BEFORE THE COLORADO WATER CONSERVATION BOARD

IN THE MATTER OF PROPOSED INSTREAM FLOW APPROPRIATIONS DIVISION 2: UPPER HUERFANO RIVER, LOWER HUERFANO RIVER AND CUCHARAS CREEK

PRE-HEARING STATEMENT FOR HUERFANO COUNTY AND THE HUERFANO COUNTY WATER CONSERVANCY DISTRICT

Huerfano County (hereinafter the "County"), and the Huerfano County Water Conservancy District (hereinafter the "District"), through their attorneys FELT, MONSON & CULICHIA, LLC, and pursuant to the Second Revised Notice of Pre-Hearing Deadlines for Submissions and Pre-Hearing Conference dated September 18, 2009, submits the following Pre-Hearing Statement concerning the contested hearing currently scheduled for November 16-17, 2009:

I. Statement of Factual and Legal Claims Asserted and Legal Basis of the County and District

The County is a political subdivision of the State, charged with the provision of services and protection of the rights of the citizens of Huerfano County, Colorado. The District is a properly formed conservancy district under C.R.S. §37-2-101 *et seq.*, charged with the protection of public and private property, and the conservation development, utilization and disposal of water, among other purposes, within the boundaries of the District. The County , the District and their constituency believe that should the requested in-stream flows be granted to the CWCB, it would harm the County and the District, as well as other municipal, quasi-municipal and private water users in Huerfano County, in developing water rights along the Huerfano River and Cucharas Creek, including but not limited to, any future change actions and future exchanges through the reaches of the proposed in-stream flows.

C.R.S. § 37-92-102(3) charges the Colorado Water Conservation Board ("CWCB") with the exclusive authority to appropriate in-stream flows ("ISF") "to preserve the natural environment to a reasonable degree." Further, C.R.S. §37-92-102(3) provides the CWCB only with the authority to appropriate waters "for ***minimum*** stream flows... to preserve the environment to a reasonable degree" (emphasis added). The CWCB's authority to appropriate ISFs is burdened by a fiduciary duty to appropriate only the ***minimum*** amount necessary to preserve the natural environment for the people of the state. *See* Aspen Wilderness Workshop, Inc. v. CWCB, 901 P.2d 1251, 1256-1257(Colo. 1995). The County and District will hold CWCB to a strict proof standard that the proposed ISFs are of a ***minimum*** quantity necessary for the preservation of the natural environment. The County

and District assert that the ISF quantities are excessive, at times well in excess of the physical flows which are available in the subject reaches, evidencing that whatever natural environment exists can be preserved with lesser appropriations, if such ISF appropriations are necessary at all.

The statutorily prescribed duties of the CWCB include: "conservation of the waters of the of Colorado in order to secure the ***greatest utilization*** of such waters" (*see* C.R.S. §37-60-106(1)); "to devise and formulate methods, means, and plans for bringing about the ***greater utilization of the waters of the state***" (Id. at (c)); "to gather data and information looking toward the ***greater utilization of the waters of the state***" (Id. at (d)); "***to maintain a balance between the development of the state's water resources and the protection of the state's fish and wildlife resources***" (Id. at (q)); "to foster the conservation of the water of the state of Colorado by promotion and implementation of sound measures to enhance water use efficiency in order to ***serve all the water needs of the state, to assure the availability of adequate supplies for future uses***, and to assure that necessary water services are provided at reasonable cost" (Id. at (c)) (emphasis added to all). The County and the District will hold the CWCB to strict proof as to compliance with its statutory duties. The County and the District believe that CWCB's utilization of inappropriate scientific methodology in determining ISF amounts may be violative of the above referenced duties, in over-appropriating such ISF amounts to the detriment of the "greater utilization" of Colorado's water resources, and in excess of the minimum flows required for preservation of the natural environment to a reasonable degree.

To that end, the County and the District will provide evidence that the methodologies, analysis and techniques utilized by the CWCB in determining the volumes and quantities of the ISFs at issue here, and indeed virtually all ISFs sought by the CWCB, are inappropriate, and result in over-appropriation of water in excess of that minimum amount required for the preservation of the natural environment to a reasonable degree. The County and the District will demonstrate that material errors exist in the analysis and data relied upon by the CWCB in calculating the ISF amounts for the subject reaches of the Huerfano River/Cucharas Creek, and that independent analysis of water availability and quantities necessary for the preservation of the natural environment provide for far reduced flows from those recommended.

Further, the County and the District will provide evidence that the notice provisions utilized by the CWCB fail to meet procedural due process requirements, and the requirements of statute, being insufficient in providing members of the public at large with notice of recommendations and eventual appropriations which could affect vested water rights. C.R.S. §37-92-102(4)(a) requires that any and all appropriations made by the CWCB utilize a "public notice and comment procedure". Such terms are later defined by statute, at C.R.S. §37-92-102(4)(b)(II)(A) as meaning, for the purposes of ISF decreases, "printed in the resume in the water court having jurisdiction..." and publication "in a newspaper of statewide distribution". For purposes of an initial ISF recommendation,

however, the CWCB, rather than publishing in a paper of local distribution and publishing in the "water resume", it instead "publishes" ISF recommendations only to a select group of individuals who elect to subscribe to the CWCB ISF Notification List, through the CWCB website. The CWCB then acts as the finder of fact based upon presentations and information submitted by the Board Staff, and those interested parties who happen to be on the ISF Notification List. Once administrative proceedings are completed and final, the CWCB then, files applications with the Water Court of proper jurisdiction, and meets the standard public notice requirements upon such application of resume notice and newspaper publication. However, the Water Court's standard of review for CWCB ISF filings, unlike other water rights, is only that provided for judicial review of an administrative finding (*see* C.R.S. §24-4-106(7)), i.e. an arbitrary and capricious standard. As such, the public is denied the notice necessary to contest the amount, manner of appropriation, and other factors, such decisions being made in limited-notice hearings before the CWCB prior to resume and traditional publication, open only to those "in the know" who have elected to be notified. Such limited-notice proceedings are inconsistent with the Colorado Constitution as concerns procedural due process, contrary to statute as to the adjudication of water rights, inconsistent with statute concerning the CWCB's own publication requirements, and inconsistent with the concepts of transparency and the 'consent of the governed' in regards to government actions (particularly those such as the CWCB's which are ostensibly "for the people"). The County and the District will evidence that the CWCB's policy and practice of completing all material aspects of water appropriations without proper public notice and before a non-neutral fact finder is inconsistent with Constitutional due process requirements, and any statute authorizing such procedure is similarly unconstitutional, as such procedure never provides for a de novo hearing before the judiciary.

II. List of Exhibits to be Introduced at Hearing

The County and the District may introduce the following attached exhibits at hearing:

A. Exhibit 1: Memorandum dated September 30, 2009 prepared by Dave Mehan of Bikis Water Consultants, LLC concerning Water Availability Assessment for Huerfano River and Cucharas Creek In Stream Flow Filings;

B. Exhibit 2: Memorandum dated September 30, 2009 prepared by Dave Mehan of Bikis Water Consultants, LLC concerning R2Cross Modeling for Cucharas Creek and Huerfano River;

C. Exhibit 3: Memorandum dated September 30, 2009 prepared by Dave Mehan of Bikis Water Consultants, LLC concerning Evaluation Water Reservation for Huerfano County – Proposed CWCB In Stream Flow Filings;

D. Any and all exhibits identified, introduced or utilized by another party or participant.

The County and District reserve the right to update this exhibit list in their Rebuttal Pre-Hearing statement.

III. List of Witnesses to be Called and a Description of Their Testimony

Name, Address and Telephone Numbers of Witnesses Likely to Testify on Behalf of the County and the District:

1. John Galusha
   County Administrator
   Huerfano County
   401 Main Street
   Walsenburg, CO 81089-2045
   (719) 738-3485

2. Dawson Jordan
   Board Member
   Huerfano County Water Conservancy District
   2192 County Rd 616
   Walsenburg, CO 81089
   (719) 738-1483

3. Ray Harriman
   President, HCWCD
   19 Grays Peak Road
   Walsenburg, CO 81089
   (719) 738-3429

Mr. Galusha, Mr. Jordan, and Mr. Harriman may testify to information relevant to this action including knowledge of County demographics, County growth projects, anticipated large-scale projects which may occur in Huerfano County, water use requirements and the potential affect of the proposed in-stream flow rights sought by the CWCB upon the citizens of Huerfano County and their present and future uses of water.

4. Dave Mehan, P.W.S.
   Bikis Water Consultants, LLC
   555 RiverGate Lane, Suite B4-82
   Durango, Colorado 81301
   (970) 385-2340

5. Ted Zorich
   P.O. Box 19365
   Colorado City, CO 81019
   (719) 676-3649

Mr. Mehan and Mr. Zorich may testify as to methodological errors in the CWCB analysis of ISF quantities and requirements, potential impacts to the citizens, municipalities, and quasi-municipalities of Huerfano county which could occur should the CWCB requested ISF water rights be approved, and other matters of water resource engineering and analysis nature.

6. Douglas Brgoch
Water Commissioner, Water District 16/18
Division of Water Resources
Department of Natural Resources
310 E. Abriendo Avenue
Pueblo, Colorado 81004
(719) 859-0122

7. Edward "Ray" Garcia
Water Commissioner, Water District 79
Division of Water Resources
Department of Natural Resources
310 E. Abriendo Avenue
Pueblo, Colorado 81004
(719) 746-2362

Mr. Brgoch and Mr. Garcia may testify as to their familiarity with existing water rights and their uses on the Huerfano River and Cucharas Creek, the typical flows available in each respective reach of stream, the potential impacts of the requested ISFs on the use and enjoyment of such existing water rights, and the restrictive impacts on the potential change of such water rights to other uses should the requested ISFs be approved.

The County and the District reserve the right to update their prospective witness list in its Rebuttal Pre-Hearing Statement.

IV. Alternative Proposal to Proposed Instream Flow

Applicants' proposed alternative is articulated in the Memorandum dated September 30, 2009 prepared by Dave Mehan of Bikis Water Consultants, LLC concerning R2Cross Modeling for Cucharas Creek and Huerfano River. Said proposal is as follows:

1. Cucharas Creek ISF be reduced to the following flows:

5/15-6/30	2.4 cfs
7/1-8/14	2.4 cfs
8/15-9/15	1.0 cfs
9/16-4/14	1.0 cfs

4/15-5/14	2.4 cfs

2. Upper Huerfano River ISF be reduced to the following flows:

5/1-10/31	2.4 cfs
11/1-4/30	2.2 cfs

3. Lower Huerfano River ISF flows be reduced as follows:

4/1-10/31	4.5 cfs
11/1-3/31	2.75 cfs

V. Written Testimony to be Offered into Evidence at Hearing

None at this time, but the County and District reserve the right to offer written testimony in their Rebuttal Pre-Hearing Statement.

VI. Legal Memoranda.

None at this time, but the County and the District reserve the right to submit legal memoranda in a rebuttal statement.

Respectfully Submitted this 7th day of October, 2009.

FELT, MONSON & CULICHIA, LLC

Chris D. Cummins, #35154
David M. Shohet, #36675

CERTIFICATE OF SERVICE

I hereby certify that I have duly served the within **Pre-Hearing Statement of Huerfano County and the Huerfano County Water Conservancy District** to the parties herein via e-mail or by depositing copies of the same in the United States Mail, postage prepaid, at Colorado Springs, Colorado this 7th day of October, 2009, addressed as follows:

Linda Bassi
Colorado Water Conservation Board
1313 Sherman St., Rm 721
Denver, CO 80203
(303) 866-3945
linda.bassi@state.co.us

Susan Schneider - Staff Attorney
Natural Resources and Environment Section
Colorado Department of Law
1525 Sherman St., 5th Fl.
Denver, CO 80203
(303) 866-5033
susan.schneider@state.co.us

Casey Shpall - Hearing Officer
Colorado Attorney General's Office
1525 Sherman St., 5th Floor
Denver, CO 80203
(303) 866-5069
casey.shpall@state.co.us

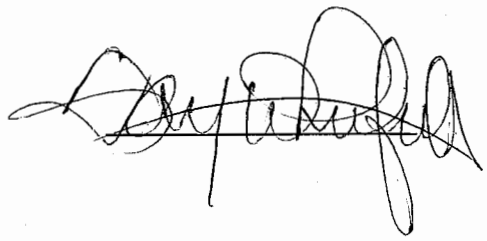
Mark Uppendahl
Colorado Division of Wildlife
6060 Broadway
Denver, CO 80216
(303) 291-7267
mark.uppendahl@state.co.us

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

Andrew Peternell
Trout Unlimited
1320 Pearl St., Ste. 320
Boulder, CO 80302
(303) 440-2937
dpeternell@tu.org

Dwight Harrison
P.O. Box 1559
Monument, CO 80132

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



555 RiverGate Lane, Suite B4-82
Durango, Colorado 81301
Tele: 970.385.2340
Fax: 970.385.2341
www.BikisWater.com

BĪKIS Water Consultants LLC

MEMORANDUM

To: Huerfano County
C/o Chris Cummins, Esq

From: Dave Mehan and Eric Bikis
Bikis Water Consultants, LLC

Date: September 30, 2009

Re: Water Availability Assessment for Huerfano River and Cucharas Creek Instream Flow Filings

Bikis Water Consultants, LLC (BWC) completed an assessment of water availability for the instream flow (ISF) filings proposed for the upper reaches of the Huerfano River and Cucharas Creek by the Colorado Water Conservation Board (CWCB) and Colorado Division of Wildlife (CDOW). The bases of the proposed filings, including water availability assessments, are provided in the "Executive Summaries and Staff Analyses and Recommendations" available on the CWCB website. The locations of the proposed filings and relevant hydrologic information are shown on Figures 1 and 2.

ANALYSIS BY CWCB

A water availability assessment was completed by the CWCB for the Upper and Lower Huerfano River segments, and the mainstem of Cucharas Creek (referred to as the Cucharas River downstream). A similar assessment was completed for each segment which entailed calculation of the geometric mean of daily discharges using gaged streamflow pro-rated based on watershed area, and adjusted (reduced) for historic water rights diversions. Ninety-five percent confidence limits were placed on the geometric mean flows. The stream gage on the Huerfano River at Manzanares (U.S. Geological Survey (USGS) No. 07111000) was used for the Huerfano River segments; the stream gage at Boyd Ranch (USGS No. 07114000) was used for Cucharas Creek (Figures 1 and 2). Both of these gages have reasonable periods of record and are located relatively close to the downstream ends of the ISF segments.

It is not clear whether the pro-rated flows actually had historic diversions subtracted. Graphs were prepared which show the geometric mean daily discharge and ninety-five percent confidence limits with the proposed ISF flow amounts. These graphs (copies in Attachment 1) indicate that the geometric mean daily flow is well above the proposed ISF amounts for the upper Huerfano River segments, and close to the flows for the Cucharas Creek segment.

No specific water availability assessments are posted on the CWCB website for the four tributaries of the Cucharas River.

ANALYSIS BY BWC

BWC is concerned with the use of geometric mean daily flows to determine water availability. As described in the USGS's Techniques of Water-Resources Investigations Series by D. R. Helsel and R. M. Hirsch, which is cited as the basis for use of this method in the CWCB documents, the geometric mean is less affected by extreme values or outliers and is a more stable measure of the central tendency of a data set. It is also typically less than the arithmetic mean. However, we question the validity of the use of geometric means to assess water availability for the purpose of setting an ISF. Geometric means may be more appropriate for data that is extremely variable, i.e., data which has a range of several orders of magnitude, or numbers that are multiplied together (e.g., determining the average rate of return on an investment).

Use of the geometric mean reduces the variability in the flow data, but this variability is essential for a realistic assessment of water availability. Water supply planning is typically based on more extreme drought events. The frequency of droughts determines the economic viability of the enterprise for which the water is being used (e.g., irrigation for crop production, municipal water supply, industrial water uses, etc.).

Daily flows for the Huerfano River at Manzanares (period of record 1923-present), and Cucharas River at Boyd Ranch (period of record 1943-present) were pro-rated based on watershed area by BWC. Watershed areas for the gages and ISF segments are shown on Figures 1 and 2 and are as follows:

Manzanares Gage:	75.52 mi^2
Upper Huerfano ISF Segment:	13.52 mi^2
Lower Huerfano ISF Segment:	38.72 mi^2
Cucharas at Boyd Ranch Gage:	53.14 mi^2
Cucharas ISF Segment:	9.47 mi^2

The areas used by the CWCB in their analysis varied slightly but not enough to significantly affect the results. Based on the areas shown above, mean daily flows at the gages were adjusted by the following ratios for the proposed ISF segments:

Upper Huerfano River:	0.18
Lower Huerfano River:	0.51
Cucharas River:	0.18

Adjusted flows were not reduced by any water rights diversions. Records from the Colorado Division of Water Resources (CDWR) show that there are four ditches and several relatively small springs upstream of the Manzanares stream gage (Figure 1). The four ditches and their status are as follows:

- Central Branch Ditch: Decreed for 1.0 cfs from the Central Branch; the only recent diversions (since 1942) are reported in 1999.

- Alti Ditch: Decreed for 1.0 cfs from the Huerfano River; sporadic diversions recorded 17 years from 1942 - 2008. Most recent diversions in 2005.

- Santi Ditch: Decreed for 0.5 cfs from the South Fork of the Huerfano River; sporadic diversions recorded 14 years from 1942 - 2008. Most recent diversions in 1999.

- Pathfinder Ditch: Decreed for 0.5 cfs from the Huerfano River. Relatively continuous diversion records from 1943 - 1965. No recent diversions and ditch noted as "Not Usable" in 2008.

Based on this information, it does not appear that there are significant diversions from the Huerfano River upstream of the Manzanares gage. Likewise, records from the CDWR do not indicate any direct diversions from the Cucharas River in the reach proposed for the ISF. Therefore, no diversions or historic consumptive use were subtracted from the adjusted river flows.

Figures 3 to 5 show the adjusted mean daily flows compared to the proposed ISF amounts for the upper Huerfano, lower Huerfano and Cucharas Creek for a ten-year period from 1997-2007. This period was chosen as it represents recent data; the results are similar for the entire periods of record. Figures 3 to 5 contrast to the graphs by the CWCB in Attachment 1.

Figure 3 shows the actual flow in the upper Huerfano River is less than the proposed ISF every year for a relatively long period. The flow is less than the proposed ISF during drought years in the lower Huerfano River segment (Figure 4). The figure in Attachment 1 for this reach shows the flow to always be greater than the proposed ISF. Lastly, the flow is less than the proposed ISF each year for the Cucharas Creek segment (Figure 5). It should be noted that the flows in Figures 3 to 5 actually occur while the flows in the figures in attachment 1 are statistical constructs and may never actually occur.

The average percent of time that the flow is less than the proposed ISFs for the period of record for each stream gage is shown in Figures 6 to 8. Table 1 show the average and maximum number of days that the proposed ISFs are not met. As Figure 6 shows, flow in the upper Huerfano is less than the proposed ISF 78 percent of the time during the winter and 35 percent of the time during the summer. The proposed ISF is not met at all during drought years in this segment (Table 1). More water is available to meet the proposed ISF for the Lower Huerfano River (Figure 7); however, the ISF is not met for a significant number of days during a dry year (162 days, see Table 1). The proposed ISF for the Cucharas Creek is not met much of the time (Figure 8), and it is not met at all during drought years (Table 1).

SUMMARY

The analysis completed by BWC which used actual streamflow data found that water is not available to meet the proposed ISFs, especially for the Upper Huerfano River and Cucharas Creek. In contrast, the water availability assessment completed by the CWCB found water to be available to meet the flows, but this assessment used geometric means which BWC believes are not appropriate for water availability studies. Geometric means mask the variability in flows, yet this variability is crucial for water supply assessments.

The lack of available water means that the proposed ISFs could affect existing and future water rights in the basins. In particular, new rights for storage or direct diversion in the upper portions of

the basin could be affected. The results of this analysis would be even more critical if existing diversions are subtracted from the adjusted flows.

Attachments: Table 1. Number of Days Flow in River is Less Than the Proposed ISF Values
Figure 1. Huerfano River Proposed CWCB Instream Flow Filings
Figure 2. Cucharas River Proposed CWCB Instream Flow Filings
Figures 3-5. Proposed ISF vs. Discharge Graphs
Figures 6-8. Average Percentage of Days Below ISF Graphs
Attachment 1. CWCB Graphs

cc:

P:\Project Files\128-09 Huerfano County\Water Avail study\Blue Dot\WaterAvailStudy 9-30-09.doc

Tables

Table 1. Number of Days Flow in River is Less Than the Proposed ISF Values
Huerfano River and Cucharas Creeks

River Segment	Average Number of Days Below ISF	Maximum Number of Days Below ISF
Huerfano River Upper Segment	204	365
Huerfano River Lower Segment	15	162
Cucharas Creek	117	365

Source:
USGS Streamflow Data for Huerfano River at Mazanares Gage, and Cucharas River and Boyd Ranch Gage. Period of Record 1923-present and 1934-present, respectively.

Notes:
ISF = in-stream flow

Figures

105°30'0"W 105°28'0"W 105°26'0"W 105°24'0"W 105°22'0"W 105°20'0"W 105°18'0"W

37°48'0"N 37°46'0"N 37°44'0"N 37°42'0"N 37°40'0"N 37°38'0"N 37°36'0"N 37°34'0"N

128-09\Mapping\ArcMaps\Huerfano ISF Map

Map Sources:
Base Map - Huerfano County Topo and DEM - USGS
Rivers and Streams and Diversions - CDSS
Proposed ISF Reaches - CWCB
Watershed Boundaries - NRCS

un-named
un-named
un-named
un-named
un-named
Panfleon Creek
North May Creek
South May Creek
SHARPSDALE DITCH
MOSCOW DITCH
75.52 mi²
Potato Creek
May Creek
Montez Ditch
Manzanares Gage
(USGS 07111000)
Aspen Creek
un-named
MCINTIRE DITCH NO 2
Huerfano River
Huerfano River (Lower Reach)
5.75 cfs (April 1 to October 31)
2.75 cfs (November 1 to March 31)
TIMOTHY DITCH
STANLEY DITCH
BEN BUTLER DITCH
Rito Creek
PATHFINDER DITCH
un-named
Stanley Creek
Manzanarez Creek
38.72 mi²
Sheep Creek
Deer Creek
ALTI DITCH
SANTI DITCH
un-named
Deep Canyon
Central Branch Huerfano
South Fork Huerfano
Cascade Creek
CENTRAL BRANCH DITCH
HALLOWAY RESERVOIR DITCH
Dutch Creek
Deep Creek
Huerfano River (Upper Reach)
4.10 cfs (May 1 – October 31)
2.70 cfs (November 1 – April 30)
13.52 mi²
Blanca Peak

Map Legend

- Ditch Headgate Within CWCB Study Area
- Gage Station
- Existing ISF Right
- Stream
- Huerfano River
- Huerfano River Watershed Boundaries

CWCB Proposed Instream Flow Reach

- Upper Terminus
- Lower Terminus

*Only small springs exist upstream from the Manzanares Gage aside from the labled surface water diversions

BIKIS Water Consultants LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340ph 385-2341fx
www.BikisWater.com

0 3,000 6,000 12,000 Feet

1 inch = 6,000 feet

Designed by: MJK
Detail by: DBM
Date: 09/30/2009
Scale: 1:72,000

Huerfano River Proposed CWCB Instream Flow Filings

Figure 1

105°10'W 105°8'W 105°6'W 105°4'W 105°2'W

37°28'N 37°26'N 37°24'N 37°22'N 37°20'N 37°18'N 37°16'N

128-09 \ Mapping \ ArcMaps \ Cucharas ISF Map

Map Sources:
Base Map - Huerfano County Topo and DEM - USGS
Rivers and Streams - CDSS
Proposed ISF Reaches - CWCB
Watershed Boundaries - NRCS

Indian Creek
Price Canyon
Rilling Creek
un-named
Harrison Bridge Gage
Boyd Ranch Gage
(USGS 07114000)
Wade Canyon
Voires Canyon
Echo Canyon
53.14 mi²
Cucharas River
Chaparral Creek
Bonnett Creek
Dodgeton Creek
Indian Peaks
Wilderness
San Isabella
National Forest
Baker Creek
White Creek
South Fork Cucharas Creek
Guajatoyah Creek
Ogden Creek
un-named
9.47 mi²
North Fork Purgatoire River

Bonnet Creek
0.8 cfs (05/01 – 07/31)
0.5 cfs (08/01 – 08/31)
0.3 cfs (09/01 – 04/30)

Dodgeton Creek
1.5 cfs (05/01 – 07/31)
1.1 cfs (08/01 – 08/31)
0.6 cfs (09/01 – 04/30)

Chaparral Creek
2.5 cfs (05/01 – 07/31)
1.0 cfs (08/01 – 10/31)
0.7 cfs (11/01 – 04/30)

Baker Creek
2.1 cfs (05/01 – 07/31)
0.8 cfs (08/01 – 10/31)
0.6 cfs (11/01 – 04/30)

Cucharas Creek
4.9 cfs (May 15 to June 30)
2.5 cfs (July 1 to August 14)
1.6 cfs (August 15 to September 15)
1.2 cfs (September 16 to April 14)
3.0 cfs (April 15 to May 14)

Map Legend

- Gage Station
- Existing ISF Right
- Stream
- Cucharas River
- Cucharas River Watershed Boundaries

CWCB Proposed Instream Flow Reach

- Upper Terminus
- Lower Terminus

Only small springs exist upstream from the Boyd Ranch Gage

BIKIS Water Consultants LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340ph 385-2341fx
www.BikisWater.com

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

Designed by: MJK
Detail by: DBM
Date: 09/30/2009
Scale: 1:60,000

Cucharas River Proposed CWCB Instream Flow Filings

Figure 2

Figure 3. Proposed ISF vs. Discharge, Upper Huerfano River 1997-2007

Huerfano County

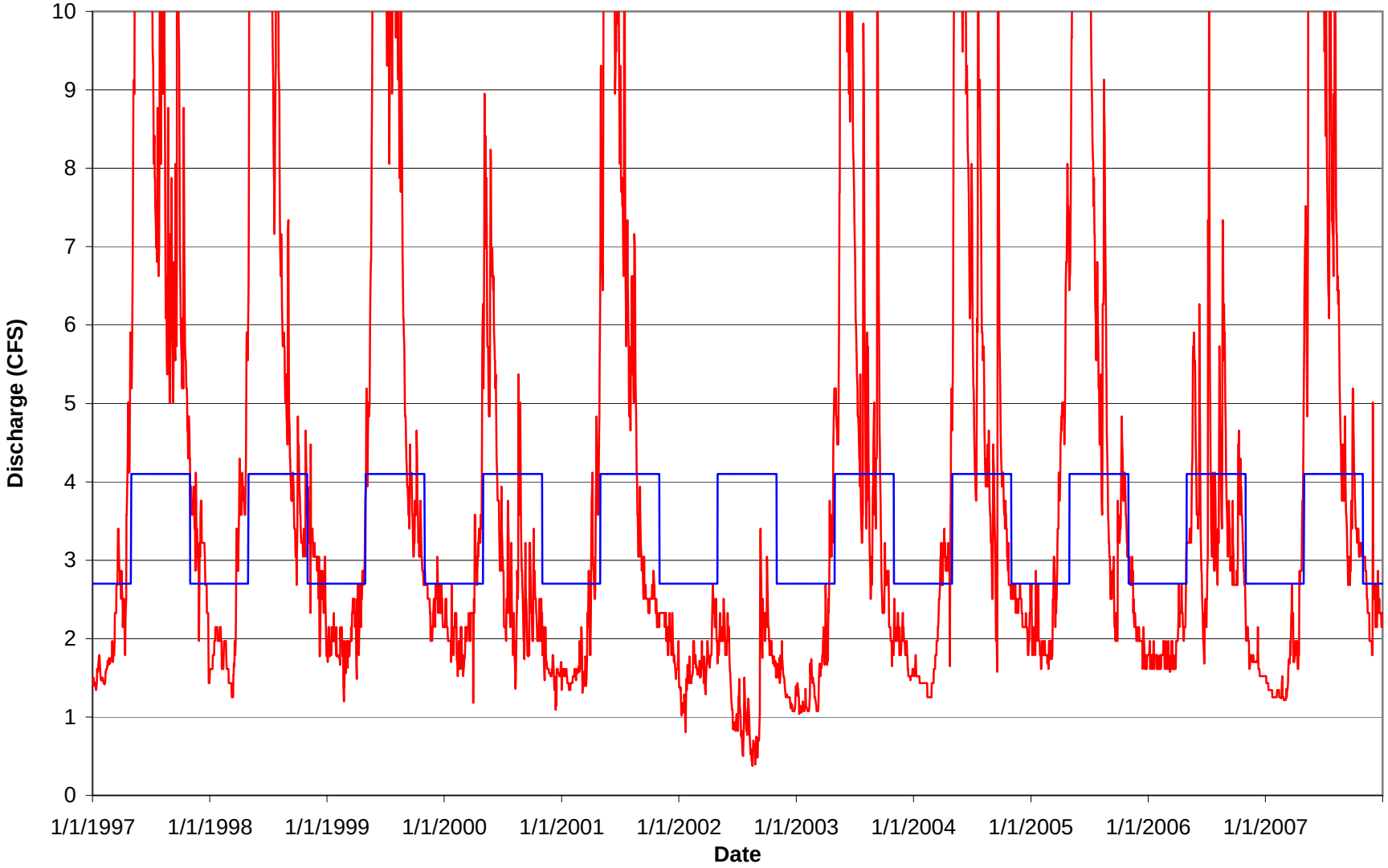


Figure 4. Proposed ISF vs. Discharge, Lower Huerfano River 1997-2007

Huerfano County

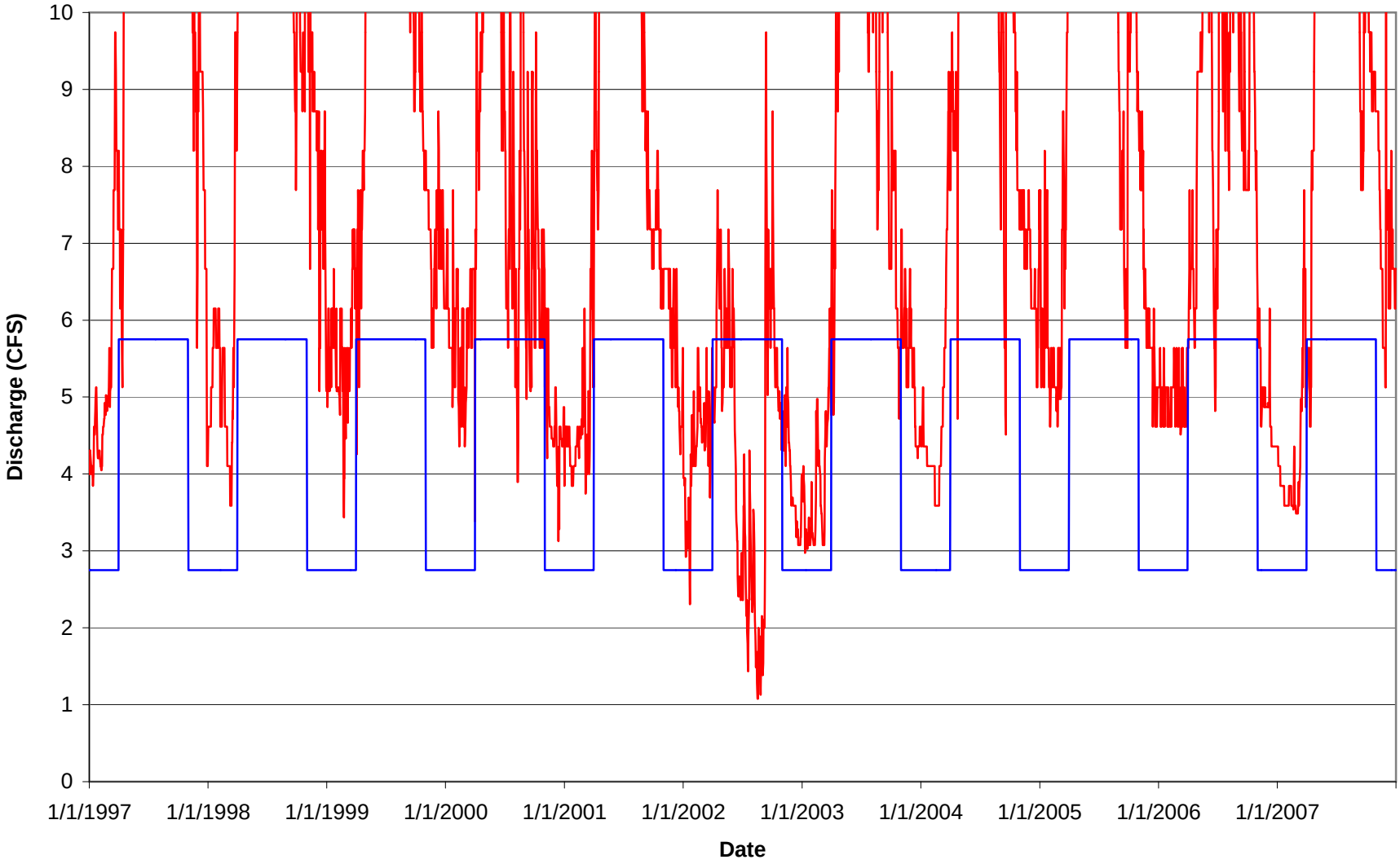


Figure 5. Proposed ISF vs. Discharge, Cucharas River, 1997-2007
Huerfano County

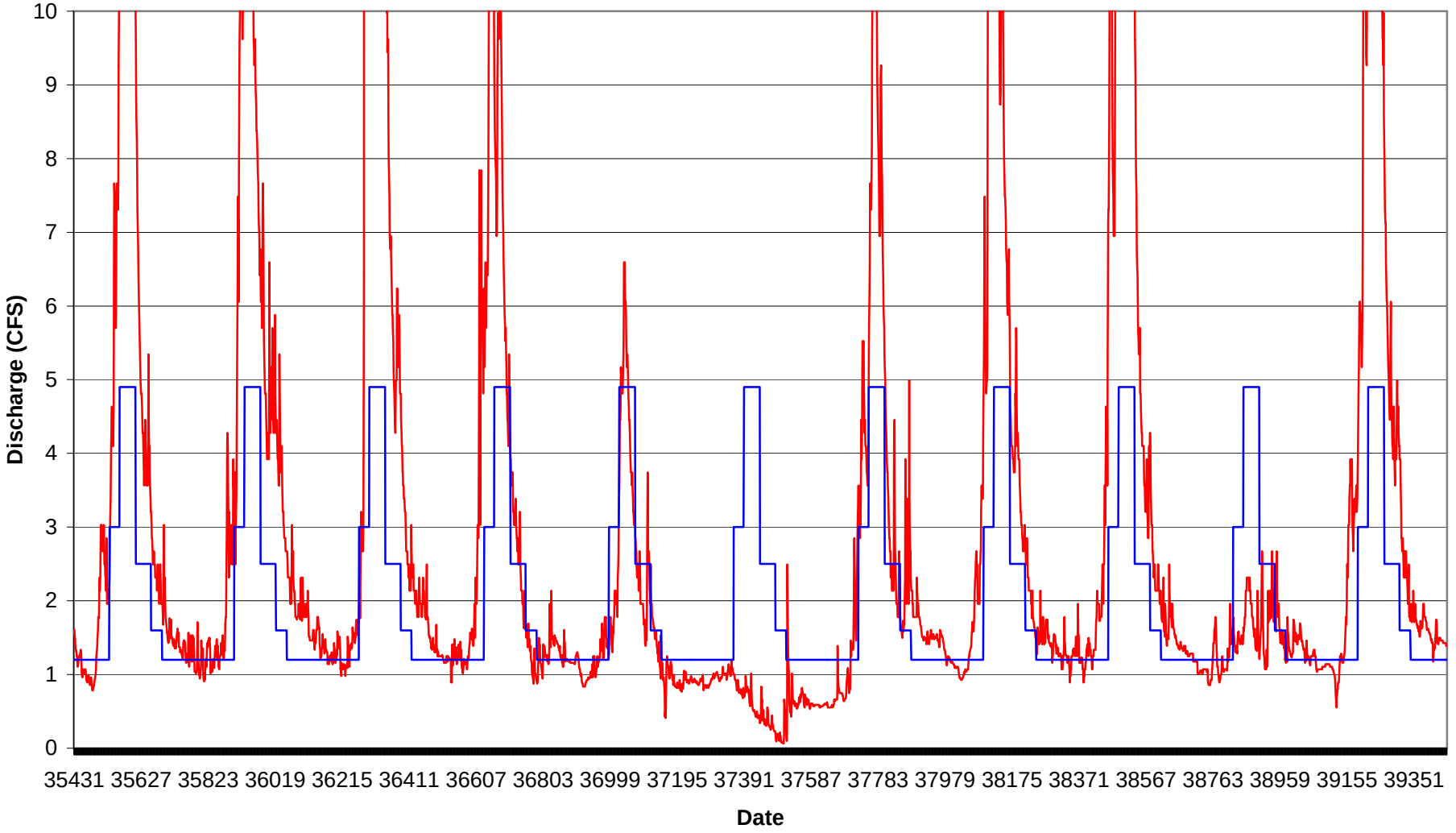
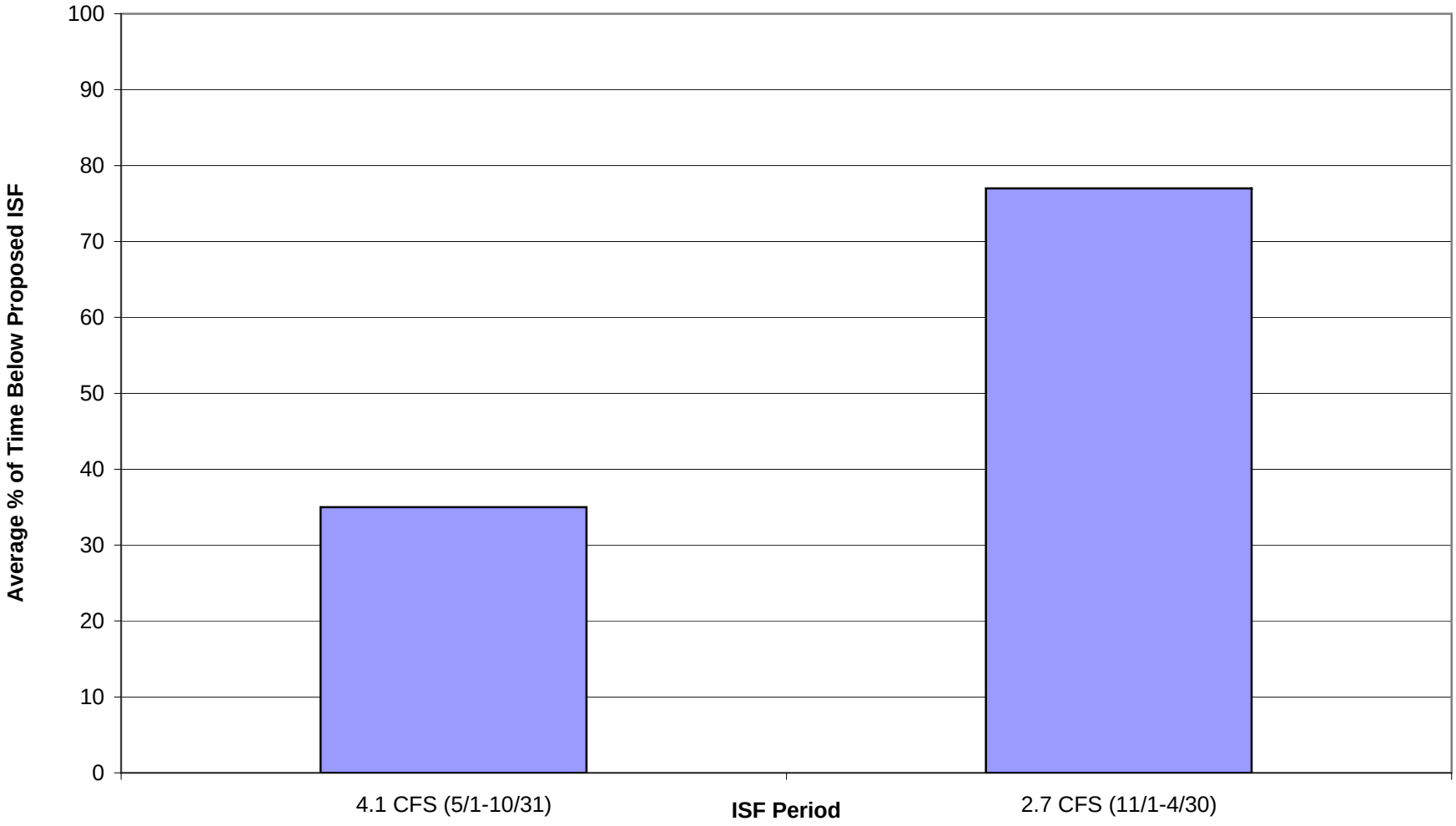
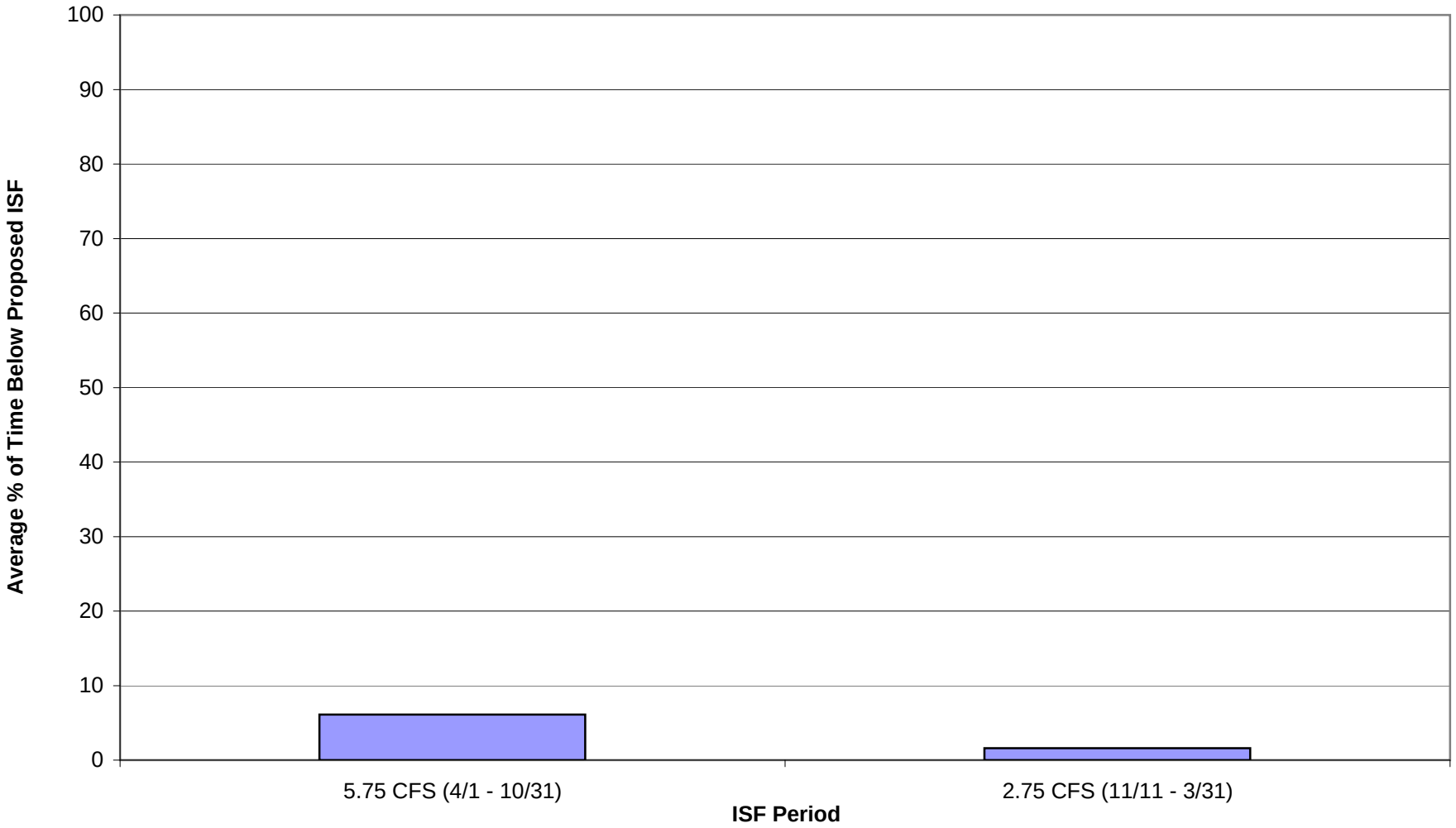


Figure 6. Average Percentage of Days Below Proposed ISF
Upper Huerfano River



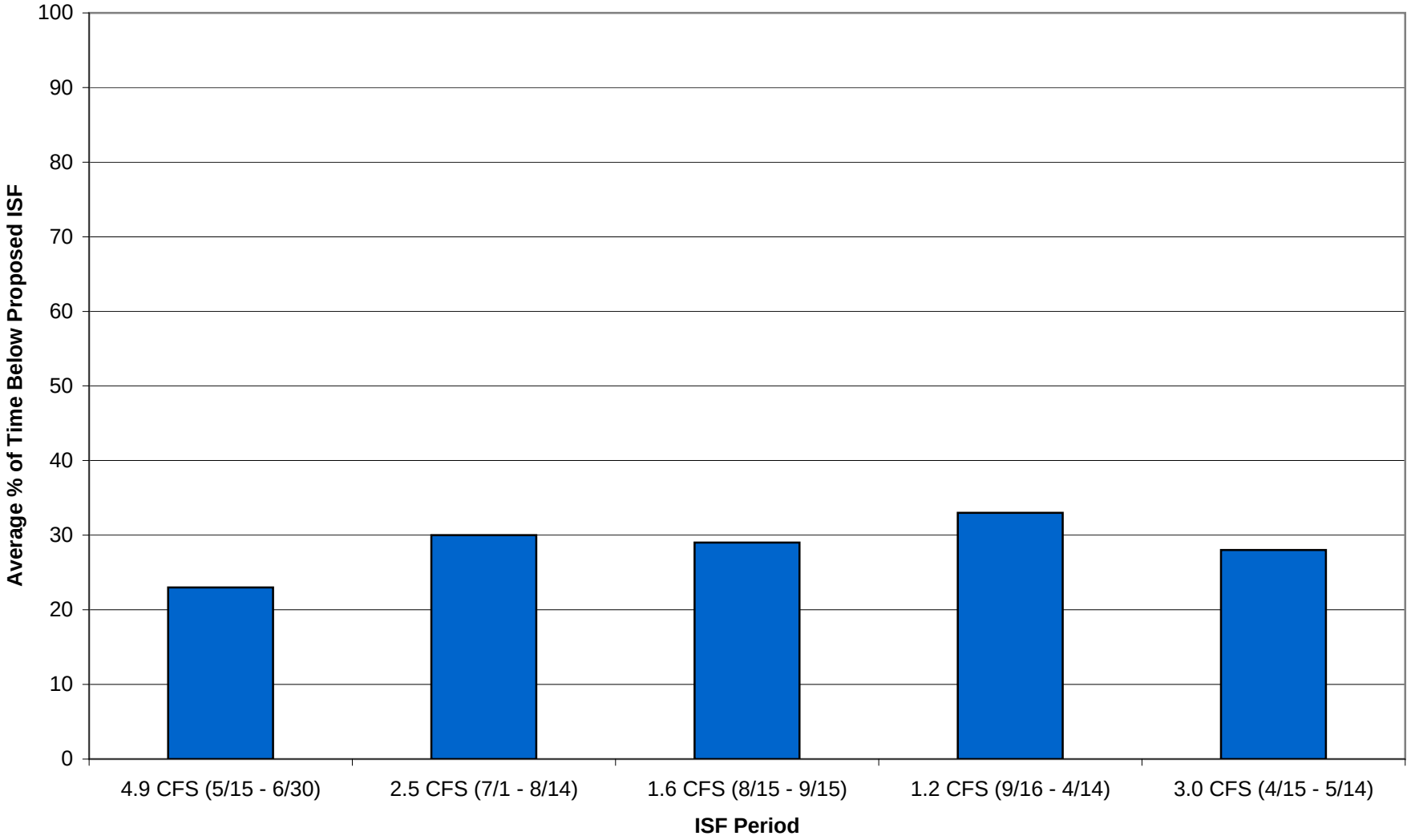
Source: Huerfano River Manzanares Gage (USGS 07111000), 1923 - Present

Figure 7. Average Percentage of Days Below Proposed ISF
Lower Huerfano River



Source: Huerfano River Manzanares Gage (USGS 07111000), 1923 - Present

Figure 8. Average Percentage of Days Below Proposed ISF
Cucharas River



Source: Cucharas River Boyd Ranch Gage (USGS 01114000), 1934 - Present

Attachment 1:

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

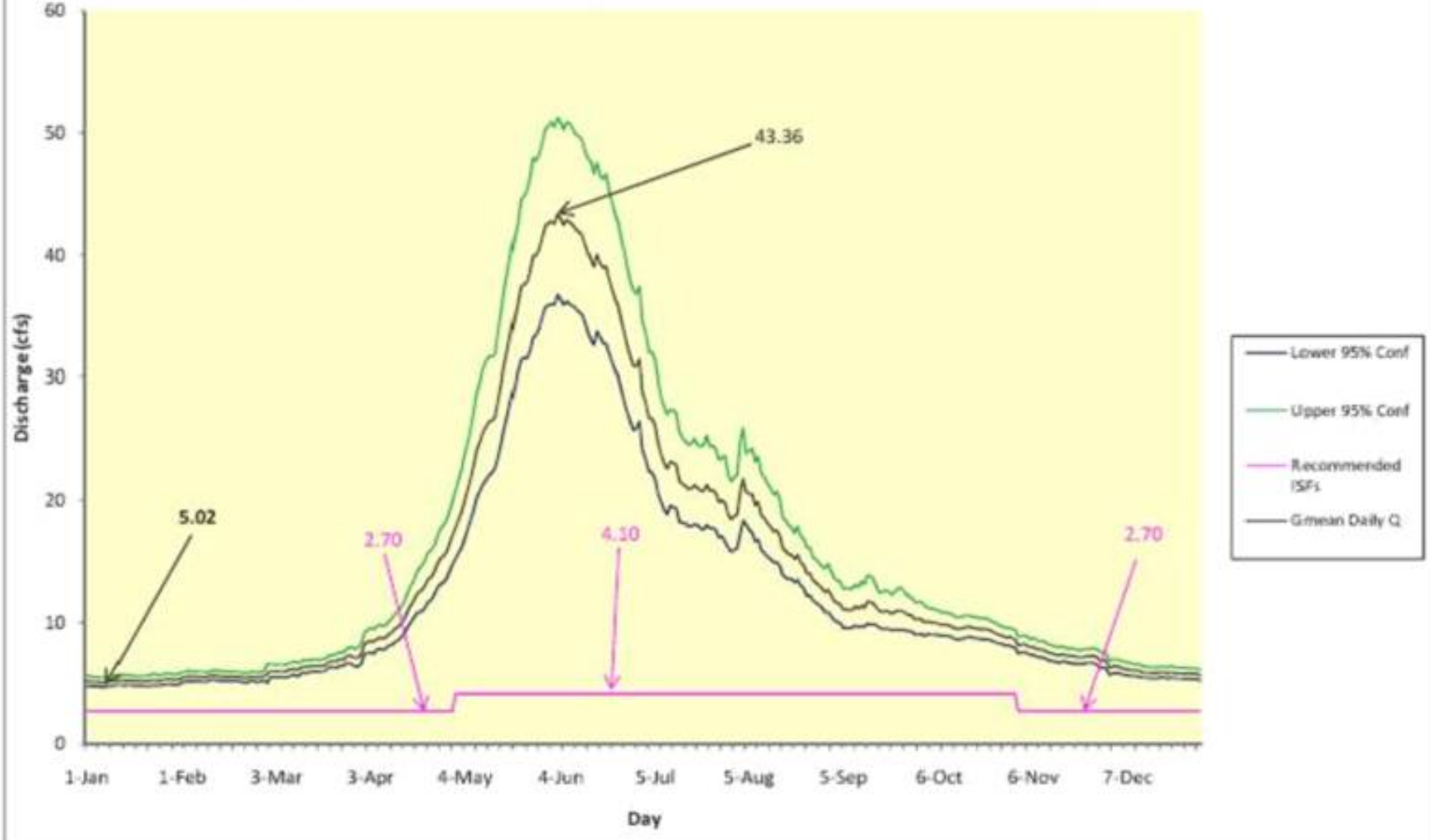


Fig. 1. Geometric Mean Daily Discharge Lower Huerfano R. abv LT (proportioned on Huerfano R. at Manzaneres-adj for irr), Adjusted for Irr, & ISFs

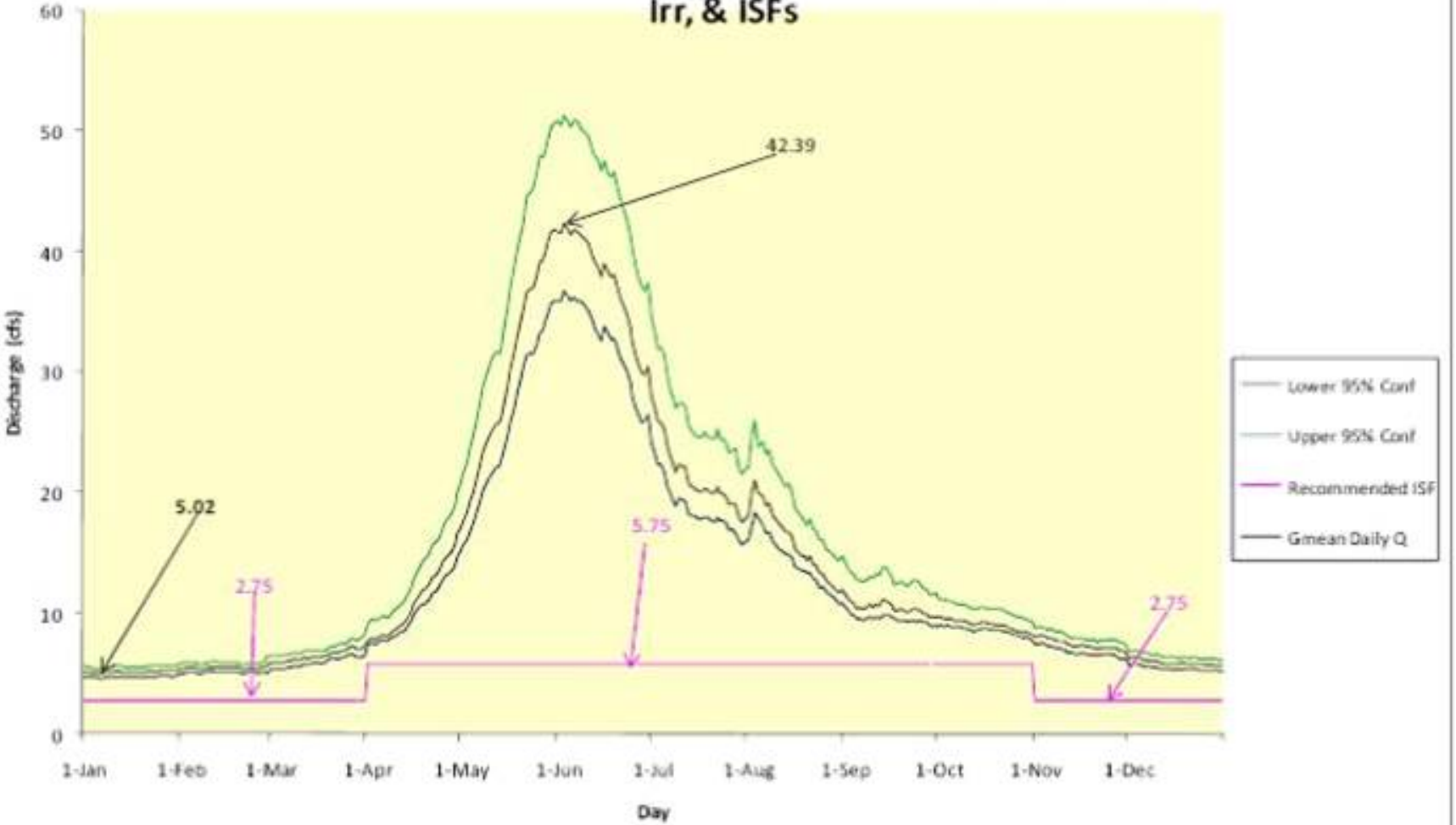
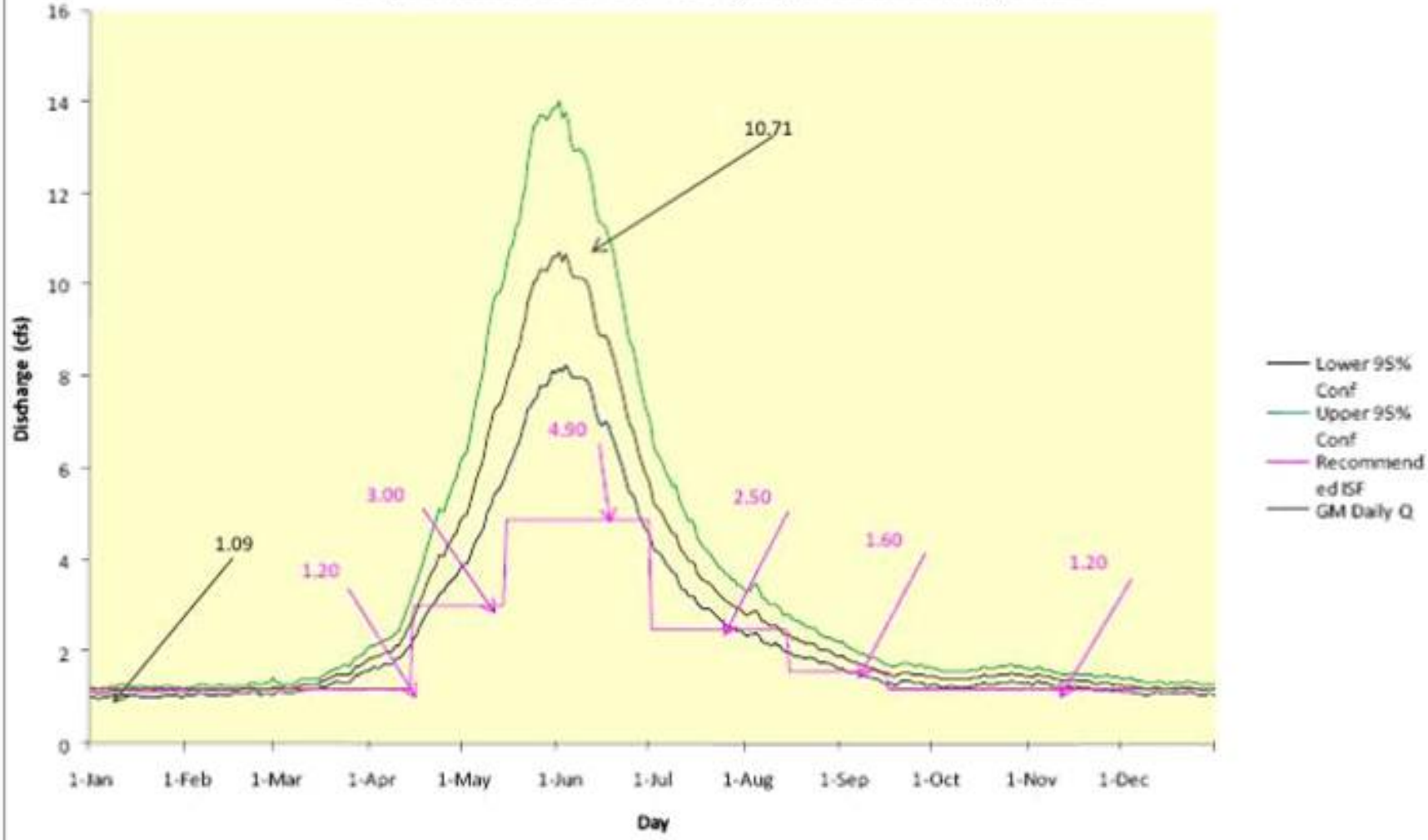


Fig. 1. Geometric Mean Q Cucharas Cr abv LT (prop on Cucharas R at Boyd Ranch near La Veta, adjusted for irr) & ISFs



555 RiverGate Lane, Suite B4-82
Durango, Colorado 81301
Tele: 970.385.2340
Fax: 970.385.2341
www.BikisWater.com

BĪKIS Water Consultants LLC

MEMORANDUM

To: Chris Cummins, Esq.

From: Dave Mehan
Bikis Water Consultants, LLC

Date: September 30, 2009

Re: R2Cross Modeling for Cucharas and Huerfano Rivers

INTRODUCTION/PURPOSE

This memorandum presents the results of field work and modeling to assess the reasonableness of the instream flows (ISFs) being proposed by the Colorado Water Conservation Board (CWCB) for the Cucharas and Huerfano Rivers.

BACKGROUND

The proposed ISFs and their bases are discussed in the "Executive Summaries and Staff Analysis and Recommendations", available at: www.cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices. The flow levels proposed for these water bodies are as follows:

Cucharas River:

- May 15 to June 30: 4.9 cubic feet per second (cfs)
- July 1 to August 14: 2.5 cfs
- August 15 to September 15: 1.6 cfs,
- September 16 to April 14: 1.2 cfs
- April 15 to May 14: 3.0 cfs

Upper Huerfano River:

- May 1 to October 31: 4.1 cfs
- November 1 to April 30: 2.70 cfs

Lower Huerfano River:

- April 1 to October 31: 5.75 cfs

- November 1 to March 31: 2.75 cfs

These proposed flows are based on R2Cross model runs and a water availability assessment by the CWCB, as described in the Executive Summaries at the website cited above.

R2Cross is a hydraulic model based on Manning's equation that is used to determine the amount of water needed to protect the natural environment. Use of the model is described in "Development of Instream Flow Recommendations Using R2Cross" (CWCB January 1996). Based on this manual, three specified parameters must be met: average depth, average velocity, and percent wetted perimeter. All three parameters must be met for an initial summer ISF recommendation; two of three parameters must be met for the initial wintertime ISF recommendation.

The values of these parameters depend on stream width. For the three stream reaches of interest that all have a top width of less than 20 feet, the values of these parameters are as follows:

- Average depth: 0.2 feet
- Average velocity: 1.0 feet per second (fps)
- Percent (bank-full) wetted perimeter: 50 percent

Fieldwork necessary for R2Cross includes completion of a cross-section and flow measurements at a riffle. The model is able to predict the values of the three parameters at flows that are 40 to 240 percent of the measured flow.

The recommended flows from R2Cross are adjusted to reflect water availability and water rights information.

METHODS

Fieldwork was conducted at both rivers on August 19, 2009, at which time baseflow conditions existed. A representative riffle was identified in each stream reach, the locations of which are shown on Figures 1a. and 1b. Field work consisted of the following at each site:

- Surveying of the channel cross-section and slope with a rod, tape and survey level.
- Measurement of flow at the section using a pigmy current meter.
- Qualitative macroinvertebrate assessment.
- Documentation of conditions with photographs.

Field data were input into R2Cross and the model run for each site. The results of the model runs were compared to the specified values of the hydraulic parameters and the results found by the CWCB.

RESULTS

Figures 2 through 4 show the surveyed cross-sections at the three sites. Tables 1 to 3 show the flow measurement calculations; the stream gaging field sheets are included in Attachment 1. Photographs of the sites are included in Attachment 2.

The measured flows at the sites on August 19, 2009, are as follows:

- Cucharas River: 6.43 cfs
- Upper Huerfano River: 7.25 cfs
- Lower Huerfano River: 14.61 cfs

The flow on this day at the U.S. Geologic Survey (USGS) stream gage at Boyd Ranch on Cucharas River was around 8.0 cfs; however, this gage is located a distance downstream with several intervening tributaries. The flow in the Huerfano River at Manzanares, which is downstream of the lower site, was around 10 cfs. The lower flow at the gage was due to irrigation diversions between the lower site and the stream gage.

The results of the R2Cross modeling are included in Attachment 3. The modeling by Bikis Water Consultants, LLC (BWC) found the following flows are needed to meet the model parameters:

- Cucharas River:
  - Summertime initial flow recommendation (all three parameters met): 2.4 cfs
  - Wintertime initial flow recommendation (two parameters met): 1.7 cfs
- Upper Huerfano River:
  - Summertime flow: 2.4 cfs
  - Wintertime flow: 2.2 cfs
- Lower Huerfano River:
  - Summertime flow: 4.5 cfs
  - Wintertime flow: 3.6 cfs

It should be noted that the above flows are slightly outside of the recommended range of accuracy of the R2Cross model (40 percent of the measured flow). However, the modeling results are still indicative of the amount of water required to meet the parameters, and results are often projected outside of the accepted range. For example, the winter flow recommendation by the State for the Lower Huerfano River was outside the accepted range of their modeling.

DISCUSSION

The summertime flow recommendation for Cucharas River by the CWCB is 4.9 cfs. CWCB reduced this to 3.0 and 2.5 cfs due to water availability limitations. The wintertime flow recommendation from the CWCB modeling was 1.3 to 2.0 cfs. The average of this (1.6 cfs) was reduced by CWCB to 1.2 cfs due to water availability limitations.

The water availability study by BWC found that the flow in the Cucharas River routinely goes below 1.0 cfs each winter (see Figure 5 of the BWC study). Therefore, it is recommended that any ISF that is adopted for this reach more accurately reflect water availability and be less than 1.0 cfs for the winter. Likewise, the water availability assessment found that the flow is less than 2.5 cfs towards the end of the summer in most years so that any flow adopted for July 1 to August 14 should be less than 2.5 cfs.

The summer and winter flow recommendations by the CWCB for the upper Huerfano River are 4.1 and 2.7 cfs, respectively. The water availability assessment by BWC showed that the flow in the river is less than these values each year, with flow being significantly below 2.7 cfs in the winter each year (See Figure 3 of BWC's study). The summer flow of 2.4 cfs determined by BWC's R2Cross modeling is more appropriate and supported by water availability. Any winter ISF adopted should be 2.2 cfs or less, consistent with BWC's model results and water availability.

The winter flow proposed by the CWCB for the Lower Huerfano (2.75 cfs) is lower than the flow derived by BWC. Flow data indicate that this flow is available most years (Figure 4 of BWC study). Therefore, 2.75 cfs appears reasonable if a winter ISF is adopted. The proposed summer ISF of 5.75 cfs is met most years, though the flow in the river is less than this amount at the beginning and end of the summer (Figure 4 of BWC study). The flow of 4.5 cfs derived by BWC is met more often. It is recommended that 4.5 cfs be used as the summer ISF to be more consistent with water availability.

Attachments: Figures 1a. and 1b. Locations of Field Work by BWC
Figures 2. to 4. Cross-sections
Attachment 1. Streamflow Gaging Forms
Attachment 2. Photographs
Attachment 3. BWC R2Cross Model Results

P:\Project Files\128-09 Huerfano County\R2Cross model memo 8-09\Memo-R2Cross Model report 9-30-09.doc

Figures

105°10'W 105°8'W 105°6'W 105°4'W 105°2'W

37°28'N 37°26'N 37°24'N 37°22'N 37°20'N 37°18'N 37°16'N

128-09 \Mapping \ArcMaps \Figure 1a

Map Sources:
Base Map - Huerfano County Topo and DEM - USGS
Rivers and Streams - CDSS
Proposed ISF Reaches - CWCB

Indian Creek
Price Canyon
Rilling Creek
un-named
Harrison Bridge Gage
Boyd Ranch Gage
(USGS 07114000)
Wade Canyon
Echo Canyon
Voires Canyon
Cucharas River
Bonnett Creek
Dodgeton Creek
Chaparral Creek
White Creek
Guajatoyah Creek
Baker Creek
Lower Terminus
BWC Fieldwork Location
Ogden Creek
un-named
un-named
Upper Terminus
North Fork Purgatoire River

Map Legend

- BWC Fieldwork Location (8/19/2009)
- Cucharas River Proposed ISF Reach
- Gage Station
- Stream
- Cucharas River

BIKIS Water Consultants LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340ph 385-2341fx
www.BikisWater.com

Feet
0 2,500 5,000 10,000
1 inch = 5,000 feet

Designed by: MJK
Detail by: DBM
Date: 08/28/2009
Scale: 1:60,000

Cucharas River Fieldwork Location Map

Figure 1A

Map Sources:
Base Map - Huerfano County Topo and DEM - USGS
Rivers and Streams and Diversions - CDSS
Proposed ISF Reaches - CWCB
Watershed Boundaries - NRCS

128-09\Mapping\ArcMaps\Huerfano ISF Map

105°30'0"W 105°28'0"W 105°26'0"W 105°24'0"W 105°22'0"W 105°20'0"W 105°18'0"W

37°48'0"N 37°46'0"N 37°44'0"N 37°42'0"N 37°40'0"N 37°38'0"N 37°36'0"N 37°34'0"N

Horse Canyon
Castle Creek
Sawmill Canyon
un-named
Garder Creek
Mosca Gulch
Morris Gulch
Aspen Creek
Potato Creek
un-named
un-named
un-named
un-named
North May Creek
South May Creek
May Creek
Pandeon Creek
Montez Ditch
Manzanares Gage
(USGS 07111000)
Huerfano River
Lower Huerfano River
BWC Fieldwork Location
Lower Terminus
Rito Creek
Stanley Creek
un-named
Manzanarez Creek
Sheep Creek
Deer Creek
Upper Terminus
Zapata Creek
Lower Terminus
South Fork Huerfano
un-named
Deep Canyon
un-named
Upper Huerfano River
BWC Fieldwork Location
Cascade Creek
Dutch Creek
Deep Creek
South Fork Huerfano
Middle Fork Placer
Placer Creek
un-named
Ute Creek
Upper Terminus
un-named
Grayback Canyon
Blanca Peak
East Fork Ute
un-named
Little Ute Creek

SAN ISABEL NATIONAL FOREST
SANGRE DE CRISTO

Map Legend

- BWC Fieldwork Location (8/19/2009)
- Lower Huerfano River Proposed ISF Reach
- Upper Huerfano River Proposed ISF Reach
- Gage Station
- Stream
- Huerfano River

BIKIS Water Consultants
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340ph 385-2341fx
www.BikisWater.com

Feet
0 3,000 6,000 12,000
1 inch = 6,000 feet

Designed by: MJK
Detail by: DBM
Date: 08/28/2009
Scale: 1:72,000

Huerfano River Fieldwork Location Map

Figure 1B

Figure 2. Upper Cucharas River Cross-section

Huerfano County

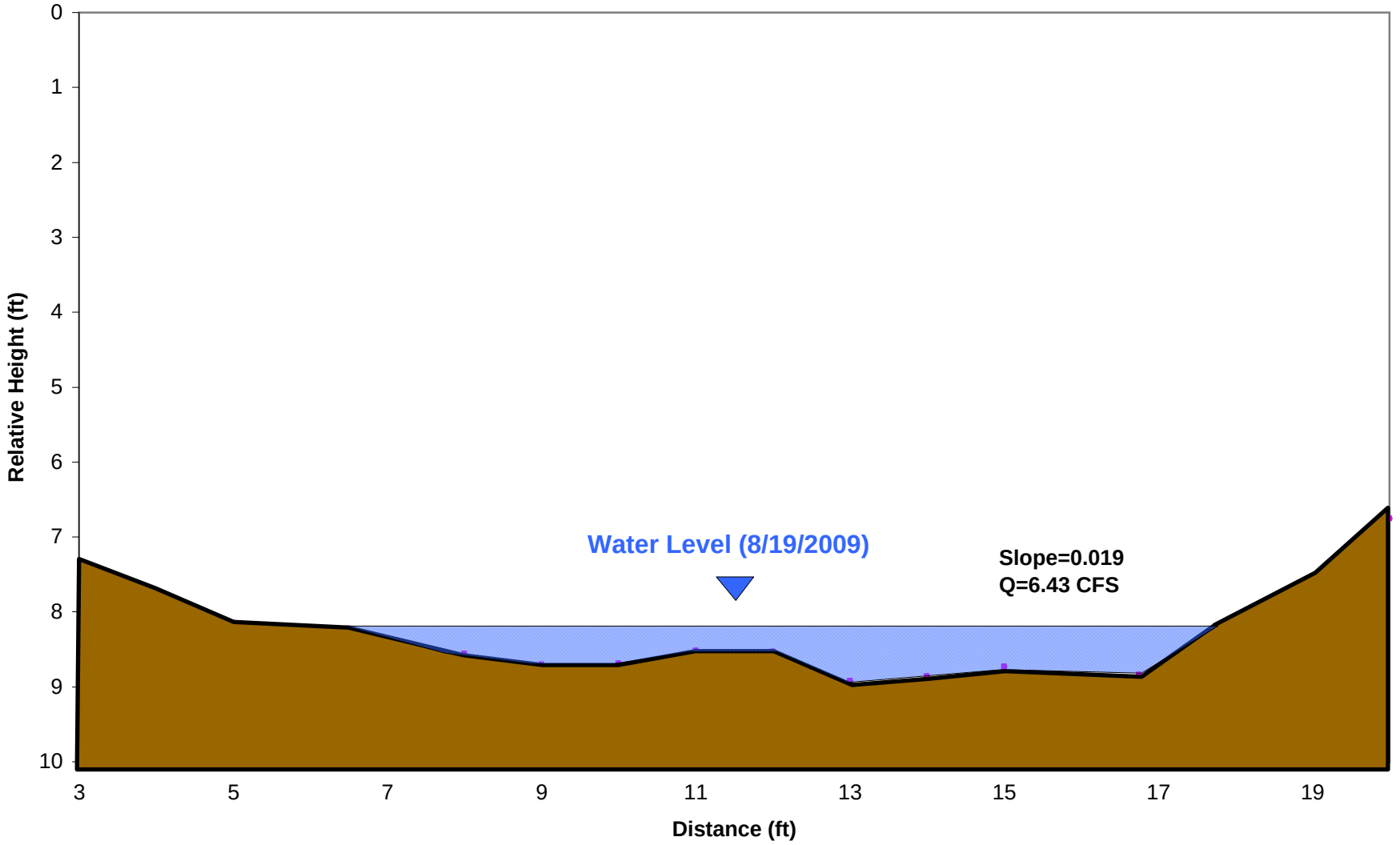


Figure 3. Upper Huerfano River Cross-section

Huerfano County

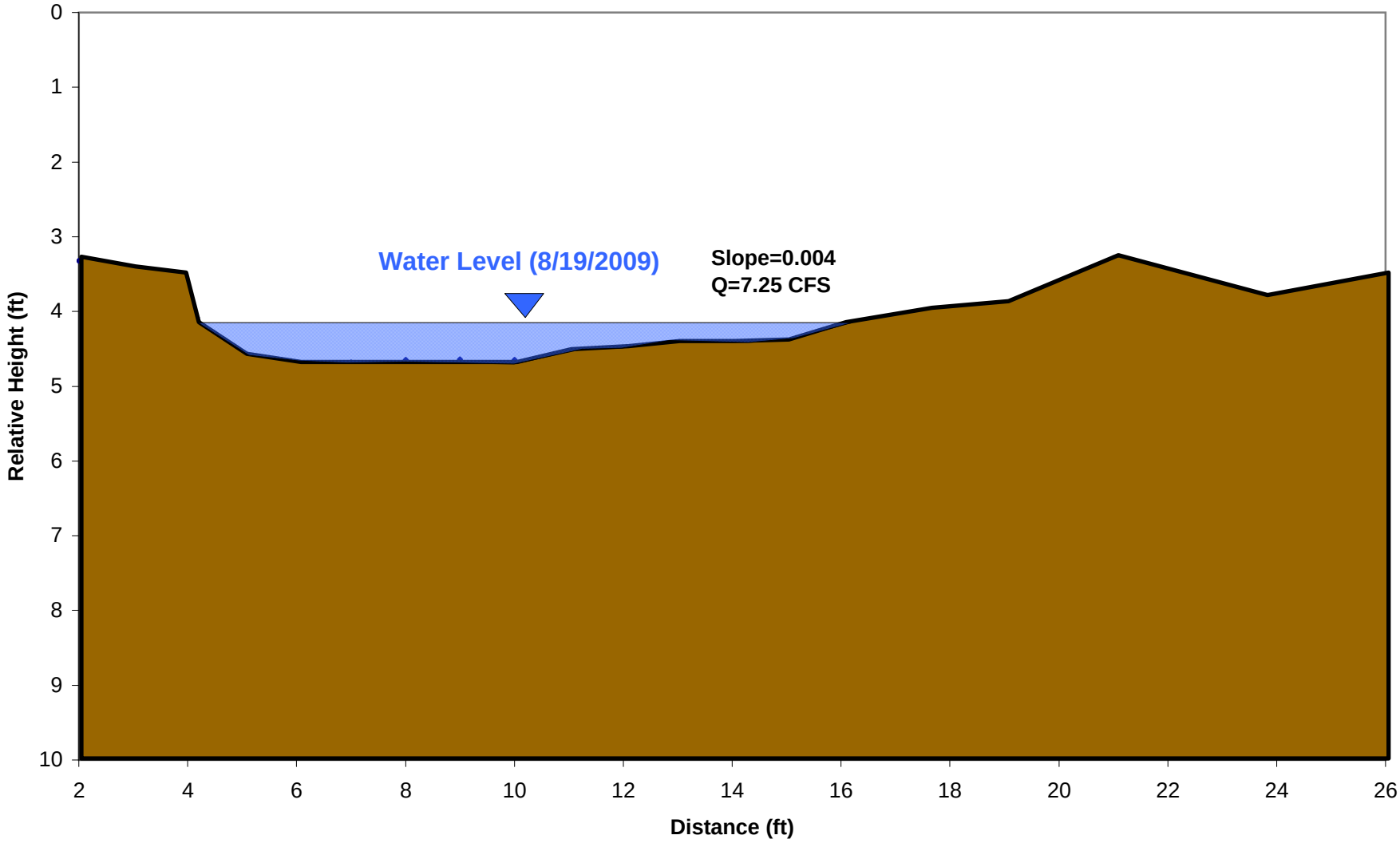
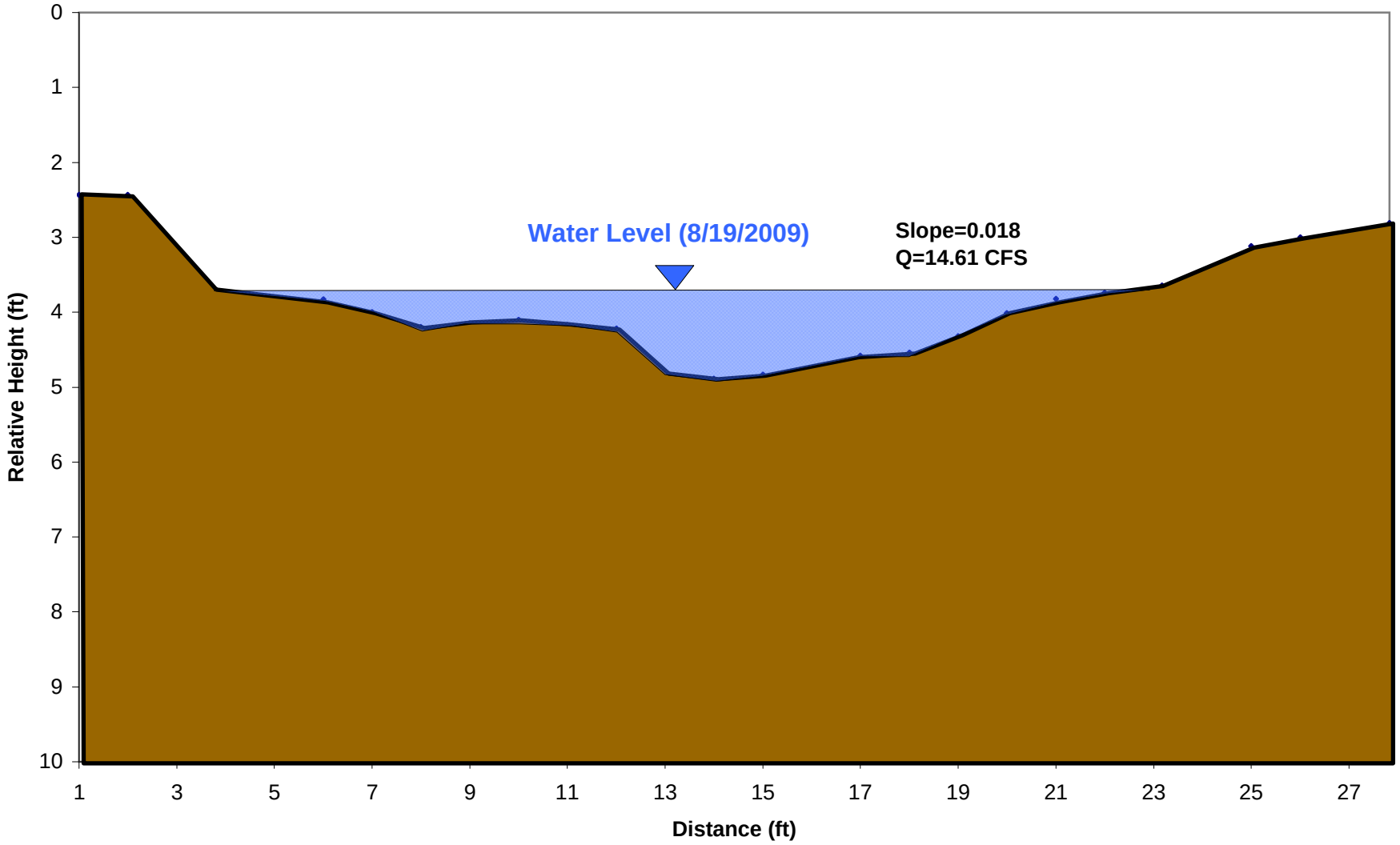


Figure 4. Lower Huerfano River Cross-section

Huerfano County



Attachment 1:

Form 9-275F
(Apr. 2001)

U.S. DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
WATER RESOURCES DIVISION
DISCHARGE MEASUREMENT AND
GAGE INSPECTION NOTES

Meas No 1
Comp by RR
Checked by OM

Sta No. LOWER HUCKLEBERRY 6/19/09
Sta Name
Date 6/19 2009 Party BWO
Width Area Vel G H Disch
Method WADING No secs G H change in hrs
Method coef. Horiz. angle coef. Susp Tags checked
Meter Type PIGMY Meter No. Meter ft. above bottom of wt.
Rating used Spin test before meas , after
Meas. plots % diff. from rating no. Indicated shift

GAGE READINGS

Time					Inside	Outside
	Start					
	Finish					
Weighted MGH						
GH correction						
Correct MGH						

Samples collected: water quality, sediment, biological, other
Measurements documented on separate sheets: water quality, aux./base gage, other
Rain gage serviced/calibrated
Weather: CLEAR, WARM
Air Temp 70 °F at
Water Temp °C at
Check bar/chain found
Changed to at
Correct

Wading, cable, ice, boat, upstr., downstr., side bridge, ft, mi upstr., downstr. of gage
Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow BASEFLOW
Cross section: UNIFORM

Gage operating Record Removed
Battery voltage Intake/Orifice cleaned/purged
Bubble-gage pressure, psi: Tank , Line , Bubble-rate /min
Extreme-GH indicators: max , min
CSG checked HWM height on stick Ref. elev HWM elev
HWM inside/outside:
Control:
Remarks:
GH of zero flow = GH - depth at control = ft rated
Sheet No 1 of 1 sheets

Front

River at -

ANGLE COEFFICIENT	DIST FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY AT POINT	VELOCITY MEAN IN VERTICAL	ADJUSTED FOR HOR. ANGLE OR	AREA	DISCHARGE
2.17	232"		0		0	0					
	21'		.1"		24	40					
	20'		.35		4	40					
	19'		.165		10	40					
	18'		.65		18	40					
	17'		.9		85	40					
	16'		.8		90	40					
	15'		.9		85	40					
	13'6"		1.2		24	40					
	12'		.5		45	40					
	11'		.7		95	40					
	10'		.66		90	40					
	9'		.66		100	40					
	8'		.5		87	40					
0	7'2"		.4		91	40					
0.33	6'4"		.15		64	40					
5.5	5'5"		.1		11	40					
3.92	3'11"		0		0	0					

SEE CALCULATIONS IN TABLE IN REPORT

WATER'S EDGE N. SIDE

WATER'S EDGE S. SIDE

Inside Top

Form 9-275F
(Apr. 2001)

U.S. DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
WATER RESOURCES DIVISION
DISCHARGE MEASUREMENT AND
GAGE INSPECTION NOTES

Meas No 1
Comp by RK
Checked by DM

Sta No. UPPER HUERFANO 8-19-09
Sta Name
Date 8/19 2009 Party RWC
Width ____ Area ____ Vel ____ G H ____ Disch ____
Method WADING No secs ____ G H change ____ in ____ hrs
Method coef ____ Horiz. angle coef ____ Susp ____ Tags checked ____
Meter Type PIGMY Meter No. ____ Meter ____ ft above bottom of wt
Rating used ____ Spin test before meas ____ , after ____
Meas. plots ____ % diff. from rating no. ____ Indicated shift ____

GAGE READINGS

Time					Inside	Outside
	Start					
	Finish					
Weighted MGH						
GH correction						
Correct MGH						

Samples collected: water quality, sediment, biological, other ____

Measurements documented on separate sheets: water quality, aux./base gage, other ____

Rain gage serviced/calibrated ____

Weather clear, warm
Air Temp ____ °C at ____
Water Temp ____ °C at ____
Check bar/chain found ____
Changed to ____ at ____
Correct ____

Wading, cable, ice, boat, upstr., downstr., side bridge, ____ ft, mi upstr., downstr. of gage
Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow BASEFLOW
Cross section: UNIFORM

Gage operating ____ Record Removed ____
Battery voltage ____ Intake/Orifice cleaned/purged ____
Bubble-gage pressure, psi Tank ____ Line ____ Bubble-rate ____ /min
Extreme-GH indicators: max ____ , min ____
CSG checked ____ HWM height on stick ____ Ref. elev ____ HWM elev ____
HWM inside/outside: ____
Control ____

Remarks ____

GH of zero flow = GH ____ - depth at control ____ = ____ ft rated ____

Sheet No 1 of 1 sheets

Front

River at -

ANGLE COEFFICIENT	DIST. FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY AT POINT	VELOCITY MEAN IN VERTICAL	ADJUSTED FOR HOR. ANGLE OR	AREA	DISCHARGE
0	4'		0		0	0					
4.42	4'5"		.3		25	40					
	5'		.1		34	40					
	5'6"		.6		43	40					
	6'8"		.75		67	40					
	7'6"		.65		78	40					
	8'6"		.3		39	40					
	9'6"		.3		20	40					
	10'6"		.5		68	40					
	11'6"		.3		94	40					
	12'6"		.25		69	40					
	13'6"		.5		87	40					
	14'6"		.4		55	40					
	15'6"		.25		15	40					
0	16'		.2		44	40					
18.92	16'11"		0		0	0					

WATERS EDGE W. SIDE

WATERS EDGE E. SIDE

See calculations in Table in Report.

Inside Top

J Smy 6 cfs

CDC 45 DAVE 5.5

Form 9-275F (Apr. 2001)

U.S. DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
WATER RESOURCES DIVISION
DISCHARGE MEASUREMENT AND GAGE INSPECTION NOTES

Meas. No 1
Comp by RK
Checked by OM

Sta No. Upper Cuchoras ck
Sta Name
Date 8/19 20 02 Party RWC
Width ____ Area ____ Vel ____ G.H. ____ Disch ____
Method WADING ____ No. secs ____ G.H. change ____ in ____ hrs
Method coef. ____ Horiz. angle coef. ____ Susp. ____ Tags checked ____
Meter Type PIGMY Meter No. ____ Meter ____ ft. above bottom of wt.
Rating used ____ Spin test before meas ____ , after ____
Meas. plots ____ % diff. from rating no. ____ Indicated shift ____

GAGE READINGS

Time					Inside	Outside
	Start					
	Finish					
Weighted MGH						
GH correction						
Correct MGH						

Samples collected: water quality, sediment, biological, other ____

Measurements documented on separate sheets: water quality, aux./base gage, other ____

Rain gage serviced/calibrated ____

Weather ____
Air Temp ____ °C at ____
Water Temp ____ °C at ____
Check bar/chain found ____
Changed to ____ at ____
Correct ____

Wading, cable, ice, boat, upstr., downstr., side bridge, ____ ft., mi. upstr., downstr. of gage.
Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow Baseflow
Cross section: UNIFORM

Gage operating ____ Record Removed ____
Battery voltage ____ Intake/Orifice cleaned/purged ____
Bubble-gage pressure, psi: Tank ____ , Line ____ , Bubble-rate ____ /min
Extreme-GH indicators: max ____ , min ____
CSG checked ____ HWM height on stick ____ Ref. elev ____ HWM elev ____
HWM inside/outside: ____
Control ____
Remarks ____

GH of zero flow = GH ____ - depth at control ____ = ____ ft. rated ____

Sheet No. 1 of 1 sheets

Front

River at -

ANGLE COEFFICIENT	DIST. FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY AT POINT	VELOCITY MEAN IN VERTICAL	ADJUST. ED FOR HOR. ANGLE OR	AREA	DISCHARGE
20.17	20'2"		0		0	0					
19.67	19'8"		.3		22	40					
	18'6"		.4		26	40					
	17'4"		.55		25	40					
	16'3"		.6		57	40					
	15'		.7		86	40					
	14'		.45		114	40					
	13'		.3		106	40					
	12'		.4		63	40					
	11'		.4		41	40					
	10'		.25		30	40					
	9'3"		.1		15	40					
	8'		0								

WATERS EDGE EAST BANK

WATERS EDGE WEST BANK

SEE CALCULATIONS IN Table in REPORT.

Inside Top

Attachment 2:

Huerfano County

Photo 1. Upper Cucharas River site.

Photo 2. Upper Cucharas River site looking downstream

Photo 3. Lower Huerfano River site.

Huerfano County

Photo 4. Lower Huerfano River site looking downstream.

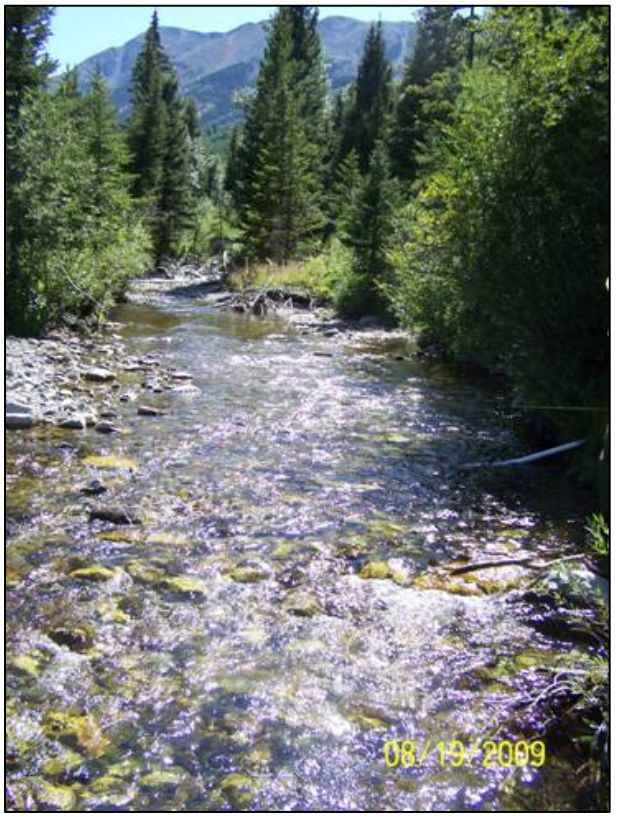


Photo 5. Upper Huerfano River site.

Photo 6. Upper Huerfano River site looking downsteram.

Attachment 3:

STREAM NAME: Cucharas River
XS LOCATION: 0
XS NUMBER: 0

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

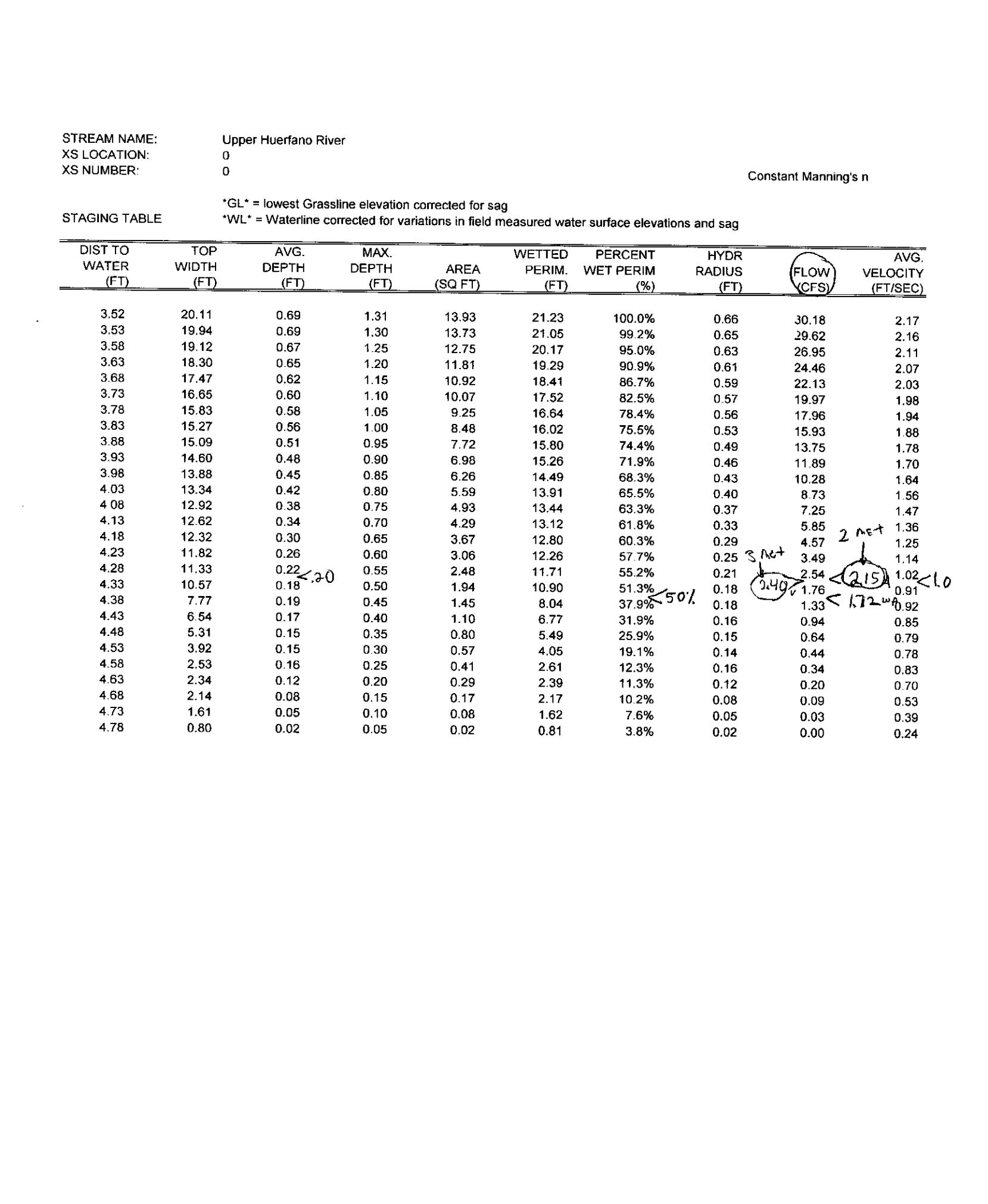
DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
7.56	17.92	1.12	1.70	20.10	18.60	100.0%	1.08	55.29	2.75
7.56	17.92	1.12	1.70	20.10	18.60	100.0%	1.08	55.29	2.75
7.61	17.72	1.08	1.65	19.21	18.37	98.8%	1.05	51.69	2.69
7.66	17.52	1.05	1.60	18.33	18.15	97.6%	1.01	48.20	2.63
7.71	17.32	1.01	1.55	17.46	17.92	96.3%	0.97	44.82	2.57
7.76	17.12	0.97	1.50	16.60	17.70	95.1%	0.94	41.54	2.50
7.81	16.94	0.93	1.45	15.75	17.49	94.0%	0.90	38.35	2.44
7.86	16.75	0.89	1.40	14.90	17.27	92.9%	0.86	35.28	2.37
7.91	16.57	0.85	1.35	14.07	17.06	91.7%	0.82	32.32	2.30
7.96	16.38	0.81	1.30	13.25	16.85	90.6%	0.79	29.47	2.23
8.01	16.20	0.77	1.25	12.43	16.64	89.4%	0.75	26.74	2.15
8.06	16.01	0.73	1.20	11.63	16.43	88.3%	0.71	24.12	2.07
8.11	15.83	0.68	1.15	10.83	16.21	87.2%	0.67	21.62	2.00
8.16	15.46	0.65	1.10	10.04	15.81	85.0%	0.64	19.39	1.93
8.21	14.32	0.65	1.05	9.30	14.66	78.8%	0.63	17.93	1.93
8.26	13.87	0.62	1.00	8.60	14.19	76.3%	0.61	16.09	1.87
8.31	13.59	0.58	0.95	7.91	13.88	74.6%	0.57	14.21	1.80
8.36	13.30	0.54	0.90	7.24	13.57	73.0%	0.53	12.44	1.72
8.41	13.02	0.51	0.85	6.58	13.27	71.3%	0.50	10.77	1.64
8.46	12.74	0.47	0.80	5.94	12.96	69.7%	0.46	9.22	1.55
8.51	12.45	0.43	0.75	5.31	12.66	68.0%	0.42	7.77	1.46
8.56	12.17	0.39	0.70	4.69	12.35	66.4%	0.38	6.43	1.37
8.61	11.46	0.36	0.65	4.10	11.62	62.5%	0.35	5.35	1.30
8.66	10.75	0.33	0.60	3.55	10.90	58.6%	0.33	4.38	1.24
8.71	10.42	0.29	0.55	3.02	10.55	56.7%	0.29	3.42	1.13
8.76	10.09	0.25	0.50	2.50	10.20	54.8%	0.25	2.57	1.02
8.81	9.75	0.21 < .20	0.45	2.01	9.84	52.9%	0.20 3 met	1.82 (1.43 d)	0.91 < 1.0
8.86	9.34	0.16	0.40	1.53	9.41	50.6% < 50%	0.16	1.19 (1.69 d)	0.78
8.91	7.58	0.15	0.35	1.11	7.65	41.1%	0.14 2 met	0.80 (1.17 w.p.)	0.72
8.96	4.83	0.16	0.30	0.77	4.88	26.2%	0.16	0.59	0.76
9.01	4.11	0.13	0.25	0.55	4.15	22.3%	0.13	0.37	0.68
9.06	3.52	0.10	0.20	0.36	3.55	19.1%	0.10	0.20	0.57
9.11	2.93	0.07	0.15	0.20	2.95	15.9%	0.07	0.08	0.43
9.16	1.65	0.05	0.10	0.08	1.67	9.0%	0.05	0.03	0.35
9.21	0.83	0.03	0.05	0.02	0.83	4.5%	0.02	0.00	0.22
9.26	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Upper Huerfano River
XS LOCATION: 0
XS NUMBER: 0

Constant Manning's n

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

DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
3.52	20.11	0.69	1.31	13.93	21.23	100.0%	0.66	30.18	2.17
3.53	19.94	0.69	1.30	13.73	21.05	99.2%	0.65	29.62	2.16
3.58	19.12	0.67	1.25	12.75	20.17	95.0%	0.63	26.95	2.11
3.63	18.30	0.65	1.20	11.81	19.29	90.9%	0.61	24.46	2.07
3.68	17.47	0.62	1.15	10.92	18.41	86.7%	0.59	22.13	2.03
3.73	16.65	0.60	1.10	10.07	17.52	82.5%	0.57	19.97	1.98
3.78	15.83	0.58	1.05	9.25	16.64	78.4%	0.56	17.96	1.94
3.83	15.27	0.56	1.00	8.48	16.02	75.5%	0.53	15.93	1.88
3.88	15.09	0.51	0.95	7.72	15.80	74.4%	0.49	13.75	1.78
3.93	14.60	0.48	0.90	6.98	15.26	71.9%	0.46	11.89	1.70
3.98	13.88	0.45	0.85	6.26	14.49	68.3%	0.43	10.28	1.64
4.03	13.34	0.42	0.80	5.59	13.91	65.5%	0.40	8.73	1.56
4.08	12.92	0.38	0.75	4.93	13.44	63.3%	0.37	7.25	1.47
4.13	12.62	0.34	0.70	4.29	13.12	61.8%	0.33	5.85	1.36
4.18	12.32	0.30	0.65	3.67	12.80	60.3%	0.29	4.57	1.25
4.23	11.82	0.26	0.60	3.06	12.26	57.7%	0.25	3.49	1.14
4.28	11.33	0.22	0.55	2.48	11.71	55.2%	0.21	2.54	1.02
4.33	10.57	0.18	0.50	1.94	10.90	51.3%	0.18	1.76	0.91
4.38	7.77	0.19	0.45	1.45	8.04	37.9%	0.18	1.33	0.92
4.43	6.54	0.17	0.40	1.10	6.77	31.9%	0.16	0.94	0.85
4.48	5.31	0.15	0.35	0.80	5.49	25.9%	0.15	0.64	0.79
4.53	3.92	0.15	0.30	0.57	4.05	19.1%	0.14	0.44	0.78
4.58	2.53	0.16	0.25	0.41	2.61	12.3%	0.16	0.34	0.83
4.63	2.34	0.12	0.20	0.29	2.39	11.3%	0.12	0.20	0.70
4.68	2.14	0.08	0.15	0.17	2.17	10.2%	0.08	0.09	0.53
4.73	1.61	0.05	0.10	0.08	1.62	7.6%	0.05	0.03	0.39
4.78	0.80	0.02	0.05	0.02	0.81	3.8%	0.02	0.00	0.24



STREAM NAME: Lower Huerfano River
XS LOCATION: 0
XS NUMBER: 0

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)
2.81	25.25	1.15	2.08	28.94	25.99	100.0%	1.11	71.25	2.46
2.84	24.94	1.13	2.05	28.24	25.66	98.8%	1.10	68.96	2.44
2.89	24.38	1.11	2.00	27.01	25.09	96.5%	1.08	64.99	2.41
2.94	23.82	1.08	1.95	25.80	24.51	94.3%	1.05	61.16	2.37
2.99	23.26	1.06	1.90	24.63	23.94	92.1%	1.03	57.49	2.33
3.04	22.76	1.03	1.85	23.47	23.41	90.1%	1.00	53.87	2.29
3.09	22.26	1.00	1.80	22.35	22.90	88.1%	0.98	50.37	2.25
3.14	21.86	0.97	1.75	21.25	22.47	86.5%	0.95	46.89	2.21
3.19	21.61	0.93	1.70	20.16	22.20	85.4%	0.91	43.31	2.15
3.24	21.35	0.89	1.65	19.09	21.93	84.4%	0.87	39.86	2.09
3.29	21.10	0.85	1.60	18.03	21.65	83.3%	0.83	36.54	2.03
3.34	20.85	0.81	1.55	16.98	21.38	82.3%	0.79	33.35	1.96
3.39	20.60	0.77	1.50	15.94	21.10	81.2%	0.76	30.29	1.90
3.44	20.34	0.73	1.45	14.92	20.83	80.2%	0.72	27.35	1.83
3.49	20.09	0.69	1.40	13.91	20.56	79.1%	0.68	24.55	1.77
3.54	19.84	0.65	1.35	12.91	20.28	78.1%	0.64	21.88	1.69
3.59	19.59	0.61	1.30	11.92	20.01	77.0%	0.60	19.34	1.62
3.64	19.34	0.57	1.25	10.95	19.73	75.9%	0.55	16.94	1.55
3.69	18.56	0.54	1.20	10.00	18.94	72.9%	0.53	14.97	1.50
3.74	17.11	0.53	1.15	9.11	17.49	67.3%	0.52	13.51	1.48
3.79	15.64	0.53	1.10	8.29	16.01	61.6%	0.52	12.25	1.48
3.84	14.51	0.52	1.05	7.54	14.88	57.3%	0.51	10.97	1.46
3.89	14.12	0.48	1.00	6.82	14.47	55.7%	0.47	9.47	1.39
3.94	13.75	0.45	0.95	6.13	14.09	54.2%	0.43	8.05	1.31
3.99	13.38	0.41	0.90	5.45	13.71	52.7%	0.40	6.74	1.24
4.04	13.01	0.37	0.85	4.79	13.33	51.3%	0.36	5.54 (4.52 wp)	1.16
4.09	12.68	0.33	0.80	4.15	12.98	49.9% < 50%	0.32	3 met 4.44 (3.61 v)	1.07 < 1.0
4.14	12.10	0.29	0.75	3.53	12.39	47.7%	0.28	3.49	0.99
4.19	11.52	0.25	0.70	2.93	11.80	45.4%	0.25	2 met 2.66	0.91
4.24	10.52	0.23	0.65	2.38	10.77	41.4%	0.22	2.00	0.84
4.29	9.49	0.20	0.60	1.88	9.72	37.4%	0.19	1.44	0.77
4.34	7.47	0.20	0.55	1.48	7.67	29.5%	0.19	1.14 d	0.77
4.39	5.41	0.22	0.50	1.18	5.59	21.5%	0.21	0.96	0.81
4.44	5.08	0.18	0.45	0.92	5.23	20.1%	0.18	0.66	0.72
4.49	4.77	0.14	0.40	0.68	4.91	18.9%	0.14	0.41	0.61
4.54	3.50	0.13	0.35	0.47	3.62	13.9%	0.13	0.27	0.59
4.59	2.19	0.15	0.30	0.33	2.29	8.8%	0.14	0.20	0.62
4.64	1.80	0.13	0.25	0.23	1.88	7.2%	0.12	0.13	0.56
4.69	1.44	0.10	0.20	0.15	1.51	5.8%	0.10	0.07	0.48
4.74	1.09	0.08	0.15	0.08	1.13	4.4%	0.07	0.03	0.40
4.79	0.73	0.05	0.10	0.04	0.76	2.9%	0.05	0.01	0.31
4.84	0.37	0.03	0.05	0.01	0.39	1.5%	0.02	0.00	0.20
4.89	0.01	0.00	0.00	0.00	0.01	0.1%	0.00	0.00	0.02

555 RiverGate Lane, Suite B4-82
Durango, Colorado 81301
Tele: 970.385.2340
Fax: 970.385.2341
www.BikisWater.com

BĪKIS Water Consultants LLC

MEMORANDUM

To: Huerfano County
C/o Chris Cummins, Esq

From: Dave Mehan and Eric Bikis
Bikis Water Consultants, LLC

Date: September 30, 2009

Re: Evaluation of Water Reservation for Huerfano County–Proposed CWCB Instream Flow Filings

As requested, Bikis Water Consultants, LLC (BWC) has evaluated the need for a "carve-out" or "reservation" of water for Huerfano County that would be senior to the instream flow (ISF) filings proposed for the Cucharas and Huerfano Rivers by the Colorado Water Conservation Board (CWCB). It is our understanding that the goal is to define locations, volumes, and diversion rates of water that could be stored in one or more reservoirs in the upper reaches of the watersheds for future uses. Such reservoirs could be constructed by the County and/or local water districts and entities and used per an agreement between the parties.

An agreement would be reached with the CWCB to allow this water to be stored, even though it would be junior to the ISF rights.

This evaluation is based on discussions with representatives of the County regarding future water demands, along with our analysis of future water demands in the area, and our previous experience with ISF water rights filings elsewhere in the state.

The following summarizes our conclusions on future water demands:

1. Growth is projected at one to two percent for Huerfano County. However, this rate appears low and is not appropriate for future water supply planning. While there is uncertainty with the growth of the national and state economies at this time, completion of only one or two projects in the County could result in relatively significant growth and an associated increase in future water demand. Such projects include energy-related developments or the re-opening of Cucharas Ski Resort (CSR). To put it another way, there appears to be a reasonable chance that a project will come on-line in the County in the foreseeable future, and if water is not available (reserved), it could have a significant, negative impact on the economy of Huerfano County.

2. Given the current distribution of population and potential growth, much of the future growth and associated water demand will be in the Cucharas River basin. Re-opening of the CSR is possible. This would result in immediate water demands for the ski area, including for snowmaking, and also new water demands for development at the ski area base, the Town of Cucharas, and in and around La Veta.

Reports by others have found that CSR is restricted by inadequate snowmaking, and by a lack of storage for this and other uses, in particular. If the ISF's that are being proposed for Baker Creek and Upper Cucharas Creek are adopted, future water rights applications for storage in the basin would be junior to the ISF rights.

The City of Walsenburg, the largest city in the County, also relies on Cucharas Creek. While towards the downstream end of the basin, it too could benefit from increased storage in the upper basin.

3. The upper Huerfano River basin is reliant upon water for agricultural uses. There is a substantial amount of irrigation in the upper basin. The protection of water for this purpose is essential. Reservation of water for agricultural uses could increase the flexibility of water used for irrigation.

WATER RIGHTS AND ESTIMATED FUTURE DEMANDS

A reservation of water for the subject basins can be based on the nature of the decreed water rights owned, and on projections of future water use.

Cucharas River Basin

Water rights and future water demands for the Cucharas River were assessed through evaluation of demands by:

- The CSR and associated development,
- The Town of Cucharas,
- The Cucharas Water and Sanitation District (CWSD), and
- The City of Walsenburg.

Information provided indicates that CSR owns historic ditch rights in the Cucharas River, and the CWSD owns decreed rights in the Calf Pasture Ditch and the Baker Creek Diversion.

A relatively detailed assessment of future water needs for CSR was completed by W.W. Wheeler and Associates (Wheeler) in 1984. This assessment considered snowmaking demands along with other uses at CSR and downstream. Without detailed, updated information on plans at CSR, we recommend that this study be used for future water demands in the upper Cucharas basin. This assessment found that water demand is more critical during winter months when demands for snowmaking and in-house use at CSR compete with downstream agricultural uses (stock watering) and municipal uses by La Veta, Walsenburg, and CWSD. Wheeler reports the minimum flow in Baker Creek during the winter to be 0.45 cubic feet per second (cfs), and the combined municipal and snowmaking water demand to be 0.11 to 0.13 cfs.

CSR is approved for 1,077 residential units by the County, of which 407 units are currently unallocated for future growth. The CWSD considers one residential unit to equate to one equivalent residential unit (EQR), with one EQR equal to 0.000341 cfs. Therefore, the annual water requirement for the 407 units is approximately 100 acre-feet (AF) per year. CSR obtained a

commitment for water service for this level of development in exchange for water rights in the Calf Pasture Ditch which were conveyed to the CWSD in 1984. The EQRs are fully transferable within the development for residential and snowmaking purposes.

CSR owns an additional 2.266 cfs of water rights downstream on the Cucharas River. These water rights could reportedly be used to meet future water needs for CSR and surrounding area, including for storage, but they would need a change in use for this purpose. This change could be junior to any ISF filing on the upper Cucharas River (and Baker Creek).

Based on an evaluation of the snowmaking system, Wheeler found that sufficient water rights exist to provide the recommended amount of snowmaking, but that storage was lacking. Based on our experience, the numbers Wheeler used for snowmaking appear reasonable. They recommended that 8 AF of storage be constructed to enable a viable snowmaking system. A filling rate of 200 gallons per minute (0.45 cfs) is recommended to enable filling of the pond in 12 days.

Information provided by the towns of La Veta and Walsenburg indicate that both rely on water from the Cucharas River. Around 206 AF is currently used by La Veta; around 1,080 AF is used by Walsenberg. Demand is projected to increase by three percent annually for a total demand of 1,727 AF per year in ten years and 2,322 AF per year in 20 years. This results in an increased water demand for both towns of approximately 1,036 AF per year.

Lastly, there has been interest in a wind farm or other alternative energy development. While the exact water requirements of such a project are not known, there could be a relatively large water demand, including for construction.

Huerfano River Basin

The principal water use in the Huerfano basin is for agriculture. Aerial photographs (summer of 2005) indicate that there is over 7,000 acres of irrigated land currently in the upper basin in a mix of pasture grass and alfalfa.

Water for this irrigation is provided principally by direct flow water rights. There are several relatively small reservoirs on tributaries to the river, but no main stem storage. Therefore, irrigation is largely dependent on water flow in the river. Construction of additional storage would provide more flexibility for irrigators.

This irrigation results in a significant amount of consumptive use (CU). This is evidenced by the fact that the Huerfano River is often dry at Boone, near its mouth, while upper stations always report flow.

RECOMMENDATIONS

1. It is recommended that a separate storage and diversion reservation be requested for the upper Huerfano and Cucharas basins. The reservations should be based on projected water demands and decreed water rights amounts. The reservation could be stored in one or more structures and the water could be used for any purpose. Management of the reservoirs would be determined jointly by those desiring to participate, including the County, CWSD, the Towns, and CSR.

2. For the upper Cucharas River, we recommend that a storage amount of 108 AF (8 AF for snowmaking plus 100 AF for in-house uses) be requested. In addition, future demand in lower basin is projected to be 1,036 AF for a total of 1,144 AF per year to the entire Cucharas River basin.

3. It is more difficult to derive a recommended reservation of water for the Huerfano River since most of the use is for irrigation. If based on this irrigation, a relatively large reservation would be calculated. For example, a reasonable basis is to reserve one month of demand during the summer. However, a demand of three inches for July for 7,000 acres of irrigation is 1,750 AF.

   Alternatively, we recommend that 250 AF be reserved for storage. This amount would provide flexibility for irrigation practices, could be stored realistically, and would not result in a significant reduction in stream flow.

P:\Project Files\128-09 Huerfano County\Future Water Needs\Memo-Eval for Water Reservation 09-30-09.doc\