper)	Boulder	City of Louisville
4	Big Dominguez Creek	Delta, Mesa	CDoW, TU
4	Little Dominguez Creek	Delta, Mesa	CDoW, TU
4	San Miguel River	Montrose	BLM, CDoW
5	Colorado River	Eagle	Eagle BOCC
5	Eagle River	Eagle	Minturn, CDoW
6	Indian Creek	Jackson	BLM
6	North Fork North Platte River	Jackson	BLM
6	Piceance Creek	Rio Blanco	BLM, CDoW
6	South Fork Big Creek	Jackson	BLM
6	Yellow Creek	Rio Blanco	BLM, CDoW

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler
Stream and Lake Protection Section

DATE: March 9, 2008

SUBJECT: **Agenda Item 25, March 18-19, 2008, Board Meeting**
Stream and Lake Protection Section – 2009 Instream Flow Appropriations

Summary

This memo outlines 35 new instream flow recommendations that are being noticed and processed by staff for possible inclusion into the Instream flow and Natural Lake Level Program in 2009. It also reviews the current basin rotation approach to considering new recommendations as well as the merits of a prioritization approach for considering recommendations.

Staff recommends that the Board eliminate the basin rotation approach for considering new appropriations and replace it with a prioritization approach that is based on the Environmental Plan of Action as outlined in the Board's revised strategic plan.

Background

On February 13, 2008, Staff held its annual Instream Flow Workshop at the Colorado History Museum in Denver. The meeting was well attended by staff, two CWCB Members and representatives from the CDOW, BLM, Trout Unlimited, USFS, Upper Arkansas Water Conservancy District, Denver Water, City of Louisville, City of Greeley, Boulder County, Eagle County, Routt County and others.

The main objective of the workshop was to allow stakeholders an opportunity to present stream and lake recommendations to staff and the Board for inclusion in the Instream Flow and Natural Lake Level (ISF) program in 2009. Each entity was given an opportunity to provide specific information regarding the natural environment to be protected and to discuss why protection was important for these particular streams. During the workshop, the Board and the public had the opportunity to raise questions and/or concerns regarding the recommendations. Under the Board's ISF Rules, the earliest that the Board could declare its intent to appropriate water rights on these streams is January 2009.

Below is the list of the streams that were discussed at the workshop and are being noticed for possible inclusion into the Program in January 2009. Additional information regarding these streams will be available for review on the Board's new web site by March 14, 2008. One can access the information by going to the Stream and Lake Protection tab, followed by New Appropriations, Instream Flow Appropriation Notices, then 2009 Proposed Appropriations.

Division	Stream Name	County	Recommender(s)*
1	**Coal Creek** *(Boulder County Open Space boundary to WWTP)*	Boulder	City of Louisville
1	**Coal Creek** *(WWTP to Lafayette Pumping Station #2)*	Boulder	City of Louisville
2	**Maxwell Creek** *(Headwaters to O.W. Friskey Ditch)*	Chaffee	CDOW
2	**Gibson Creek** *(Headwaters to confl Verde Creek)*	Custer	CDOW
2	**Cucharas River** *(Headwaters to confl Deadman Creek)*	Huerfano	CDOW
2	**Huerfano River** *(Headwaters to Central Branch Huerfano)*	Huerfano	CDOW
2	**Huerfano River** *(Deer Creek to Stanley Creek)*	Huerfano	CDOW
2	**Rock Creek** *(Native Lake to confl Willow Creek)*	Lake	CDOW
2	**Purgatoire River** *(Confl Middle & West Fork Purgatoire to confl Lopez Canyon)*	Las Animas	CDOW
2	**South Fork Purgatoire River** *(Unnamed trib. to confl Tores Canyon)*	Las Animas	CDOW
4	**Clear Fork East Muddy Creek** *(Headwaters to .4 mi upstream of confl with Little Muddy Ck)*	Gunnison	CDOW, TU
4	**East Elk Creek** (Increase to existing ISF right) (Existing ISF: 4-84CW378) *(Confl Bear Wallow Gulch to confl Blue Mesa Reservoir)*	Gunnison	BLM, CDOW
4	**Gunnison River** *(Almont to Curecanti National Recreation Area)*	Gunnison	High Country Citizens' Alliance
4	**Little Spring Creek** *(Crystal Springs to Crystal Ditch Headgate)*	Gunnison	BLM
4	**Bent Creek** *(Headwaters to confl Lake Fork of the Gunnison)*	Hinsdale	BLM
4	**Grizzly Gulch** *(Unnamed Lake to confl with Lake Fork Gunnison)*	Hinsdale	BLM, TU
4	**Henson Creek** (Increase to existing ISF right) (Existing ISF: 4-84CW386) *(Confl. NFK Henson to confl Nellie Creek)*	Hinsdale	BLM
4	**Schafer Gulch** (Increase to existing ISF right) (Existing ISF: 4-84CW383) *(Headwaters to confl Henson Creek)*	Hinsdale	BLM
4	**San Miguel River** *(Confl Calamity Draw to confl Dolores River)*	Montrose	BLM, CDOW
4	**Tabeguache Creek** *(Confl Fortyseven Creek to confl San Miguel River)*	Montrose	BLM
5	**Colorado River** *(Eagle/Grand County Line to confl Eagle River)*	Eagle	Board of County Com'rs of Eagle

			Cty
5	**Eagle River** (Increase to existing ISF right) (Existing ISF: 5-78W3796) *(Confl Cross Creek to confl Gore Creek)*	Eagle	Town of Minturn, CDOW
5	**Corral Creek** (Increase to existing ISF right) (Existing ISF: 5-86CW214) *(Confl Smith Creek to confl Colorado River)*	Grand	BLM
5	**Troublesome Creek** *(Matheson Reservoir to Confl Rabbit Ears Creek)*	Grand	BLM
5	**Troublesome Creek** *(Confl Rabbit Ears Creek to Pickering Ditch)*	Grand	BLM
5	**Buzzard Creek** *(Confl. Willow Creek to confl Owens Creek)*	Mesa	CDOW, TU
6	**Moeller Creek** *(Headwaters to confl Fawn Creek)*	Rio Blanco	CDOW
6	**Indian Creek** *(Headwaters to headgate W. Arapahoe Feeder Ditch)*	Jackson	BLM
6	**North Fork North Platte River** *(Headwaters to confl Little Nellie Ditch)*	Jackson	BLM
6	**South Fork Big Creek** *(Confl Wheeler Ck to Colorado/Wyoming Border)*	Jackson	BLM
6	**Piceance Creek** *(Confl Dry Fork to confl White River)*	Rio Blanco	BLM, CDOW
6	**Yellow Creek** *(Springs to confl White River)*	Rio Blanco	BLM, CDOW
6	**Grizzly Creek** *(Confl w/ Unnamed trib to USFS Boundary)*	Routt	CDOW, TU
6	**South Fork Slater Creek** *(Headwaters to confl with Slater Creek)*	Routt	CDOW, TU
6	**West Prong South Fork Slater Creek** *(Headwaters to confl South Fork Slater Creek)*	Routt	CDOW, TU

* CDOW (Colorado Division of Wildlife), TU (Trout Unlimited) and BLM (Bureau of Land Management)

Staff will process these 35 segments during the next year. Staff will review, explore, develop information, and identify and attempt to resolve issues on each of these segments so that the Board can form its intent to appropriate instream flow water rights and make the necessary findings per Rule 5i that 1) there is a natural environment to be preserved; 2) there is water available; and 3) the natural environment can exist without material injury to water rights.

Basin Rotation vs. Recommendation Prioritization

In 2006, the Board adopted and directed staff to implement a basin oriented approach for considering new ISF recommendations. This policy guidance directed staff to work with the recommending entities to develop recommendations in no more than two water divisions in any given year. At the time the policy was adopted, the Stream and Lake Protection Section was not fully staffed and concerns existed over resource limitations and the ability of staff to process recommendations across multiple divisions. In addition, it was thought that limiting the number of basins would provide certainty to some stakeholders that ISF issues in their basins would be addressed in a specific and narrow timeframe, thereby allowing those entities to increase their efficiencies in addressing issues related to proposed ISF recommendations.

At this time, the section is fully staffed and resource limitations are less of an issue. In addition, other significant factors have been identified over the past two years which suggest that the basin

oriented approach to considering ISF recommendations should be abandoned in favor of a prioritization approach to considering recommendations. In general, prioritization of ISF rights would involve a collaborative process by which multiple stakeholders identify and prioritize streams for protection based on one or more sets of natural environment attributes, with issues fully vetted in a public process with Board involvement. Some of the key factors supporting a prioritization approach include:

1. The IBCC and SWSI efforts both use an approach by which stakeholders prioritize non-consumptive needs, including ISF rights, based on a set of identified stream attributes with the goal of achieving a balance between consumptive needs and non-consumptive needs. The basin rotation approach would limit the ability of all the Roundtables to effectively participate in the ISF Program in a timely manner.
2. Recommending entities often prioritize proposed ISF rights that they are interested in based on factors such as the presence of unique, threatened or endangered species. A geographic basin approach unnecessarily limits the recommenders from protecting sensitive species that are located in multiple basins.
3. The Board's proposed strategic plan revisions require the Stream and Lake Protection Section to collaborate with state and federal agencies, water users, environmentalists, recreational interests and the Basin Roundtables to develop an Environmental Plan of Action to meet environmental needs. A key component of the plan is the prioritization of ISF recommendations statewide by multiple interests.

In addition to these key factors, recommending entities have concerns that the Basin Rotation approach unnecessarily restricts their ability to effectively participate in the program because data collection and resulting recommendations in a given basin may be limited due to above or below normal basin runoff conditions. This is a situation that occurred last year in Water Division 6.

In summary, Staff has found the basin rotation approach to be impractical given the new emphasis by the Roundtables and others on indentifying and prioritizing non-consumptive needs across the state. A better approach would be to continue to develop an Environmental Plan of Action in accordance with the strategic plan by which the CWCB, recommending entities, the Roundtables and other stakeholders jointly identify common ISF goals and priorities for inclusion into the Program.

Although there has been significant progress among the Roundtables to address non-consumptive uses, it will likely take additional time before a working environmental plan of action can be developed. As a result, Staff will continue to process and internally prioritize recommendations when necessary based on staff resources, data needs, and Board direction.

Staff Recommendation

Staff recommends that the Board eliminate the basin rotation approach for considering new appropriations with the goal of replacing it with a prioritization approach that is based on the Environmental Plan of Action as outlined in the Board's revised strategic plan. Staff further recommends, that in the interim, the Board allow staff to internally prioritize recommendations by taking into account staff resources, data needs, and Board direction.