BEFORE THE COLORADO WATER CONSERVATION BOARD

STATE OF COLORADO

Prehearing Statement of Staff of the Colorado Water Conservation Board

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IN THE MATTER OF THE CWCB STAFF'S RECOMMENDATIONS FOR AN INSTREAM FLOW APPROPRIATION ON MORRISON CREEK, DIVISION 6

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 an instream flow ("ISF") appropriation on the subject reaches of Morrison Creek 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 Morrison Creek, in Routt County. None of the parties to this proceeding have contested the existence of a natural environment on the subject reaches of Morrison Creek.

2) The instream flow amounts recommended by Staff for the subject reaches of Morrison Creek:

   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 Morrison Creek: (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 recommendation for the Morrison Creek ISF meets 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 14, 2010 Memorandum from Jeff Baessler to the CWCB, Agenda Item 11a, containing the stream flow tabulation for the Morrison Creek ISF and Staff's request that the Board form its intent to appropriate, attached as **Exhibit 1**.

2) Letter from the CDOW, dated January 8, 2010 and letter from James Larson, Dequine Family LLC, and Flying Diamond Resources, dated February 20, 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 instream flow appropriations on Morrison Creek, 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 2, 2010 Notice to the ISF Subscription Mailing List, indicating that the CWCB Board declared its intent to appropriate an ISF on Morrison Creek and the deadline to contest the appropriation is March 31, 2010, attached as **Exhibit 6.**

7) November 12, 2009 Notice to the ISF Subscription Mailing List, indicating that Morrison Creek is being considered for an instream flow appropriation at the January 2010 CWCB Board meeting, attached as **Exhibit 7.**

8) March 17, 2009 Notice to the ISF Subscription Mailing List, indicating that Morrison Creek is being considered for an instream flow appropriation at the January 2010 CWCB Board meeting, attached as **Exhibit 8.**

9) November 7, 2009 Memorandum from Jeff Baessler to the CWCB, Agenda Item 10, indicating that Morrison Creek is being considered by for an instream flow appropriation at the January 2010 CWCB Board meeting, attached as **Exhibit 9.**

10) March 6, 2009 Memorandum from Jeff Baessler to the CWCB, Agenda Item 21, outlining 54 new instream flow recommendations being noticed and processed by staff for possible inclusion into the Instream flow and Natural Lake Level Program in 2010, including the subject reaches of Morrison Creek, attached as **Exhibit 10.**

11) July 29, 2009 Notice to the ISF Subscription Mailing List, indicating that CWCB will be giving a presentation on division 6 proposed ISF's for 2010 at the Routt County Commissioner meeting in Steamboat Springs on August 4th 2009, attached as **Exhibit 11.**

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

13) 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.

Dated this 9th day of July, 2010.

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 9th day of July, 2010, I caused a true and correct copy of the foregoing Prehearing Statement to be served via electronic mail to each of the following:

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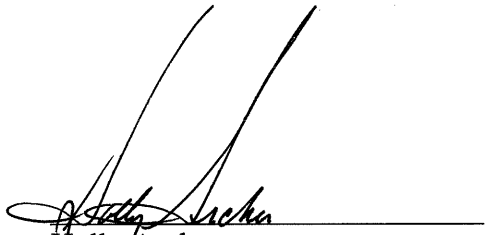

Holly Archer
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Exhibit 1

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
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TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler
Stream and Lake Protection Section

DATE: January 14, 2010

SUBJECT: **Agenda Item 11a, January 26-27, 2010, Board Meeting**
Stream and Lake Protection Section – New Appropriation Recommendations in Water Divisions 1, 2, 4, 5, 6 and 7

Summary

This memo outlines the history of ISF recommendations identified for appropriation in 2010 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 25 new instream flow water rights in Water Divisions 1, 2, 4, 5, 6 and 7 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 instream 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 25 stream segments in Water Divisions 1, 2, 4, 5, 6 and 7 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, Custer, Gunnison, Hinsdale, Jackson, Larimer, Moffat, Montrose, Pueblo, Rio Blanco, Routt, Saguache, and San Juan Counties. Letters and correspondence regarding some of these recommendations have been included in the Instream Flow Recommendation Notebook and are also available on the Board's web site.

It should be noted that although 52 recommendations either were received at the February 2009 workshop, or were carryover recommendations from previous years, only the attached 25 recommendations are being moved forward by staff at this time. The San Miguel River recommendation will be discussed in Agenda Item 11b. Staff has been unable to move forward on the remaining 26 stream segments because additional stakeholder discourse and/or additional

data collection and analysis are required. The following table identifies the streams that Staff will bring back to the Board at a future date.

Division	Stream Name	County (ies)	Recommender(s)
1	Coal Creek *(Boulder County Open Space Boundary to Louisville Wastewater Treatment outfall)*	Boulder	City of Louisville, CDOW
1	Coal Creek *(to Louisville Wastewater Treatment outfall to Lafayette pumping station #2)*	Boulder	City of Louisville, CDOW
2	Gibson Creek *(headwaters to Verde Creek)*	Custer	CDOW
2	Beaver Creek *(East Beaver Creek to Unnamed Tributary)*	Fremont	CDOW
2	East Beaver Creek *(Gould Creek to Beaver Creek)*	Fremont	CDOW
2	West Beaver Creek *(Douglas Gulch to East Beaver Creek)*	Fremont	CDOW
2	Baker Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Bonnett Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Chaparral Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Dodgeton Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
3	Mill Creek *(USFS boundary to hdgt Harence Ditch)*	Saguache	BLM
4	Big Dominguez Creek *(Segment in Wilderness Boundaries)*	Delta/Mesa	BLM
4	Little Dominguez Creek *(Segment in Wilderness Boundaries)*		
4	Tabeguache Creek *(unnamed trib to Forest Service Boundary)*	Montrose	USFS
4	North Fork Tabeguache Creek *(headwaters to Tabeguache Creek)*	Montrose	USFS
4	Red Canyon Creek (*headwaters to Horsefly Creek)*	Montrose	USFS
5	Eagle River (ISF Increase) *(confl Cross Creek to confl Gore Creek)*	Eagle	Town of Minturn, CDOW
5	Colorado River *(Blue River to Piney River)*	Grand/Eagle	CDOW
5	Colorado River *(Piney River to Eagle River)*	Grand/Eagle	CDOW
5	Colorado River *(Eagle/Grand County Line to Eagle River)*	Eagle	Eagle County
6	Moeller Creek *(headwaters to confl Fawn Creek)*	Rio Blanco	CDOW
6	Wheeler Creek *(Headwaters to South Fork Big Creek)*	Jackson	BLM
6	North Fork North Platte River *(Headwaters to headgate Little Nellie Ditch)*	Jackson	BLM
6	South Fork Big Creek *(confl Wheeler Creek to Colorado-Wyoming Border)*	Jackson	BLM
6	Piceance Creek *(confl with Dry Fork to Confl with White River)*	Rio Blanco	BLM, CDOW
6	Yellow Creek *(Springs in NWNE S12, T1N R98W, 6PM to confl White R.)*	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. In some cases, staff also relied upon pressure transducer data and flow measurements made as part of the field survey to help identify the amount of water physically available in each stream. In addition, staff 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,

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

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 1

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
10/1/A-001	Black Hollow Creek	Cache la Poudre	Larimer	headwaters in the vicinity of lat 40 38 28N long 105 41 24W	confl Cache la Poudre River at lat 40 42 04N long 105 38 52W	5.49	Kinikinik	1.4 (10/1 - 11/15) 0.75 (11/16 - 4/30) 2.2 (5/1 - 9/30)	

Totals for Water Division 1

Total # of Stream Miles = 5.49

Total # of Appropriations = 1

(Totals do not include donated/acquired water rights)

Instream Flow Tabulation - Water Division 2

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
10/2/A-001	Baldwin Creek	Arkansas headwaters	Chaffee	outlet of Baldwin Lake at lat 38 39 34N long 106 18 11W	confl Chalk Creek at lat 38 42 52N long 106 16 12W	5.04	Saint Elmo	1.8 (11/1 - 2/29) 0.9 (3/1 - 4/15) 1.8 (4/16 - 5/14) 6.5 (5/15 - 8/31) 3.2 (9/1 - 10/31)	
10/2/A-002	Middle Creek	Upper Arkansas	Custer	headwaters in the vicinity of lat 38 02 44N long 105 10 31W	confl Ophir Creek at lat 38 03 56N long 105 06 20W	4.78	Deer Peak Saint Charles Peak	3.4 (4/15 - 6/30) 2 (7/1 - 8/31) 1 (9/1 - 4/14)	
10/2/A-003	Middle Creek	Upper Arkansas	Pueblo Custer	confl Ophir Creek at lat 38 03 56N long 105 06 20W	inlet of Beulah Water Works at lat 38 04 55N long 105 06 20W	6.72	Saint Charles Peak	5.1 (4/1 - 8/31) 2.8 (9/1 - 3/31)	

Totals for Water Division 2

Total # of Stream Miles = **16.54**

Total # of Appropriations = **3**

(Totals do not include donated/acquired water rights)

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
10/4/A-004	Alpine Gulch	Upper Gunnison	Hinsdale	headwaters in the vicinity of lat 37 57 18N long 107 24 18W	confl Henson Creek at lat 38 01 8N long 107 21 31W	5.69	Lake City Lake San Cristobal Redcloud Peak	1 (10/1 - 4/14) 5 (4/15 - 9/30)	
10/4/A-002 (increase)	Blue Creek	Upper Gunnison	Gunnison	confl Little Blue Creek at lat 38 24 16N long 107 24 28W	confl Morrow Point Reservoir at lat 38 26 59N long 107 24 46W	3.53	Curecanti Needle	4.5 (4/1 - 7/31)	
10/4/A-006	Cebolla Creek	Upper Gunnison	Hinsdale	confl Brush Creek at lat 38 01 41N long 107 08 55W	conf Spring Creek at lat 38 05 47N long 107 02 08W	10.10	Cannibal Plateau Mineral Mountain	12.5 (10/1 - 11/15) 7.5 (11/16 - 3/31) 16.5 (4/1 - 4/30) 23 (5/1 - 9/30)	
10/4/A-007	Cebolla Creek	Upper Gunnison	Hinsdale Gunnison	confl Spring Creek at lat 38 05 47N long 107 02 08W	Powderhorn USGS gage at lat 38 13 39N long 107 04 24W	10.79	Mineral Mountain Rudolph Hill	22 (10/1 - 11/15) 13.5 (11/16 - 3/31) 26 (4/1 - 9/30)	
10/4/A-014	Cochetopa Creek	Tomichi Creek	Saguache	confl Nutras Creek at lat 38 03 22N long 106 48 25W	hdgt Mesa Ditch At lat 38 08 09N long 106 45 38W	7.54	Cold Spring Park Elk Park	4.5 (10/1 - 11/15) 2.75 (11/16 - 3/15) 5 (3/16 - 5/15) 11.3 (5/16 - 8/15) 7.5 (8/16 - 9/30)	
10/4/A-015 (increase)	Cochetopa Creek	Tomichi Creek	Saguache	confl Alkai Creek at lat 38 17 35N long 106 45 36W	hdgt South Krueger Ditch at lat 38 31 11N long 106 47 20W	12.91	Iris Sawtooth Mountain	6.8 (5/1 - 11/15)	
10/4/A-011	East Beaver Creek	Upper Gunnison	Saguache	headwaters in the vicinity of lat 38 16 41N long 106 51 46W	confl South Beaver Creek at lat 38 20 32N long 106 55 24W	6.26	Sawtooth Mountain Spring Hill Creek	2.4 (11/1 - 3/31) 5.8 (4/1 - 7/31) 3.7 (8/1 - 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
10/4/A-005	Spring Creek	Upper Gunnison	Hinsdale	hdgt Creede Trail Ditch at lat 38 03 54N long 107 0 10W	confl Cebolla Creek at lat 38 05 47N long 107 02 08W	3.25	Mineral Mountain	3.3 (10/1 - 11/15) 2 (11/16 - 3/31) 5 (4/1 - 9/30)	
09/4/A-010	Tabeguache Creek	San Miguel	Montrose	conf Fortyseven Creek at lat 38 22 10N long 108 31 5W	hdgt Templeton Ditch at lat 38 21 42N long 108 35 25W	5.40	Nucla Uravan	1.6 (12/1 - 3/31) 4.75 (4/1 - 6/30) 1.9 (7/1 - 11/30)	
09/4/A-011	Tabeguache 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 42W	9.70	Nucla Uravan	4.75 (3/15 - 6/30)	
10/4/A-003	Willow Creek	Upper Gunnison	Gunnison	confl Sugar Creek at lat 38 25 37N long 107 02 58W	confl Blue Mesa Reservoir at lat 38 28 15N long 107 03 49W	3.59	Big Mesa	2.3 (4/1 - 6/30) 0.5 (7/1 - 3/31)	

Totals for Water Division 4

Total # of Stream Miles = **78.76**

Total # of Appropriations = **11**

(Totals do not include donated/acquired water rights)

Instream Flow Tabulation - Water Division 6

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
10/6/A-002 (increase)	Big Beaver Creek	Upper White	Rio Blanco	confl Allen Creek at lat 40 04 38N long 107 36 33W	confl East Beaver Creek lat 40 02 06N long 107 38 41W	3.94	Fawn Creek Sawmill Mountain	2.1 (4/1 - 6/30)	
09/6/A-002	Grizzly Creek	Little Snake	Routt	confl unnamed tributary 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	1.3 (3/15 - 7/15) 0.5 (7/16 - 3/14)	
07/6/A-008	Indian Creek	North Platte headwaters	Jackson	headwaters in the vicinity of lat 40 20 57N long 106 24 26W	confl W Araphoe Feeder D 2 at lat 40 25 35N long 106 27 24W	7.70	Spicer Peak Whiteley Peak	4 (4/1 - 7/15) 0.7 (7/16 - 3/31)	
10/6/A-003	Morrison Creek	Upper Yampa	Routt	confl Muddy Creek at lat 40 10 55N long 106 45 0W	confl Silver Creek at lat 40 14 42N long 106 47 11W	8.99	Green Ridge	1.4 (11/1 - 3/31) 3.1 (4/1 - 10/31)	
10/6/A-004	Morrison Creek	Upper Yampa	Routt	confl Silver Creek at lat 40 14 42N long 106 47 11W	confl Yampa River at lat 40 17 24N long 106 48 57W	4.91	Blacktail Mountain Green Ridge	13.2 (4/1 - 8/15) 8.1 (8/16 - 3/31)	
09/6/A-003	South Fork Slater Creek	Little Snake	Routt Moffat	headwaters in the vicinity of lat 40 46 22N long 107 19 7W	confl. W Prong S Fork Slater Creek at lat 40 49 37N long 107 17 47W	4.60	Buck Point	4.1 (4/1 - 6/30) 1.25 (7/1 - 7/31) 0.65 (8/1 - 9/15) 1.25 (9/16 - 3/31)	
10/6/A-006	South Fork Slater Creek	Little Snake	Routt	confl W Prong SF Slater Creek at lat 40 49 37N long 107 17 47W	confl Slater Creek at lat 40 51 06N long 107 17 26W	1.96	Buck Point	5.25 (10/16 - 3/14) 9 (3/15 - 7/15) 2 (7/16 - 8/15) 0.8 (8/16 - 10/15)	
10/6/A-007	West Prong South Fork Slater Creek	Little Snake	Routt Moffat	headwaters in the vicinity of lat 40 46 33N long 107 21 19W	hdgt Decker Ditch No 1 at lat 40 48 53N long 107 18 1W	4.58	Buck Point	2.5 (11/1 - 2/29) 4.9 (3/1 - 7/31) 3.5 (8/1 - 10/31)	

Instream Flow Tabulation - Water Division 6

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date

Totals for Water Division 6

Total # of Stream Miles = 39.58

Total # of Appropriations = 8

(Totals do not include donated/acquired water rights)

Instream Flow Tabulation - Water Division 7

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
10/7/A-001	Animas River	Animas	San Juan	confl Minnie Gulch at lat 37 51 45N long 107 34 23W	confl Cunnigham Creek at lat 37 50 11N long 107 35 52W	2.58	Howardsville	9.1 (11/1 - 4/30) 12.2 (5/1 - 10/31)	
10/7/A-002	Animas River	Animas	San Juan	confl Cunningham Creek at lat 37 50 11N long 107 35 52W	confl Arrastra Creek at lat 37 49 38N long 107 37 37W	1.94	Howardsville	13 (11/1 - 4/30) 25 (5/1 - 10/31)	

Totals for Water Division 7

Total # of Stream Miles = 4.52

Total # of Appropriations = 2

(Totals do not include donated/acquired water rights)

Report Totals

Total # of Stream Miles = 144.89

Total # of Appropriations = 25

(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

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For Wildlife-
For People

January 8, 2010

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 Morrison Creek.

Dear Linda,

The purpose of this letter is to formally transmit the Colorado Division of Wildlife's (CDOW) Instream Flow Recommendations for Morrison Creek pursuant to Rule 5n of the Rules Concerning the Colorado Instream Flow and Natural Lake Levels. The CDOW believes that Morrison Creek 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. As you know, 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 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.

Location and Land Status

The Morrison Creek instream flow recommendations begin at the confluence of Muddy Creek and extend downstream to the confluence with the Yampa River. The Morrison Creek instream flow recommendation was segmented at the confluence with Silver Creek. The proposed instream flow segments are located north of the City of Steamboat Springs. 23% of the proposed segments (Muddy Creek to Yampa River) are located on public lands and 77% of the proposed segments are located on private lands. It should be noted that there is strong support for these instream flow appropriations from the local land owners (see attached February 20, 2009 letter).

Biological Summary and R2CROSS Analysis

The CDOW, Bureau of Land Management (BLM) and local land owners have collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of the Morrison Creek. Morrison Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment of the Morrison Creek supports a naturally reproducing brook trout (*Salvelinus fontinalis*) population. The Board staff relies 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).

The results of the R2CROSS data collection efforts for the upper segment indicate that an instream flow recommendation of 3.1 cfs, is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter, and 1.4 cfs, is required to maintain two of the three principal hydraulic criteria. The results of the R2CROSS data collection efforts for the lower segment indicate that an instream flow recommendation of 13.2 cfs, is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter, and 8.1 cfs, is required to maintain two of the three principal hydraulic criteria. However, these results are only based on the physical and biological data collected to date and do not incorporate any water availability constraints.

Water Availability Analysis and Instream Flow Recommendation

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation based on data collected at the USGS stream gage for Service Creek near Oak Creek, CO (#09237800). Subsequent to this preliminary analysis, the CWCB completed their geometric mean analysis of daily flows for Morrison Creek. We have used the CWCB's water availability analysis to adjust the seasonality and quantities of the R2CROSS instream flow recommendation so that the estimated daily flow of Morrison Creek reasonably exceeds the recommended instream flow amounts. These seasonal adjustments are reflected in the final instream flow recommendations shown below:

Muddy Creek to Silver Creek

- 3.1 cfs (April 1 through October 31)
- 1.4 cfs (November 1 through March 31)

Silver Creek to Yampa River

- 13.2 cfs (April 1 through August 15)
- 8.1 cfs (August 16 through March 31)

Relationship to State Policy

The CDOW supports the Instream Flow Program because the appropriation of instream flow water rights helps the CDOW meet our statutory mission as described in Title 33 of the Colorado Revised Statutes (CRS):

> §33-1-101 – "It is the policy of the state of Colorado 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 … that there shall be provided a comprehensive program designed to offer the greatest possible variety of wildlife-related recreational opportunity to 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."
>
> §33-2-106 – "(1) The division [of Wildlife] shall establish such programs including acquisition of land or aquatic habitat as are deemed necessary for management of nongame, endangered, or threatened wildlife. (2) … the division may enter into agreements with federal agencies or political subdivisions of this state or with private persons for administration and management of any area established under this section or utilized for management of nongame, endangered, or threatened wildlife."
>
> §33-5-101 – "It is declared to be the policy of the state that its fish and wildlife resources, and particularly the fishing waters within the state, are to be protected and preserved from the actions of any state agency to the end that they be available for all time and without change in their natural existing state, except as may be necessary and appropriate after due consideration of all factors involved."

In addition to meeting the state policy discussed above Morrison Creek satisfies criteria identified by the CWCB for ISF appropriations, including:

a) The recommendations have broad public support;

b) The proposed appropriations will have a positive impact on state or local economies;

c) The recommendations are part of a water acquisition strategy;

d) The recommendations are part of a collaborative solution to a unique natural resource issue with federal, state or local partners; and

e) The instream flow amount and timing recommended by CDOW and CWCB staff:

- Is based upon standard scientific methodology and an accurate R2CROSS analysis;
- Reflects the amount of water available for appropriation as an instream flow water right; and
- Is required to preserve the natural environment to a reasonable degree.

I have also attached copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. If you have any questions regarding the attached information or the instream flow recommendations please contact me at (303)-291-7267.

Sincerely,

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
Dave Graf, CDOW Water Resource Specialist – w/o attachments
Sherman Hebein, CDOW Senior Aquatic Biologist – w/o attachments
Ron Velarde, CDOW Northwest Regional Manager - w/o attachments
Bill Atkinson, CDOW Area Aquatic Biologist – w/o attachments
Jim Haskins, CDOW Area 10 Wildlife Manager - w/o attachments
Libby Miller, CDOW District Wildlife Manager – w/o attachments

Stream: Morrison Creek

Executive Summary

Water Division: 6
Water District: 44
CDOW#: 21294

Segment: Muddy Creek to Silver Creek

Upper Terminus: Muddy Creek
Latitude: 40º 10’ 57.8”N Longitude: 106º 45’ 00.0"W

Lower Terminus: Silver Creek
Latitude: 40º 14’ 40.6”N Longitude: 106º 47’ 13.3"W

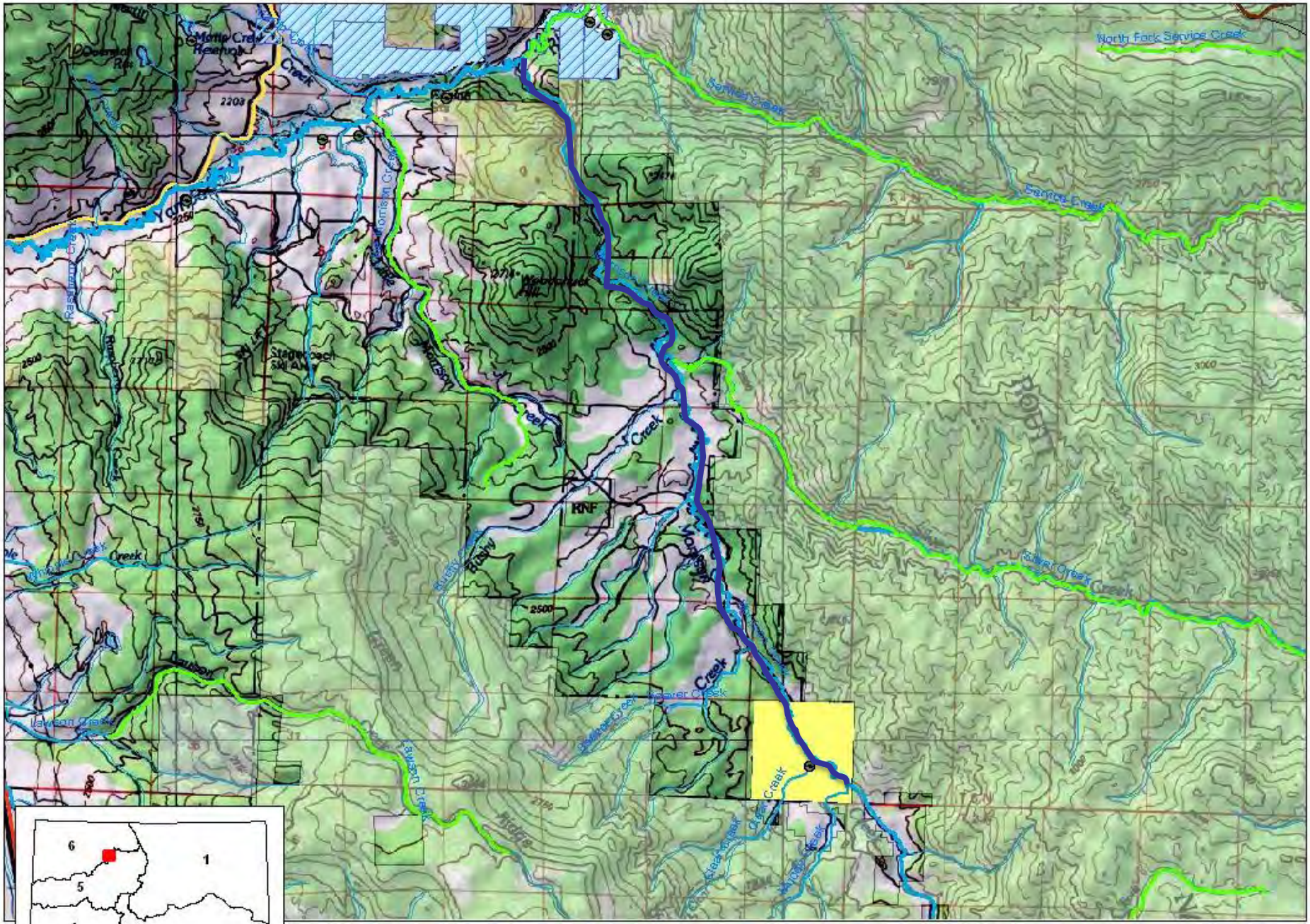
Counties: Routt
Length: 5.0 miles
ISF Appropriation: 3.1 cfs (04/01 – 10/31)
2.0 cfs (11/01 – 03/31)

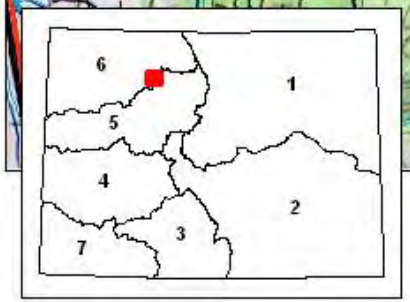
Segment: Silver Creek to Yampa River

Upper Terminus: **Silver Creek**
Latitude: 40º 14’ 40.6”N Longitude: 106º 47’ 13.3"W

Lower Terminus: Yampa River
Latitude: 40º 14’ 40.6”N Longitude: 106º 47’ 13.3"W

Counties: Routt
Length: 4.5 miles
ISF Appropriation: 13.2 cfs (04/01 – 07/31)
10.0 cfs (08/01 – 08/31)
7.9 cfs (09/01 – 03/31)





Colorado Division of Wildlife
Routt County
Morrison Creek


Yampa River
Silver Creek
Morrison Creek - SLB
Google
40°14'00.56" N 106°46'04.48" W
Jun 17, 2005 Eye alt 46466 ft

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

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

STREAM NAME: Morrison Creek
XS LOCATION: 100 yds u/s of road crossing on State Trust Lands
XS NUMBER: 1

DATE: 10/17/97
OBSERVERS: Upperdahl, Ramp, Ta

1/4 SEC:
SECTION: 36
TWP:
RANGE:
PM: 6th

COUNTY: Routt
WATERSHED: Yampa
DIVISION: 6
DOW CODE:

USGS MAP: Green Ridge
USFS MAP: Routt

SUPPLEMENTAL DATA
==========

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

TAPE WT: 0.0106
TENSION: 12

CHANNEL PROFILE DATA
==========
SLOPE: 0.009

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

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

STREAM NAME: Morrison Creek

XS LOCATION: 100 yds u/s of road crossing on State Trust Lands

XS NUMBER: 1

	INPUT DATA	# DATA POINTS=	40		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	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
1	g	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	w	1.10	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
		1.50	2.30	0.35	0.63	0.57	0.35	0.16	0.10	0.6%
		2.00	2.35	0.50	1.01	0.50	0.50	0.25	0.25	1.6%
		2.50	2.35	0.50	0.64	0.50	0.50	0.25	0.16	1.0%
		3.00	2.30	0.40	1.39	0.50	0.40	0.20	0.28	1.8%
		3.50	2.40	0.60	2.01	0.51	0.60	0.30	0.60	3.8%
		4.00	2.40	0.55	2.03	0.50	0.55	0.28	0.56	3.6%
		4.50	2.45	0.60	1.97	0.50	0.60	0.30	0.59	3.8%
		5.00	2.30	0.45	2.66	0.52	0.45	0.23	0.60	3.8%
		5.50	2.30	0.45	2.92	0.50	0.45	0.23	0.66	4.2%
		6.00	2.30	0.35	3.39	0.50	0.35	0.18	0.59	3.8%
		6.50	2.30	0.35	4.10	0.50	0.35	0.18	0.72	4.6%
		7.00	2.35	0.40	2.75	0.50	0.40	0.20	0.55	3.5%
		7.50	2.40	0.50	2.30	0.50	0.50	0.25	0.58	3.7%
		8.00	2.50	0.60	2.30	0.51	0.60	0.30	0.69	4.4%
		8.50	2.50	0.60	2.71	0.50	0.60	0.30	0.81	5.2%
		9.00	2.55	0.70	2.58	0.50	0.70	0.35	0.90	5.8%
		9.50	2.60	0.70	1.84	0.50	0.70	0.35	0.64	4.1%
		10.00	2.60	0.60	0.63	0.50	0.60	0.30	0.19	1.2%
		10.50	2.50	0.60	2.30	0.51	0.60	0.30	0.69	4.4%
		11.00	2.50	0.60	1.70	0.50	0.60	0.30	0.51	3.3%
		11.50	2.50	0.65	2.95	0.50	0.65	0.33	0.96	6.1%
		12.00	2.55	0.65	2.25	0.50	0.65	0.33	0.73	4.7%
		12.50	2.50	0.65	2.55	0.50	0.65	0.33	0.83	5.3%
		13.00	2.35	0.45	2.49	0.52	0.45	0.23	0.56	3.6%
		13.50	2.30	0.40	1.89	0.50	0.40	0.20	0.38	2.4%
		14.00	2.35	0.40	1.64	0.50	0.40	0.20	0.33	2.1%
		14.50	2.30	0.40	1.60	0.50	0.40	0.20	0.32	2.0%
		15.00	2.30	0.40	0.89	0.50	0.40	0.20	0.18	1.1%
		15.50	2.30	0.40	1.17	0.50	0.40	0.20	0.23	1.5%
		16.00	2.25	0.30	1.17	0.50	0.30	0.15	0.18	1.1%
		16.50	2.20	0.30	0.99	0.50	0.30	0.15	0.15	0.9%
		17.00	2.15	0.25	1.10	0.50	0.25	0.13	0.14	0.9%
		17.50	2.20	0.20	0.54	0.50	0.20	0.06	0.03	0.2%
	w	17.60	1.95	0.00	0.00	0.27	0.00	0.00	0.00	0.0%
		17.80	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
1	g	18.50	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	S	19.60	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	TOTALS					16.95	0.7 (Max.)	7.87	15.68	100.0%

Manning's n = 0.0424

STREAM NAME: Morrison Creek
XS LOCATION: 100 yds u/s of road crossing o
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
1.69	7.87	11.89	51.1%
1.71	7.87	11.55	46.8%
1.73	7.87	11.22	42.6%
1.75	7.87	10.89	38.4%
1.77	7.87	10.56	34.2%
1.79	7.87	10.22	29.9%
1.81	7.87	9.89	25.7%
1.83	7.87	9.56	21.5%
1.85	7.87	9.23	17.3%
1.87	7.87	8.90	13.1%
1.89	7.87	8.57	8.9%
1.90	7.87	8.40	6.8%
1.91	7.87	8.24	4.7%
1.92	7.87	8.07	2.6%
1.93	7.87	7.91	0.5%
1.94	7.87	7.74	-1.6%
1.95	7.87	7.58	-3.7%
1.96	7.87	7.41	-5.8%
1.97	7.87	7.25	-7.9%
1.98	7.87	7.08	-10.0%
1.99	7.87	6.92	-12.1%
2.01	7.87	6.59	-16.2%
2.03	7.87	6.26	-20.4%
2.05	7.87	5.94	-24.5%
2.07	7.87	5.61	-28.7%
2.09	7.87	5.28	-32.8%
2.11	7.87	4.96	-37.0%
2.13	7.87	4.63	-41.1%
2.15	7.87	4.31	-45.2%
2.17	7.87	3.99	-49.3%
2.19	7.87	3.67	-53.4%

WATERLINE AT ZERO
AREA ERROR = 1.930

STREAM NAME: Morrison Creek
XS LOCATION: 100 yds u/s of road crossing on State Trust Lands
XS NUMBER: 1

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 PER (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	1.31	17.47	1.05	1.33	18.28	18.78	100.0%	0.97	59.73	3.27
	1.33	17.39	1.03	1.31	17.93	18.69	99.5%	0.96	57.98	3.23
	1.38	17.22	0.99	1.26	17.06	18.46	98.3%	0.92	53.83	3.16
	1.43	17.04	0.95	1.21	16.20	18.23	97.1%	0.89	49.81	3.07
	1.48	16.87	0.91	1.16	15.36	18.00	95.9%	0.85	45.93	2.99
	1.53	16.74	0.87	1.11	14.52	17.81	94.8%	0.82	42.12	2.90
	1.58	16.71	0.82	1.06	13.68	17.71	94.3%	0.77	38.30	2.80
	1.63	16.68	0.77	1.01	12.85	17.60	93.7%	0.73	34.63	2.70
	1.68	16.65	0.72	0.96	12.01	17.50	93.2%	0.69	31.09	2.59
	1.73	16.62	0.67	0.91	11.18	17.39	92.6%	0.64	27.69	2.48
	1.78	16.60	0.62	0.86	10.35	17.29	92.0%	0.60	24.45	2.36
	1.83	16.57	0.57	0.81	9.52	17.18	91.5%	0.55	21.36	2.24
	1.88	16.54	0.53	0.76	8.69	17.08	90.9%	0.51	18.43	2.12
WL	1.93	16.50	0.48	0.71	7.87	16.96	90.3%	0.46	15.67	1.99
	1.98	16.42	0.43	0.66	7.04	16.84	89.7%	0.42	13.10	1.86
	2.03	16.35	0.38	0.61	6.23	16.71	89.0%	0.37	10.71	1.72
	2.08	16.29	0.33	0.56	5.41	16.59	88.3%	0.33	8.52	1.58
	2.13	16.22	0.28	0.51	4.60	16.47	87.7%	0.28	6.53	1.42
	2.18	15.94	0.24	0.46	3.79	16.14	85.9%	0.23	4.79	1.27
	2.23	15.02	0.20	0.41	3.02	15.16	80.7%	0.20	3.42	1.13
	2.28	14.49	0.16	0.36	2.28	14.61	77.8%	0.16	2.20	0.96
	2.33	13.42	0.12	0.31	1.57	13.52	72.0%	0.12	1.24	0.79
	2.38	7.83	0.14	0.26	1.08	7.91	42.1%	0.14	0.95	0.88
	2.43	6.12	0.12	0.21	0.72	6.17	32.9%	0.12	0.57	0.79
	2.48	5.00	0.09	0.16	0.44	5.04	26.8%	0.09	0.29	0.66
	2.53	4.59	0.04	0.11	0.20	4.61	24.6%	0.04	0.09	0.42
	2.58	1.65	0.04	0.06	0.06	1.66	8.8%	0.04	0.02	0.37
	2.63	0.69	0.01	0.01	0.01	0.69	3.7%	0.01	0.00	0.16

D = 3.42
V = 2.5
PWP = 1.03

STREAM NAME: Morrison Creek
XS LOCATION: 100 yds u/s of road crossing on State Trust Lands
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	15.68 cfs	RECOMMENDED INSTREAM FLOW:
CALCULATED FLOW (Qc)=	15.67 cfs	==========
(Qm-Qc)/Qm * 100 =	0.1 %	
		FLOW (CFS) PERIOD
MEASURED WATERLINE (WLm)=	1.94 ft	========== ======
CALCULATED WATERLINE (WLc)=	1.93 ft	
(WLm-WLc)/WLm * 100 =	0.4 %	
MAX MEASURED DEPTH (Dm)=	0.70 ft	
MAX CALCULATED DEPTH (Dc)=	0.71 ft	
(Dm-Dc)/Dm * 100	-1.8 %	
MEAN VELOCITY=	1.99 ft/sec	
MANNING'S N=	0.042	
SLOPE=	0.009 ft/ft	
.4 * Qm =	6.3 cfs	
2.5 * Qm=	39.2 cfs	

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

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

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

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek
XS LOCATION:	0
XS NUMBER:	0
DATE:	29-Jun-06
OBSERVERS:	Mark Uppendahl and Bridget Molloy
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.003125

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

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

STREAM NAME: Morrison Creek
XS LOCATION: 0
XS NUMBER: 0

DATA POINTS= 39

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
Top Stake	0.00	3.54			0.00		0.00	0.00	0.0%
B Stake	0.00	4.01			0.00		0.00	0.00	0.0%
1 GL	2.00	4.25			0.00		0.00	0.00	0.0%
	5.00	4.68			0.00		0.00	0.00	0.0%
WL	8.00	5.20	0.00	0.00	0.00		0.00	0.00	0.0%
	8.50	5.30	0.10	0.00	0.51	0.10	0.05	0.00	0.0%
	9.00	5.40	0.20	0.44	0.51	0.20	0.10	0.04	0.6%
	9.50	5.40	0.20	0.74	0.50	0.20	0.10	0.07	1.0%
	10.00	5.45	0.25	1.01	0.50	0.25	0.13	0.13	1.8%
	10.50	5.50	0.30	1.07	0.50	0.30	0.15	0.16	2.2%
	11.00	5.60	0.40	1.29	0.51	0.40	0.20	0.26	3.6%
	11.50	5.55	0.35	1.36	0.50	0.35	0.18	0.24	3.3%
	12.00	5.60	0.40	1.39	0.50	0.40	0.20	0.28	3.9%
	12.50	5.70	0.50	1.50	0.51	0.50	0.25	0.38	5.2%
	13.00	5.70	0.50	1.47	0.50	0.50	0.25	0.37	5.1%
	13.50	5.75	0.55	1.39	0.50	0.55	0.28	0.38	5.3%
	14.00	5.75	0.55	1.55	0.50	0.55	0.28	0.43	6.0%
	14.50	5.70	0.50	1.60	0.50	0.50	0.25	0.40	5.6%
	15.00	5.70	0.50	1.63	0.50	0.50	0.25	0.41	5.7%
	15.50	5.70	0.50	1.60	0.50	0.50	0.25	0.40	5.6%
	16.00	5.70	0.50	1.61	0.50	0.50	0.25	0.40	5.6%
	16.50	5.70	0.50	1.45	0.50	0.50	0.25	0.36	5.1%
	17.00	5.65	0.45	1.65	0.50	0.45	0.23	0.37	5.2%
	17.50	5.70	0.50	1.56	0.50	0.50	0.25	0.39	5.5%
	18.00	5.60	0.40	1.58	0.51	0.40	0.20	0.32	4.4%
	18.50	5.75	0.55	1.46	0.52	0.55	0.28	0.40	5.6%
	19.00	5.70	0.50	1.30	0.50	0.50	0.25	0.33	4.5%
	19.50	5.65	0.45	0.73	0.50	0.45	0.23	0.16	2.3%
	20.00	5.70	0.50	1.04	0.50	0.50	0.25	0.26	3.6%
	20.50	5.70	0.50	0.74	0.50	0.50	0.25	0.19	2.6%
	21.00	5.70	0.50	0.12	0.50	0.50	0.25	0.03	0.4%
	21.50	5.50	0.30	0.00	0.54	0.30	0.15	0.00	0.0%
	22.00	5.70	0.50	0.00	0.54	0.50	0.38	0.00	0.0%
SWL	23.00	5.21	0.00		1.11		0.00	0.00	0.0%
	24.50	4.82			0.00		0.00	0.00	0.0%
1 GL	25.50	3.57			0.00		0.00	0.00	0.0%
	27.60	3.25			0.00		0.00	0.00	0.0%
B. Stake	30.00	1.86			0.00		0.00	0.00	0.0%
Top Stake	30.00	1.48			0.00		0.00	0.00	0.0%
TOTALS ----------					15.29	0.55 (Max.)	6.10	7.15	100.0%

Manning's n = 0.0384
Hydraulic Radius= 0.39896433

STREAM NAME: Morrison Creek
XS LOCATION: 0
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	6.10	6.03	-1.1%
4.96	6.10	10.08	65.2%
4.98	6.10	9.73	59.5%
5.00	6.10	9.39	53.9%
5.02	6.10	9.05	48.4%
5.04	6.10	8.72	42.9%
5.06	6.10	8.39	37.5%
5.08	6.10	8.06	32.1%
5.10	6.10	7.74	26.8%
5.12	6.10	7.42	21.6%
5.14	6.10	7.10	16.4%
5.16	6.10	6.79	11.3%
5.17	6.10	6.64	8.8%
5.18	6.10	6.48	6.3%
5.19	6.10	6.33	3.8%
5.20	6.10	6.18	1.3%
5.21	6.10	6.03	-1.1%
5.22	6.10	5.88	-3.6%
5.23	6.10	5.73	-6.0%
5.24	6.10	5.58	-8.5%
5.25	6.10	5.44	-10.9%
5.26	6.10	5.29	-13.3%
5.28	6.10	5.00	-18.1%
5.30	6.10	4.71	-22.8%
5.32	6.10	4.42	-27.5%
5.34	6.10	4.14	-32.1%
5.36	6.10	3.86	-36.7%
5.38	6.10	3.58	-41.2%
5.40	6.10	3.31	-45.7%
5.42	6.10	3.05	-50.1%
5.44	6.10	2.79	-54.3%
5.46	6.10	2.54	-58.4%

WATERLINE AT ZERO
AREA ERROR = 5.200

STREAM NAME: Morrison Creek
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)
GL	4.25	22.96	1.06	1.50	24.35	23.64	100.0%	1.03	53.66	2.20
	4.25	22.95	1.06	1.50	24.34	23.64	100.0%	1.03	53.64	2.20
	4.30	22.56	1.03	1.45	23.20	23.23	98.2%	1.00	50.11	2.16
	4.35	22.18	1.00	1.40	22.08	22.81	96.5%	0.97	46.71	2.12
	4.40	21.79	0.96	1.35	20.98	22.39	94.7%	0.94	43.43	2.07
	4.45	21.40	0.93	1.30	19.90	21.98	92.9%	0.91	40.27	2.02
	4.50	21.01	0.90	1.25	18.84	21.56	91.2%	0.87	37.23	1.98
	4.55	20.62	0.86	1.20	17.80	21.14	89.4%	0.84	34.31	1.93
	4.60	20.23	0.83	1.15	16.78	20.73	87.7%	0.81	31.51	1.88
	4.65	19.84	0.80	1.10	15.78	20.31	85.9%	0.78	28.83	1.83
	4.70	19.48	0.76	1.05	14.80	19.92	84.2%	0.74	26.24	1.77
	4.75	19.15	0.72	1.00	13.83	19.56	82.7%	0.71	23.73	1.72
	4.80	18.82	0.68	0.95	12.88	19.20	81.2%	0.67	21.34	1.66
	4.85	18.40	0.65	0.90	11.95	18.77	79.4%	0.64	19.12	1.60
	4.90	17.92	0.62	0.85	11.04	18.27	77.3%	0.60	17.06	1.54
	4.95	17.44	0.58	0.80	10.16	17.78	75.2%	0.57	15.12	1.49
	5.00	16.96	0.55	0.75	9.30	17.29	73.1%	0.54	13.29	1.43
	5.05	16.48	0.51	0.70	8.46	16.80	71.1%	0.50	11.58	1.37
	5.10	16.00	0.48	0.65	7.65	16.31	69.0%	0.47	9.99	1.31
	5.15	15.52	0.44	0.60	6.86	15.82	66.9%	0.43	8.50	1.24
WL	5.20	15.04	0.41	0.55	6.10	15.33	64.8%	0.40	7.13	1.17
	5.25	14.67	0.37	0.50	5.36	14.94	63.2%	0.36	5.84	1.09
	5.30	14.31	0.32	0.45	4.63	14.57	61.6%	0.32	4.66	1.01
	5.35	13.96	0.28	0.40	3.93	14.20	60.1%	0.28	3.60	0.92
	5.40	13.11	0.25	0.35	3.24	13.33	56.4%	0.24	2.72	0.84
	5.45	12.51	0.21	0.30	2.60	12.72	53.8%	0.20	1.95	0.75
	5.50	11.90	0.17	0.25	1.99	12.10	51.2%	0.16	1.29	0.65
	5.55	11.29	0.12	0.20	1.41	11.46	48.5%	0.12	0.75	0.53
	5.60	9.70	0.09	0.15	0.88	9.82	41.5%	0.09	0.38	0.43
	5.65	8.66	0.05	0.10	0.42	8.74	36.9%	0.05	0.12	0.29
	5.70	2.15	0.03	0.05	0.07	2.17	9.2%	0.03	0.01	0.21

3/3 ≈ 4.5

2/3 = 2.3

2.3

51.2

1.29 - 0.24 = 1.05

STREAM NAME: Morrison Creek
XS LOCATION: 0
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	7.15	cfs
CALCULATED FLOW (Qc)=	7.13	cfs
(Qm-Qc)/Qm * 100 =	0.2	%
MEASURED WATERLINE (WLm)=	5.21	ft
CALCULATED WATERLINE (WLc)=	5.20	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	0.1	%
MEAN VELOCITY=	1.17	ft/sec
MANNING'S N=	0.038	
SLOPE=	0.003125	ft/ft
.4 * Qm =	2.9	cfs
2.5 * Qm=	17.9	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek - 2007
XS LOCATION:	50' d/s of bridge - 40 11 01.8 106 45 08.3
XS NUMBER:	2007 001
DATE:	4-Sep-07
OBSERVERS:	Uppendahl & Roach (TU)
1/4 SEC:	SE
SECTION:	36
TWP:	3N
RANGE:	84W
PM:	6
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	0
USGS MAP:	0
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:	0.00934579

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

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

STREAM NAME: Morrison Creek - 2007
XS LOCATION: 50' d/s of bridge - 40 11 01.8 106 45 08.3
XS NUMBER: 2007 001

DATA POINTS= 38

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	3.75			0.00		0.00	0.00	0.0%
BS	0.01	4.22			0.00		0.00	0.00	0.0%
1 GL	2.40	4.50			0.00		0.00	0.00	0.0%
	4.50	4.95			0.00		0.00	0.00	0.0%
MUD	6.70	5.35			0.00		0.00	0.00	0.0%
	8.00	5.50			0.00		0.00	0.00	0.0%
	10.10	5.55			0.00		0.00	0.00	0.0%
WL	10.70	5.85	0.00	0.00	0.00		0.00	0.00	0.0%
	11.40	5.90	0.10	0.39	0.70	0.10	0.06	0.02	2.0%
	11.80	5.95	0.20	0.51	0.40	0.20	0.08	0.04	3.8%
	12.20	5.95	0.15	0.60	0.40	0.15	0.06	0.04	3.4%
	12.60	6.00	0.20	0.72	0.40	0.20	0.08	0.06	5.4%
	13.00	6.00	0.20	0.75	0.40	0.20	0.08	0.06	5.6%
	13.40	6.00	0.25	0.86	0.40	0.25	0.10	0.09	8.1%
	13.80	6.00	0.20	0.85	0.40	0.20	0.08	0.07	6.4%
	14.20	6.00	0.20	0.80	0.40	0.20	0.08	0.06	6.0%
	14.60	6.00	0.20	0.86	0.40	0.20	0.08	0.07	6.5%
	15.00	6.05	0.20	0.97	0.40	0.20	0.08	0.08	7.3%
	15.40	6.00	0.20	1.00	0.40	0.20	0.08	0.08	7.5%
	15.80	6.00	0.20	1.00	0.40	0.20	0.08	0.08	7.5%
	16.20	6.00	0.20	1.03	0.40	0.20	0.08	0.08	7.7%
	16.60	6.00	0.20	0.91	0.40	0.20	0.08	0.07	6.8%
	17.00	5.95	0.15	0.98	0.40	0.15	0.07	0.07	6.2%
	17.50	5.95	0.15	0.70	0.50	0.15	0.08	0.05	4.9%
	18.00	5.90	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
	18.50	5.95	0.10	0.60	0.50	0.10	0.05	0.03	2.8%
	19.00	5.90	0.10	0.39	0.50	0.10	0.05	0.02	1.8%
	19.50	5.90	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
	20.00	5.95	0.10	0.00	0.50	0.10	0.05	0.00	0.0%
	20.50	5.95	0.10	0.00	0.50	0.10	0.05	0.00	0.0%
WL	21.00	5.85	0.00	0.00	0.51		0.00	0.00	0.0%
	23.20	5.70			0.00		0.00	0.00	0.0%
	24.30	5.17			0.00		0.00	0.00	0.0%
1 GL	25.10	3.92			0.00		0.00	0.00	0.0%
	28.00	2.92			0.00		0.00	0.00	0.0%
	28.70	2.52			0.00		0.00	0.00	0.0%
BS	30.00	2.40			0.00		0.00	0.00	0.0%
TS	30.01	1.77			0.00		0.00	0.00	0.0%
TOTALS ----------					10.34	0.25 (Max.)	1.49	1.06	100.0%

Manning's n = 0.0552
Hydraulic Radius= 0.14389742

STREAM NAME: Morrison Creek - 2007
XS LOCATION: 50' d/s of bridge - 40 11 01.8 106 45 08.3
XS NUMBER: 2007 001

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.49	1.11	-25.5%
5.60	1.49	4.14	178.3%
5.62	1.49	3.88	160.6%
5.64	1.49	3.62	143.0%
5.66	1.49	3.36	125.6%
5.68	1.49	3.10	108.2%
5.70	1.49	2.84	90.9%
5.72	1.49	2.59	73.9%
5.74	1.49	2.34	57.4%
5.76	1.49	2.10	41.3%
5.78	1.49	1.87	25.7%
5.80	1.49	1.64	10.5%
5.81	1.49	1.53	3.0%
5.82	1.49	1.42	-4.3%
5.83	1.49	1.32	-11.5%
5.84	1.49	1.21	-18.6%
5.85	1.49	1.11	-25.5%
5.86	1.49	1.01	-32.4%
5.87	1.49	0.91	-39.1%
5.88	1.49	0.81	-45.7%
5.89	1.49	0.71	-52.2%
5.90	1.49	0.62	-58.6%
5.92	1.49	0.45	-69.8%
5.94	1.49	0.30	-79.5%
5.96	1.49	0.19	-87.0%
5.98	1.49	0.10	-93.1%
6.00	1.49	0.02	-98.7%
6.02	1.49	0.01	-99.5%
6.04	1.49	0.00	-99.9%
6.06	1.49	0.00	-100.0%
6.08	1.49	0.00	-100.0%
6.10	1.49	0.00	-100.0%

WATERLINE AT ZERO
AREA ERROR = 5.814

STREAM NAME: Morrison Creek - 2007
XS LOCATION: 50' d/s of bridge - 40 11 01.8 106 45 08.3
XS NUMBER: 2007 001

Constant Manning's n

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

STAGING TABLE

	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	4.50	22.33	1.12	1.55	24.97	23.02	100.0%	1.08	68.63	2.75
	4.81	20.66	0.88	1.24	18.21	21.15	91.9%	0.86	42.93	2.36
	4.86	20.40	0.84	1.19	17.19	20.85	90.6%	0.82	39.35	2.29
	4.91	20.13	0.80	1.14	16.17	20.55	89.3%	0.79	35.90	2.22
	4.96	19.85	0.76	1.09	15.17	20.24	87.9%	0.75	32.61	2.15
	5.01	19.55	0.73	1.04	14.19	19.91	86.5%	0.71	29.49	2.08
	5.06	19.24	0.69	0.99	13.22	19.57	85.0%	0.68	26.51	2.00
	5.11	18.93	0.65	0.94	12.27	19.23	83.5%	0.64	23.67	1.93
	5.16	18.63	0.61	0.89	11.33	18.89	82.0%	0.60	20.97	1.85
	5.21	18.26	0.57	0.84	10.40	18.50	80.4%	0.56	18.46	1.77
	5.26	17.88	0.53	0.79	9.50	18.11	78.6%	0.52	16.10	1.69
	5.31	17.50	0.49	0.74	8.62	17.71	76.9%	0.49	13.88	1.61
	5.36	17.07	0.45	0.69	7.75	17.27	75.0%	0.45	11.83	1.53
	5.41	16.54	0.42	0.64	6.91	16.72	72.6%	0.41	9.99	1.44
	5.46	16.00	0.38	0.59	6.10	16.17	70.2%	0.38	8.29	1.36
	5.51	14.99	0.35	0.54	5.31	15.15	65.8%	0.35	6.88	1.30
	5.56	13.35	0.35	0.49	4.62	13.49	58.6%	0.34	5.88	1.27
	5.61	13.15	0.30	0.44	3.95	13.27	57.6%	0.30	4.59	1.16
	5.66	12.95	0.26	0.39	3.30	13.04	56.6%	0.25	3.44	1.04
	5.71	12.56	0.21	0.34	2.66	12.64	54.9%	0.21	2.45	0.92
	5.76	11.73	0.18	0.29	2.05	11.79	51.2%	0.17	1.67	0.81
WL	5.81	10.90	0.14	0.24	1.49	10.94	47.5%	0.14	1.02	0.69
	5.86	10.03	0.10	0.19	0.96	10.07	43.7%	0.10	0.52	0.54
	5.91	8.10	0.06	0.14	0.50	8.12	35.3%	0.06	0.20	0.40
	5.96	4.57	0.04	0.09	0.17	4.58	19.9%	0.04	0.05	0.29
	6.01	0.57	0.02	0.04	0.01	0.58	2.5%	0.02	0.00	0.18

3/3 = 3.10
2/3 = 2.65

STREAM NAME: Morrison Creek - 2007
XS LOCATION: 50' d/s of bridge - 40 11 01.8 106 45 08.3
XS NUMBER: 2007 001

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.06	cfs
CALCULATED FLOW (Qc)=	1.02	cfs
(Qm-Qc)/Qm * 100 =	3.8	%
MEASURED WATERLINE (WLm)=	5.85	ft
CALCULATED WATERLINE (WLc)=	5.81	ft
(WLm-WLc)/WLm * 100 =	0.6	%
MAX MEASURED DEPTH (Dm)=	0.25	ft
MAX CALCULATED DEPTH (Dc)=	0.24	ft
(Dm-Dc)/Dm * 100	5.7	%
MEAN VELOCITY=	0.69	ft/sec
MANNING'S N=	0.055	
SLOPE=	0.00934579	ft/ft
.4 * Qm =	0.4	cfs
2.5 * Qm=	2.7	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek
XS LOCATION:	UTM 13 03 50 781 44 49 746
XS NUMBER:	72505001
DATE:	25-Jul-05
OBSERVERS:	Uppendahl, Dilger
1/4 SEC:	SE
SECTION:	36
TWP:	3N
RANGE:	84W
PM:	6
COUNTY:	Routt
WATERSHED:	Yampa River
DIVISION:	6
DOW CODE:	0
USGS MAP:	Green Ridge
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:	0.00318182

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

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

STREAM NAME: Morrison Creek
XS LOCATION: UTM 13 03 50 781 44 49 746
XS NUMBER: 72505001

DATA POINTS= 30

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	S	0.00	4.60			0.00		0.00	0.00	0.0%
		1.00	4.55			0.00		0.00	0.00	0.0%
1	G	1.50	4.82			0.00		0.00	0.00	0.0%
		2.00	5.40			0.00		0.00	0.00	0.0%
	W	2.50	6.17	0.00	0.00	0.00		0.00	0.00	0.0%
		3.00	6.42	0.25	0.95	0.56	0.25	0.11	0.11	4.6%
		3.40	6.42	0.25	0.94	0.40	0.25	0.10	0.09	4.1%
		3.80	6.37	0.20	0.82	0.40	0.20	0.08	0.07	2.8%
		4.20	6.37	0.20	0.82	0.40	0.20	0.08	0.07	2.8%
		4.60	6.37	0.20	0.81	0.40	0.20	0.08	0.06	2.8%
		5.00	6.37	0.20	0.82	0.40	0.20	0.08	0.07	2.8%
		5.40	6.27	0.10	0.80	0.41	0.10	0.04	0.03	1.4%
		5.80	6.22	0.05	0.50	0.40	0.05	0.02	0.01	0.4%
		6.20	6.22	0.05	0.50	0.40	0.05	0.02	0.01	0.4%
		6.60	6.27	0.10	0.39	0.40	0.10	0.04	0.02	0.7%
		7.00	6.37	0.20	1.10	0.41	0.20	0.08	0.09	3.8%
		7.40	6.42	0.25	1.05	0.40	0.25	0.10	0.11	4.6%
		7.80	6.47	0.30	1.15	0.40	0.30	0.12	0.14	6.0%
		8.20	6.52	0.35	1.13	0.40	0.35	0.14	0.16	6.9%
		8.60	6.57	0.40	1.32	0.40	0.40	0.16	0.21	9.2%
		9.00	6.62	0.45	1.52	0.40	0.45	0.18	0.27	11.9%
		9.40	6.57	0.40	1.53	0.40	0.40	0.16	0.24	10.6%
		9.80	6.62	0.45	1.36	0.40	0.45	0.18	0.24	10.6%
		10.20	6.57	0.40	1.27	0.40	0.40	0.16	0.20	8.8%
		10.60	6.67	0.50	0.70	0.41	0.50	0.14	0.10	4.2%
		10.75	6.67	0.50	0.29	0.15	0.50	0.05	0.01	0.6%
	W	10.80	6.15	0.00	0.00	0.52		0.00	0.00	0.0%
		11.20	5.43			0.00		0.00	0.00	0.0%
	G	12.00	4.85			0.00		0.00	0.00	0.0%
	Top Pin	12.40	4.35			0.00		0.00	0.00	0.0%
	TOTALS ----------					8.90	0.5 (Max.)	2.12	2.31	100.0%

Manning's n = 0.0296
Hydraulic Radius= 0.238132981

STREAM NAME: Morrison Creek
XS LOCATION: UTM 13 03 50 781 44 49 746
XS NUMBER: 72505001

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.12	2.20	3.9%
5.91	2.12	4.32	103.6%
5.93	2.12	4.14	95.5%
5.95	2.12	3.97	87.4%
5.97	2.12	3.80	79.3%
5.99	2.12	3.63	71.3%
6.01	2.12	3.46	63.3%
6.03	2.12	3.29	55.3%
6.05	2.12	3.12	47.3%
6.07	2.12	2.95	39.4%
6.09	2.12	2.79	31.4%
6.11	2.12	2.62	23.5%
6.12	2.12	2.54	19.6%
6.13	2.12	2.45	15.7%
6.14	2.12	2.37	11.7%
6.15	2.12	2.29	7.8%
6.16	2.12	2.20	3.9%
6.17	2.12	2.12	0.0%
6.18	2.12	2.04	-3.9%
6.19	2.12	1.95	-7.8%
6.20	2.12	1.87	-11.7%
6.21	2.12	1.79	-15.6%
6.23	2.12	1.63	-23.1%
6.25	2.12	1.48	-30.1%
6.27	2.12	1.34	-36.8%
6.29	2.12	1.20	-43.2%
6.31	2.12	1.07	-49.4%
6.33	2.12	0.95	-55.4%
6.35	2.12	0.82	-61.3%
6.37	2.12	0.70	-66.9%
6.39	2.12	0.61	-71.1%
6.41	2.12	0.53	-75.0%

WATERLINE AT ZERO
AREA ERROR = 6.170

STREAM NAME: Morrison Creek
XS LOCATION: UTM 13 03 50 781 44 49 746
XS NUMBER: 72505001

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.85	10.47	1.36	1.82	14.28	12.36	100.0%	1.16	44.56	3.12
	5.17	9.76	1.13	1.50	11.04	11.39	92.2%	0.97	30.66	2.78
	5.22	9.64	1.09	1.45	10.56	11.24	90.9%	0.94	28.70	2.72
	5.27	9.53	1.06	1.40	10.08	11.09	89.7%	0.91	26.80	2.66
	5.32	9.42	1.02	1.35	9.61	10.94	88.5%	0.88	24.96	2.60
	5.37	9.31	0.98	1.30	9.14	10.79	87.3%	0.85	23.18	2.54
	5.42	9.20	0.94	1.25	8.68	10.64	86.1%	0.82	21.46	2.47
	5.47	9.13	0.90	1.20	8.22	10.52	85.1%	0.78	19.75	2.40
	5.52	9.07	0.86	1.15	7.76	10.40	84.1%	0.75	18.10	2.33
	5.57	9.01	0.81	1.10	7.31	10.28	83.2%	0.71	16.50	2.26
	5.62	8.95	0.77	1.05	6.86	10.16	82.2%	0.68	14.96	2.18
	5.67	8.89	0.72	1.00	6.42	10.05	81.3%	0.64	13.48	2.10
	5.72	8.83	0.68	0.95	5.97	9.93	80.4%	0.60	12.06	2.02
	5.77	8.77	0.63	0.90	5.53	9.81	79.4%	0.56	10.70	1.93
	5.82	8.71	0.58	0.85	5.10	9.70	78.5%	0.53	9.40	1.84
	5.87	8.65	0.54	0.80	4.66	9.58	77.5%	0.49	8.17	1.75
	5.92	8.59	0.49	0.75	4.23	9.46	76.6%	0.45	7.01	1.66
	5.97	8.53	0.45	0.70	3.80	9.35	75.6%	0.41	5.91	1.56
	6.02	8.47	0.40	0.65	3.38	9.23	74.7%	0.37	4.89	1.45
	6.07	8.41	0.35	0.60	2.96	9.11	73.7%	0.32	3.95	1.34
	6.12	8.35	0.30	0.55	2.54	9.00	72.8%	0.28	3.09	1.22
WL	6.17	8.30	0.26	0.50	2.12	8.88	71.9%	0.24	2.31	1.09
	6.22	7.79	0.22	0.45	1.71	8.32	67.3%	0.21	1.68	0.99
	6.27	6.89	0.19	0.40	1.34	7.35	59.5%	0.18	1.22	0.91
	6.32	6.38	0.16	0.35	1.01	6.78	54.8%	0.15	0.80	0.80
	6.37	4.68	0.15	0.30	0.70	5.00	40.5%	0.14	0.54	0.76
	6.42	3.37	0.15	0.25	0.49	3.64	29.4%	0.13	0.37	0.75
	6.47	2.97	0.11	0.20	0.33	3.18	25.8%	0.10	0.21	0.63
	6.52	2.56	0.08	0.15	0.19	2.73	22.1%	0.07	0.09	0.49
	6.57	2.16	0.03	0.10	0.08	2.28	18.4%	0.03	0.02	0.29
	6.62	0.36	0.04	0.05	0.01	0.41	3.3%	0.03	0.00	0.28
	6.67	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

$3/3_0 = 1.20$

$2/2_0 = 1.40$

$\%_{WP} = 0.71$

STREAM NAME: Morrison Creek
XS LOCATION: UTM 13 03 50 781 44 49 746
XS NUMBER: 72505001

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.31	cfs
CALCULATED FLOW (Qc)=	2.31	cfs
(Qm-Qc)/Qm * 100 =	-0.1	%
MEASURED WATERLINE (WLm)=	6.16	ft
CALCULATED WATERLINE (WLc)=	6.17	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	1.09	ft/sec
MANNING'S N=	0.030	
SLOPE=	0.00318182	ft/ft
.4 * Qm =	0.9	cfs
2.5 * Qm=	5.8	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 8.8

3/3 = 33.0 K

2/3 = 9.3

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek near USFS boundary
XS LOCATION:	0346788 4458922
XS NUMBER:	1
DATE:	30-Sep-05
OBSERVERS:	R. Smith, O. Olsen
1/4 SEC:	SW
SECTION:	34
TWP:	4 N
RANGE:	84 W
PM:	6th
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	0
USGS MAP:	Blacktail Mountain 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.01

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

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

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0346788 4458922
XS NUMBER: 1

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	1.50	3.71			0.00		0.00	0.00	0.0%
1	GL	5.00	4.26			0.00		0.00	0.00	0.0%
		7.00	4.58			0.00		0.00	0.00	0.0%
	W	9.00	5.29			0.00		0.00	0.00	0.0%
		11.00	5.60	0.40	0.44	2.02	0.40	0.80	0.35	4.0%
		13.00	5.42	0.20	0.31	2.01	0.20	0.40	0.12	1.4%
		15.00	5.38	0.15	0.59	2.00	0.15	0.30	0.18	2.0%
		17.00	5.33	0.10	0.01	2.00	0.10	0.25	0.00	0.0%
		20.00	5.37	0.10	0.70	3.00	0.10	0.20	0.14	1.6%
		21.00	5.30	0.00	0.00	1.00		0.00	0.00	0.0%
		23.00	5.50	0.30	1.84	2.01	0.30	0.60	1.10	12.5%
		25.00	5.46	0.20	0.07	2.00	0.20	0.40	0.03	0.3%
		27.00	5.38	0.10	0.99	2.00	0.10	0.20	0.20	2.2%
		29.00	5.40	0.15	1.33	2.00	0.15	0.30	0.40	4.5%
		31.00	5.46	0.30	1.33	2.00	0.30	0.60	0.80	9.0%
		33.00	5.42	0.25	0.27	2.00	0.25	0.50	0.14	1.5%
		35.00	5.46	0.30	1.40	2.00	0.30	0.60	0.84	9.5%
		37.00	5.48	0.35	1.01	2.00	0.35	0.70	0.71	8.0%
		39.00	5.36	0.10	0.04	2.00	0.10	0.20	0.01	0.1%
		41.00	5.51	0.30	1.65	2.01	0.30	0.60	0.99	11.2%
		43.00	5.50	0.30	1.45	2.00	0.30	0.60	0.87	9.8%
		45.00	5.45	0.25	1.11	2.00	0.25	0.50	0.56	6.3%
		47.00	5.47	0.30	0.95	2.00	0.30	0.60	0.57	6.4%
		49.00	5.50	0.35	1.20	2.00	0.35	0.70	0.84	9.5%
	W	51.00	5.19			2.02		0.00	0.00	0.0%
		52.00	4.68			0.00		0.00	0.00	0.0%
1	GL	53.00	4.34			0.00		0.00	0.00	0.0%
		55.00	3.80			0.00		0.00	0.00	0.0%
	TOTALS ----------					42.08	0.4 (Max.)	9.05	8.84	100.0%

Manning's n = 0.0546
Hydraulic Radius= 0.21504789

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0346788 4458922
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.05	5.43	-40.0%
5.05	9.05	16.00	76.7%
5.07	9.05	15.14	67.3%
5.09	9.05	14.28	57.8%
5.11	9.05	13.43	48.4%
5.13	9.05	12.57	38.9%
5.15	9.05	11.72	29.5%
5.17	9.05	10.88	20.2%
5.19	9.05	10.03	10.8%
5.21	9.05	9.19	1.5%
5.23	9.05	8.35	-7.8%
5.25	9.05	7.51	-17.0%
5.26	9.05	7.09	-21.6%
5.27	9.05	6.68	-26.2%
5.28	9.05	6.26	-30.8%
5.29	9.05	5.85	-35.4%
5.30	9.05	5.43	-40.0%
5.31	9.05	5.02	-44.5%
5.32	9.05	4.62	-49.0%
5.33	9.05	4.21	-53.4%
5.34	9.05	3.82	-57.8%
5.35	9.05	3.44	-62.0%
5.37	9.05	2.73	-69.8%
5.39	9.05	2.08	-77.0%
5.41	9.05	1.52	-83.3%
5.43	9.05	1.02	-88.7%
5.45	9.05	0.61	-93.3%
5.47	9.05	0.31	-96.5%
5.49	9.05	0.15	-98.4%
5.51	9.05	0.07	-99.2%
5.53	9.05	0.04	-99.5%
5.55	9.05	0.02	-99.8%

WATERLINE AT ZERO
AREA ERROR = 5.213

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0346788 4458922
XS NUMBER: 1

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.34	47.50	1.01	1.26	47.85	47.90	100.0%	1.00	130.09	2.72
	4.36	47.29	0.99	1.24	46.75	47.68	99.5%	0.98	125.52	2.69
	4.41	46.83	0.95	1.19	44.40	47.21	98.6%	0.94	115.94	2.61
	4.46	46.37	0.91	1.14	42.07	46.74	97.6%	0.90	106.69	2.54
	4.51	45.91	0.87	1.09	39.76	46.27	96.6%	0.86	97.77	2.46
	4.56	45.45	0.82	1.04	37.48	45.80	95.6%	0.82	89.20	2.38
	4.61	45.10	0.78	0.99	35.21	45.44	94.8%	0.77	80.83	2.30
	4.66	44.81	0.74	0.94	32.97	45.13	94.2%	0.73	72.74	2.21
	4.71	44.56	0.69	0.89	30.73	44.86	93.6%	0.69	64.98	2.11
	4.76	44.32	0.64	0.84	28.51	44.60	93.1%	0.64	57.56	2.02
	4.81	44.08	0.60	0.79	26.30	44.34	92.6%	0.59	50.51	1.92
	4.86	43.84	0.55	0.74	24.10	44.08	92.0%	0.55	43.84	1.82
	4.91	43.60	0.50	0.69	21.91	43.82	91.5%	0.50	37.57	1.71
	4.96	43.37	0.46	0.64	19.74	43.56	90.9%	0.45	31.69	1.61
	5.01	43.13	0.41	0.59	17.58	43.30	90.4%	0.41	26.22	1.49
	5.06	42.89	0.36	0.54	15.43	43.04	89.8%	0.36	21.18	1.37
	5.11	42.65	0.31	0.49	13.29	42.78	89.3%	0.31	16.58	1.25
	5.16	42.41	0.26	0.44	11.16	42.52	88.8%	0.26	12.45	1.12
WL	5.21	42.07	0.22	0.39	9.05	42.16	88.0%	0.21	8.83	0.98
	5.26	41.60	0.17	0.34	6.96	41.69	87.0%	0.17	5.74	0.82
	5.31	40.73	0.12	0.29	4.89	40.81	85.2%	0.12	3.24	0.66
	5.36	34.96	0.08	0.24	2.97	35.02	73.1%	0.08	1.56	0.52
	5.41	26.10	0.05	0.19	1.43	26.15	54.6%	0.05	0.56	0.39
	5.46	13.58	0.03	0.14	0.40	13.60	28.4%	0.03	0.10	0.26
	5.51	1.52	0.04	0.09	0.07	1.53	3.2%	0.04	0.02	0.33
	5.56	0.65	0.02	0.04	0.01	0.65	1.4%	0.02	0.00	0.19

3/3 = 33.0
2/3 = 9.3

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0346788 4458922
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	8.84	cfs
CALCULATED FLOW (Qc)=	8.83	cfs
(Qm-Qc)/Qm * 100 =	0.1	%
MEASURED WATERLINE (WLm)=	5.30	ft
CALCULATED WATERLINE (WLc)=	5.21	ft
(WLm-WLc)/WLm * 100 =	1.6	%
MAX MEASURED DEPTH (Dm)=	0.40	ft
MAX CALCULATED DEPTH (Dc)=	0.39	ft
(Dm-Dc)/Dm * 100	3.3	%
MEAN VELOCITY=	0.98	ft/sec
MANNING'S N=	0.055	
SLOPE=	0.01	ft/ft
.4 * Qm =	3.5	cfs
2.5 * Qm=	22.1	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 8

3/3 = 36.7

2/3 = 28.0

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek near USFS boundary
XS LOCATION:	0
XS NUMBER:	2
DATE:	30-Sep-05
OBSERVERS:	R. Smith, O. Olsen
1/4 SEC:	SW
SECTION:	34
TWP:	4 N
RANGE:	84 W
PM:	6th
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	0
USGS MAP:	Blacktail Mountain 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.009

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

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

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0
XS NUMBER: 2

DATA POINTS= 33

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 RS/GL	0.00	3.04			0.00		0.00	0.00	0.0%
	2.00	3.60			0.00		0.00	0.00	0.0%
	4.00	3.80			0.00		0.00	0.00	0.0%
W	5.50	4.68		0.00	0.00		0.00	0.00	0.0%
	6.00	4.84	0.15	0.32	0.52	0.15	0.19	0.06	0.8%
	8.00	5.06	0.35	0.59	2.01	0.35	0.70	0.41	5.2%
	10.00	5.00	0.30	1.00	2.00	0.30	0.60	0.60	7.5%
	12.00	5.02	0.30	0.86	2.00	0.30	0.60	0.52	6.5%
	14.00	4.96	0.25	0.37	2.00	0.25	0.50	0.19	2.3%
	16.00	4.74	0.05	0.32	2.01	0.05	0.10	0.03	0.4%
	18.00	4.86	0.16	0.44	2.00	0.16	0.32	0.14	1.7%
	20.00	4.90	0.20	0.42	2.00	0.20	0.40	0.17	2.1%
	22.00	5.00	0.30	0.41	2.00	0.30	0.60	0.25	3.1%
	24.00	4.85	0.15	0.82	2.01	0.15	0.30	0.25	3.1%
	26.00	5.00	0.30	0.47	2.01	0.30	0.60	0.28	3.5%
	28.00	5.06	0.35	0.00	2.00	0.35	0.70	0.00	0.0%
	30.00	4.94	0.25	0.20	2.00	0.25	0.50	0.10	1.3%
	32.00	4.88	0.20	0.49	2.00	0.20	0.40	0.20	2.5%
	34.00	4.98	0.30	0.59	2.00	0.30	0.60	0.35	4.4%
	36.00	5.08	0.40	1.08	2.00	0.40	0.80	0.86	10.8%
	38.00	5.12	0.40	0.02	2.00	0.40	0.80	0.02	0.2%
	40.00	5.32	0.60	0.83	2.01	0.60	1.20	1.00	12.5%
	42.00	5.12	0.40	1.36	2.01	0.40	0.80	1.09	13.6%
	44.00	5.33	0.60	0.19	2.01	0.60	1.20	0.23	2.9%
	46.00	5.23	0.50	0.84	2.00	0.50	1.00	0.84	10.5%
	48.00	5.10	0.40	0.53	2.00	0.40	0.80	0.42	5.3%
	50.00	4.86	0.15	0.00	2.01	0.15	0.30	0.00	0.0%
	52.00	4.68			2.01		0.00	0.00	0.0%
	54.00	4.60			0.00		0.00	0.00	0.0%
	56.00	4.55			0.00		0.00	0.00	0.0%
	58.00	3.86			0.00		0.00	0.00	0.0%
	60.00	3.85			0.00		0.00	0.00	0.0%
	62.00	3.98			0.00		0.00	0.00	0.0%
TOTALS ----------					46.64	0.6 (Max.)	14.00	7.99	100.0%

Manning's n = 0.1107
Hydraulic Radius= 0.300249

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	14.00	15.10	7.8%
4.43	14.00	27.51	96.5%
4.45	14.00	26.49	89.1%
4.47	14.00	25.46	81.8%
4.49	14.00	24.44	74.5%
4.51	14.00	23.42	67.3%
4.53	14.00	22.41	60.0%
4.55	14.00	21.39	52.7%
4.57	14.00	20.38	45.6%
4.59	14.00	19.39	38.5%
4.61	14.00	18.42	31.5%
4.63	14.00	17.46	24.7%
4.64	14.00	16.98	21.3%
4.65	14.00	16.51	17.9%
4.66	14.00	16.04	14.5%
4.67	14.00	15.57	11.2%
4.68	14.00	15.10	7.8%
4.69	14.00	14.64	4.5%
4.70	14.00	14.17	1.2%
4.71	14.00	13.71	-2.1%
4.72	14.00	13.25	-5.4%
4.73	14.00	12.79	-8.6%
4.75	14.00	11.88	-15.1%
4.77	14.00	10.99	-21.6%
4.79	14.00	10.10	-27.8%
4.81	14.00	9.24	-34.0%
4.83	14.00	8.39	-40.1%
4.85	14.00	7.56	-46.0%
4.87	14.00	6.75	-51.8%
4.89	14.00	5.98	-57.3%
4.91	14.00	5.28	-62.3%
4.93	14.00	4.62	-67.0%

WATERLINE AT ZERO
AREA ERROR = 4.704

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0
XS NUMBER: 2

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.04	62.00	1.73	2.29	107.02	62.59	100.0%	1.71	194.82	1.82
	3.70	58.96	1.13	1.63	66.69	59.47	95.0%	1.12	91.65	1.37
	3.75	58.46	1.09	1.58	63.76	58.97	94.2%	1.08	85.50	1.34
	3.80	57.99	1.05	1.53	60.85	58.49	93.5%	1.04	79.52	1.31
	3.85	57.11	1.01	1.48	57.95	57.60	92.0%	1.01	74.07	1.28
	3.90	54.87	1.01	1.43	55.18	55.33	88.4%	1.00	70.11	1.27
	3.95	53.87	0.97	1.38	52.46	54.31	86.8%	0.97	65.26	1.24
	4.00	53.24	0.94	1.33	49.79	53.65	85.7%	0.93	60.30	1.21
	4.05	53.01	0.89	1.28	47.13	53.40	85.3%	0.88	55.20	1.17
	4.10	52.78	0.84	1.23	44.49	53.15	84.9%	0.84	50.30	1.13
	4.15	52.55	0.80	1.18	41.85	52.90	84.5%	0.79	45.58	1.09
	4.20	52.32	0.75	1.13	39.23	52.64	84.1%	0.75	41.05	1.05
	4.25	52.09	0.70	1.08	36.62	52.39	83.7%	0.70	36.72	1.00
	4.30	51.86	0.66	1.03	34.02	52.14	83.3%	0.65	32.58	0.96
	4.35	51.63	0.61	0.98	31.44	51.89	82.9%	0.61	28.65	0.91
	4.40	51.40	0.56	0.93	28.86	51.64	82.5%	0.56	24.93	0.86
	4.45	51.16	0.51	0.88	26.30	51.38	82.1%	0.51	21.42	0.81
	4.50	50.93	0.47	0.83	23.74	51.13	81.7%	0.46	18.13	0.76
	4.55	50.57	0.42	0.78	21.20	50.74	81.1%	0.42	15.09	0.71
	4.60	48.54	0.39	0.73	18.73	48.70	77.8%	0.38	12.61	0.67
	4.65	47.20	0.35	0.68	16.33	47.35	75.7%	0.34	10.23	0.63
WL	4.70	46.16	0.30	0.63	14.00	46.30	74.0%	0.30	8.03	0.57
	4.75	45.10	0.26	0.58	11.72	45.22	72.3%	0.26	6.06	0.52
	4.80	43.10	0.22	0.53	9.51	43.21	69.0%	0.22	4.41	0.46
	4.85	40.92	0.18	0.48	7.41	41.02	65.5%	0.18	3.01	0.41
	4.90	34.80	0.16	0.43	5.49	34.89	55.7%	0.16	2.04	0.37
	4.95	28.70	0.14	0.38	3.91	28.77	46.0%	0.14	1.32	0.34
	5.00	21.71	0.12	0.33	2.64	21.76	34.8%	0.12	0.82	0.31
	5.05	13.50	0.13	0.28	1.79	13.54	21.6%	0.13	0.59	0.33
	5.10	10.76	0.11	0.23	1.19	10.80	17.3%	0.11	0.35	0.29
	5.15	8.18	0.09	0.18	0.72	8.21	13.1%	0.09	0.18	0.25
	5.20	5.93	0.06	0.13	0.37	5.96	9.5%	0.06	0.07	0.20
	5.25	3.58	0.04	0.08	0.13	3.59	5.7%	0.04	0.02	0.14
	5.30	1.10	0.01	0.03	0.01	1.11	1.8%	0.01	0.00	0.07

STREAM NAME: Morrison Creek near USFS boundary
XS LOCATION: 0
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	7.99	cfs
CALCULATED FLOW (Qc)=	8.03	cfs
(Qm-Qc)/Qm * 100 =	-0.5	%
MEASURED WATERLINE (WLm)=	4.68	ft
CALCULATED WATERLINE (WLc)=	4.70	ft
(WLm-WLc)/WLm * 100 =	-0.5	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.63	ft
(Dm-Dc)/Dm * 100	-4.4	%
MEAN VELOCITY=	0.57	ft/sec
MANNING'S N=	0.111	
SLOPE=	0.009	ft/ft
.4 * Qm =	3.2	cfs
2.5 * Qm=	20.0	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 11 6

3/3 = 11.2

2/3 = 7.6

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek
XS LOCATION:	800' upstr. Fr. Conf. w/ Yampa R.
XS NUMBER:	1
DATE:	11-Jul-07
OBSERVERS:	R. Smith, O. Olsen
1/4 SEC:	SW
SECTION:	28
TWP:	4N
RANGE:	84W
PM:	Sixth
COUNTY:	Routt
WATERSHED:	Watershed
DIVISION:	Yampa
DOW CODE:	21294
USGS MAP:	Blacktail Mountain 7.5
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.021

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

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

STREAM NAME: Morrison Creek
XS LOCATION: 800' upstr. Fr. Conf. w/ Yampa R.
XS NUMBER: 1

DATA POINTS= 30

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	4.23			0.00		0.00	0.00	0.0%
1	G	1.30	4.79			0.00		0.00	0.00	0.0%
		2.00	5.02			0.00		0.00	0.00	0.0%
	W	3.30	5.60			0.00		0.00	0.00	0.0%
		5.00	5.80	0.20	0.97	1.71	0.20	0.32	0.31	2.7%
		6.50	5.94	0.30	1.11	1.51	0.30	0.53	0.58	5.0%
		8.50	5.76	0.15	1.37	2.01	0.15	0.26	0.36	3.1%
		10.00	5.76	0.15	1.41	1.50	0.15	0.19	0.26	2.3%
		11.00	6.10	0.50	0.40	1.06	0.50	0.63	0.25	2.2%
		12.50	6.08	0.45	1.55	1.50	0.45	0.68	1.05	9.0%
		14.00	6.20	0.60	0.06	1.50	0.60	0.90	0.05	0.5%
		15.50	5.99	0.40	1.41	1.51	0.40	0.60	0.85	7.3%
		17.00	6.15	0.55	0.80	1.51	0.55	0.69	0.55	4.7%
		18.00	5.96	0.35	2.31	1.02	0.35	0.35	0.81	7.0%
		19.00	5.97	0.35	0.25	1.00	0.35	0.35	0.09	0.8%
		20.00	5.92	0.30	1.91	1.00	0.30	0.30	0.57	4.9%
		21.00	6.11	0.50	0.19	1.02	0.50	0.50	0.10	0.8%
		22.00	6.04	0.40	2.18	1.00	0.40	0.40	0.87	7.5%
		23.00	5.91	0.30	2.41	1.01	0.30	0.30	0.72	6.2%
		24.00	6.08	0.50	2.32	1.01	0.50	0.50	1.16	10.0%
		25.00	6.14	0.55	0.30	1.00	0.55	0.55	0.17	1.4%
		26.00	6.18	0.55	1.28	1.00	0.55	0.55	0.70	6.1%
		27.00	6.04	0.40	0.41	1.01	0.40	0.40	0.16	1.4%
		28.00	6.01	0.40	3.20	1.00	0.40	0.40	1.28	11.0%
		29.00	5.82	0.20	1.75	1.02	0.20	0.20	0.35	3.0%
		30.00	5.74	0.10	0.36	1.00	0.10	0.10	0.04	0.3%
		31.00	5.89	0.25	1.09	1.01	0.25	0.31	0.34	2.9%
	W	32.50	5.58			1.53		0.00	0.00	0.0%
1	G	35.50	4.74			0.00		0.00	0.00	0.0%
	RS	39.90	3.64			0.00		0.00	0.00	0.0%
	TOTALS ----------					29.45	0.6 (Max.)	10.00	11.62	100.0%

VALUES COMPUTED FROM RAW FIELD DATA

Manning's n = 0.0901
Hydraulic Radius= 0.33939261

STREAM NAME: Morrison Creek
XS LOCATION: 800' upstr. Fr. Conf. w/ Yampa R.
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	10.00	10.67	6.8%
5.34	10.00	18.15	81.6%
5.36	10.00	17.54	75.5%
5.38	10.00	16.93	69.4%
5.40	10.00	16.32	63.3%
5.42	10.00	15.72	57.3%
5.44	10.00	15.12	51.2%
5.46	10.00	14.52	45.2%
5.48	10.00	13.92	39.3%
5.50	10.00	13.32	33.3%
5.52	10.00	12.73	27.4%
5.54	10.00	12.14	21.5%
5.55	10.00	11.84	18.5%
5.56	10.00	11.55	15.6%
5.57	10.00	11.26	12.6%
5.58	10.00	10.96	9.7%
5.59	10.00	10.67	6.8%
5.60	10.00	10.38	3.9%
5.61	10.00	10.09	1.0%
5.62	10.00	9.80	-1.9%
5.63	10.00	9.51	-4.8%
5.64	10.00	9.23	-7.7%
5.66	10.00	8.66	-13.4%
5.68	10.00	8.10	-19.0%
5.70	10.00	7.54	-24.6%
5.72	10.00	6.98	-30.1%
5.74	10.00	6.44	-35.6%
5.76	10.00	5.90	-41.0%
5.78	10.00	5.41	-45.9%
5.80	10.00	4.93	-50.6%
5.82	10.00	4.48	-55.2%
5.84	10.00	4.04	-59.6%

WATERLINE AT ZERO
AREA ERROR = 5.613

,021

STREAM NAME: Morrison Creek
XS LOCATION: 800' upstr. Fr. Conf. w/ Yampa R.
XS NUMBER: 1

Constant Manning's n

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.79	34.02	1.06	1.41	35.90	34.54	100.0%	1.04	88.05	2.45
	4.81	33.87	1.04	1.39	35.11	34.38	99.5%	1.02	85.10	2.42
	4.86	33.54	1.00	1.34	33.43	34.03	98.5%	0.98	78.93	2.36
	4.91	33.21	0.96	1.29	31.76	33.69	97.5%	0.94	72.97	2.30
	4.96	32.87	0.92	1.24	30.11	33.34	96.5%	0.90	67.22	2.23
	5.01	32.54	0.87	1.19	28.47	33.00	95.5%	0.86	61.67	2.17
	5.06	32.25	0.83	1.14	26.85	32.68	94.6%	0.82	56.29	2.10
	5.11	31.96	0.79	1.09	25.25	32.37	93.7%	0.78	51.12	2.02
	5.16	31.67	0.75	1.04	23.66	32.07	92.8%	0.74	46.15	1.95
	5.21	31.38	0.70	0.99	22.08	31.76	91.9%	0.70	41.41	1.88
	5.26	31.09	0.66	0.94	20.52	31.45	91.1%	0.65	36.88	1.80
	5.31	30.80	0.62	0.89	18.97	31.14	90.2%	0.61	32.58	1.72
	5.36	30.50	0.57	0.84	17.44	30.83	89.3%	0.57	28.50	1.63
	5.41	30.21	0.53	0.79	15.92	30.53	88.4%	0.52	24.65	1.55
	5.46	29.92	0.48	0.74	14.42	30.22	87.5%	0.48	21.04	1.46
	5.51	29.63	0.44	0.69	12.93	29.91	86.6%	0.43	17.66	1.37
	5.56	29.34	0.39	0.64	11.45	29.60	85.7%	0.39	14.53	1.27
WL	5.61	28.93	0.35	0.59	9.99	29.17	84.5%	0.34	11.70	1.17
	5.66	28.26	0.30	0.54	8.57	28.50	82.5%	0.30	9.18	1.07
	5.71	27.59	0.26	0.49	7.17	27.82	80.5%	0.26	6.94	0.97
	5.76	24.93	0.23	0.44	5.82	25.15	72.8%	0.23	5.24	0.90
	5.81	22.57	0.21	0.39	4.63	22.77	65.9%	0.20	3.82	0.83
	5.86	20.45	0.17	0.34	3.55	20.62	59.7%	0.17	2.63	0.74
	5.91	18.60	0.14	0.29	2.58	18.74	54.3%	0.14	1.64	0.64
	5.96	15.48	0.11	0.24	1.72	15.60	45.2%	0.11	0.95	0.55
	6.01	12.59	0.08	0.19	1.03	12.67	36.7%	0.08	0.46	0.45
	6.06	9.20	0.05	0.14	0.49	9.25	26.8%	0.05	0.17	0.34
	6.11	4.16	0.04	0.09	0.15	4.18	12.1%	0.04	0.04	0.26
	6.16	1.26	0.01	0.04	0.02	1.26	3.7%	0.01	0.00	0.14

11.2 3/3
7.6 3/3

STREAM NAME: Morrison Creek
XS LOCATION: 800' upstr. Fr. Conf. w/ Yampa R.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.62	cfs
CALCULATED FLOW (Qc)=	11.70	cfs
(Qm-Qc)/Qm * 100 =	-0.6	%
MEASURED WATERLINE (WLm)=	5.59	ft
CALCULATED WATERLINE (WLc)=	5.61	ft
(WLm-WLc)/WLm * 100 =	-0.4	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.59	ft
(Dm-Dc)/Dm * 100	2.2	%
MEAN VELOCITY=	1.17	ft/sec
MANNING'S N=	0.090	
SLOPE=	0.021	ft/ft
.4 * Qm =	4.6	cfs
2.5 * Qm=	29.1	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 12.8
3/3 = 16.0
2/3 = 8.8

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek
XS LOCATION:	600' upstr. Fr. Conf. W/ Yampa R.
XS NUMBER:	2
DATE:	11-Jul-07
OBSERVERS:	R. Smith, O. Olsen
1/4 SEC:	SW
SECTION:	28
TWP:	4N
RANGE:	84
PM:	Sixth
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	21294
USGS MAP:	Blacktail Mtn. 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.012

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

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

STREAM NAME: Morrison Creek
XS LOCATION: 600' upstr. Fr. Conf. W/ Yampa R.
XS NUMBER: 2

DATA POINTS= 29

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
LS	0.00	3.19			0.00		0.00	0.00	0.0%
1 G	2.50	3.28			0.00		0.00	0.00	0.0%
	5.50	3.86			0.00		0.00	0.00	0.0%
W	9.00	4.36			0.00		0.00	0.00	0.0%
	10.50	4.44	0.10	0.00	1.50	0.10	0.15	0.00	0.0%
	12.00	4.68	0.30	0.00	1.52	0.30	0.45	0.00	0.0%
	13.50	4.74	0.35	0.10	1.50	0.35	0.53	0.05	0.4%
	15.00	4.72	0.35	0.40	1.50	0.35	0.53	0.21	1.6%
	16.50	4.92	0.55	1.03	1.51	0.55	0.83	0.85	6.7%
	18.00	4.92	0.55	1.14	1.50	0.55	0.83	0.94	7.4%
	19.50	5.24	0.85	0.89	1.53	0.85	1.28	1.13	8.9%
	21.00	4.94	0.55	0.17	1.53	0.55	0.69	0.12	0.9%
	22.00	5.12	0.75	0.07	1.02	0.75	0.75	0.05	0.4%
	23.00	5.26	0.85	1.88	1.01	0.85	0.85	1.60	12.5%
	24.00	5.30	0.90	1.54	1.00	0.90	0.90	1.39	10.8%
	25.00	5.05	0.65	1.77	1.03	0.65	0.65	1.15	9.0%
	26.00	5.24	0.85	1.83	1.02	0.85	0.85	1.56	12.2%
	27.00	5.04	0.65	1.47	1.02	0.65	0.65	0.96	7.5%
	28.00	4.71	0.35	1.39	1.05	0.35	0.35	0.49	3.8%
	29.00	4.74	0.40	2.06	1.00	0.40	0.40	0.82	6.4%
	30.00	4.63	0.30	2.01	1.01	0.30	0.30	0.60	4.7%
	31.00	4.66	0.30	0.56	1.00	0.30	0.30	0.17	1.3%
	32.00	4.59	0.25	1.52	1.00	0.25	0.25	0.38	3.0%
	33.00	4.97	0.50	0.35	1.07	0.50	0.50	0.18	1.4%
	34.00	4.74	0.40	0.05	1.03	0.40	0.40	0.02	0.2%
	35.00	4.82	0.50	0.07	1.00	0.50	0.75	0.05	0.4%
	37.00	4.61	0.35	0.10	2.01	0.35	0.65	0.06	0.5%
W	38.70	4.35			1.72		0.00	0.00	0.0%
1 RS & G	42.00	3.21			0.00		0.00	0.00	0.0%
TOTALS ----------					30.09	0.9 (Max.)	13.81	12.78	100.0%

Manning's n = 0.1047
Hydraulic Radius= 0.45900795

STREAM NAME: Morrison Creek
XS LOCATION: 600' upstr. Fr. Conf. W/ Yampa R.
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	13.81	14.10	2.1%
4.11	13.81	21.84	58.1%
4.13	13.81	21.20	53.5%
4.15	13.81	20.56	48.9%
4.17	13.81	19.92	44.3%
4.19	13.81	19.29	39.7%
4.21	13.81	18.67	35.2%
4.23	13.81	18.05	30.7%
4.25	13.81	17.43	26.2%
4.27	13.81	16.81	21.7%
4.29	13.81	16.20	17.3%
4.31	13.81	15.60	12.9%
4.32	13.81	15.29	10.8%
4.33	13.81	14.99	8.6%
4.34	13.81	14.69	6.4%
4.35	13.81	14.40	4.2%
4.36	13.81	14.10	2.1%
4.37	13.81	13.80	-0.1%
4.38	13.81	13.51	-2.2%
4.39	13.81	13.22	-4.3%
4.40	13.81	12.93	-6.4%
4.41	13.81	12.64	-8.5%
4.43	13.81	12.08	-12.6%
4.45	13.81	11.52	-16.6%
4.47	13.81	10.97	-20.5%
4.49	13.81	10.43	-24.5%
4.51	13.81	9.89	-28.4%
4.53	13.81	9.36	-32.2%
4.55	13.81	8.83	-36.1%
4.57	13.81	8.31	-39.8%
4.59	13.81	7.79	-43.6%
4.61	13.81	7.28	-47.3%

WATERLINE AT ZERO
AREA ERROR = 4.365

STREAM NAME: Morrison Creek
XS LOCATION: 600' upstr. Fr. Conf. W/ Yampa R.
XS NUMBER: 2

Constant Manning's n

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

STAGING TABLE

	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	3.28	39.30	1.31	2.02	51.46	39.95	100.0%	1.29	94.71	1.84
	3.36	38.61	1.25	1.94	48.16	39.25	98.2%	1.23	85.81	1.78
	3.41	38.21	1.21	1.89	46.24	38.83	97.2%	1.19	80.76	1.75
	3.46	37.81	1.17	1.84	44.34	38.42	96.1%	1.15	75.84	1.71
	3.51	37.40	1.14	1.79	42.46	38.00	95.1%	1.12	71.07	1.67
	3.56	37.00	1.10	1.74	40.60	37.58	94.1%	1.08	66.45	1.64
	3.61	36.60	1.06	1.69	38.76	37.17	93.0%	1.04	61.96	1.60
	3.66	36.19	1.02	1.64	36.94	36.75	92.0%	1.01	57.62	1.56
	3.71	35.79	0.98	1.59	35.14	36.33	90.9%	0.97	53.42	1.52
	3.76	35.39	0.94	1.54	33.36	35.92	89.9%	0.93	49.37	1.48
	3.81	34.98	0.90	1.49	31.60	35.50	88.9%	0.89	45.46	1.44
	3.86	34.57	0.86	1.44	29.86	35.07	87.8%	0.85	41.70	1.40
	3.91	34.08	0.83	1.39	28.14	34.57	86.5%	0.81	38.15	1.36
	3.96	33.58	0.79	1.34	26.45	34.06	85.3%	0.78	34.74	1.31
	4.01	33.09	0.75	1.29	24.78	33.55	84.0%	0.74	31.49	1.27
	4.06	32.59	0.71	1.24	23.14	33.05	82.7%	0.70	28.37	1.23
	4.11	32.10	0.67	1.19	21.52	32.54	81.4%	0.66	25.41	1.18
	4.16	31.60	0.63	1.14	19.93	32.03	80.2%	0.62	22.59	1.13
	4.21	31.11	0.59	1.09	18.36	31.53	78.9%	0.58	19.91	1.08
	4.26	30.61	0.55	1.04	16.82	31.02	77.6%	0.54	17.39	1.03
	4.31	30.12	0.51	0.99	15.30	30.51	76.4%	0.50	15.02	0.98
WL	4.36	29.52	0.47	0.94	13.81	29.90	74.8%	0.46	12.83	0.93
	4.41	28.25	0.44	0.89	12.37	28.63	71.7%	0.43	10.99	0.89
	4.46	27.30	0.40	0.84	10.98	27.67	69.3%	0.40	9.22	0.84
	4.51	26.66	0.36	0.79	9.63	27.02	67.6%	0.36	7.53	0.78
	4.56	26.02	0.32	0.74	8.32	26.37	66.0%	0.32	5.99	0.72
	4.61	24.94	0.28	0.69	7.04	25.29	63.3%	0.28	4.66	0.66
	4.66	22.06	0.27	0.64	5.85	22.39	56.0%	0.26	3.72	0.64
	4.71	19.87	0.24	0.59	4.80	20.17	50.5%	0.24	2.86	0.60
	4.76	15.15	0.26	0.54	3.95	15.43	38.6%	0.26	2.48	0.63
	4.81	13.17	0.25	0.49	3.24	13.42	33.6%	0.24	1.96	0.60
	4.86	12.18	0.21	0.44	2.61	12.40	31.0%	0.21	1.44	0.55
	4.91	11.31	0.18	0.39	2.03	11.50	28.8%	0.18	0.99	0.49
	4.96	8.79	0.18	0.34	1.55	8.96	22.4%	0.17	0.75	0.48
	5.01	7.84	0.14	0.29	1.13	7.98	20.0%	0.14	0.48	0.42
	5.06	6.75	0.11	0.24	0.77	6.86	17.2%	0.11	0.28	0.36
	5.11	5.27	0.09	0.19	0.47	5.35	13.4%	0.09	0.14	0.31
	5.16	3.72	0.06	0.14	0.24	3.78	9.5%	0.06	0.06	0.25
	5.21	2.17	0.04	0.09	0.09	2.19	5.5%	0.04	0.02	0.19
	5.26	1.02	0.02	0.04	0.02	1.03	2.6%	0.02	0.00	0.11

2.2 = 16.0
2.3 = 8.8

STREAM NAME: Morrison Creek
XS LOCATION: 600' upstr. Fr. Conf. W/ Yampa R.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	12.78	cfs
CALCULATED FLOW (Qc)=	12.83	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	4.36	ft
CALCULATED WATERLINE (WLc)=	4.36	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.90	ft
MAX CALCULATED DEPTH (Dc)=	0.94	ft
(Dm-Dc)/Dm * 100	-3.9	%
MEAN VELOCITY=	0.93	ft/sec
MANNING'S N=	0.105	
SLOPE=	0.012	ft/ft
.4 * Qm =	5.1	cfs
2.5 * Qm=	31.9	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 5.94
3/3 = 4.0®
2/3 = 3.7

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek - 10/1/08 - #4
XS LOCATION:	100' d/s of bridge - 40 14' 44.0" 106 47' 11.0"
XS NUMBER:	100308-4
DATE:	3-Oct-08
OBSERVERS:	Uppendahl & Atkinson
1/4 SEC:	SW
SECTION:	10
TWP:	3 N
RANGE:	84 W
PM:	6
COUNTY:	ROUTT
WATERSHED:	YAMPA RIVER
DIVISION:	6
DOW CODE:	21294
USGS MAP:	0
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:	0.0122807

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

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

STREAM NAME: Morrison Creek - 10/1/08 - #4
XS LOCATION: 100' d/s of bridge - 40 14' 44.0" 106 47' 11.0"
XS NUMBER: 100308-4

DATA POINTS= 42

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	3.55			0.00		0.00	0.00	0.0%
	1.30	4.05			0.00		0.00	0.00	0.0%
	2.20	4.45			0.00		0.00	0.00	0.0%
1 GL	3.00	5.00			0.00		0.00	0.00	0.0%
	3.90	5.99			0.00		0.00	0.00	0.0%
	5.00	6.55			0.00		0.00	0.00	0.0%
	6.30	7.15			0.00		0.00	0.00	0.0%
	9.30	7.00			0.00		0.00	0.00	0.0%
	11.50	6.95			0.00		0.00	0.00	0.0%
SW	14.20	7.05	0.00	0.00	0.00		0.00	0.00	0.0%
	15.00	7.10	0.05	0.00	0.80	0.05	0.05	0.00	0.0%
	16.00	7.20	0.10	0.05	1.00	0.10	0.10	0.01	0.1%
	17.00	7.20	0.10	0.27	1.00	0.10	0.10	0.03	0.5%
	18.00	7.20	0.15	0.47	1.00	0.15	0.15	0.07	1.2%
	19.00	7.25	0.20	0.89	1.00	0.20	0.20	0.18	3.0%
	20.00	7.20	0.20	1.32	1.00	0.20	0.20	0.26	4.4%
	21.00	7.25	0.20	0.72	1.00	0.20	0.20	0.14	2.4%
	22.00	7.20	0.20	0.78	1.00	0.20	0.20	0.16	2.6%
	23.00	7.20	0.20	0.40	1.00	0.20	0.20	0.08	1.3%
	24.00	7.15	0.15	0.14	1.00	0.15	0.15	0.02	0.4%
	25.00	7.25	0.25	1.43	1.00	0.25	0.25	0.36	6.0%
	26.00	7.25	0.25	0.28	1.00	0.25	0.19	0.05	0.9%
	26.50	7.25	0.25	1.10	0.50	0.25	0.13	0.14	2.3%
	27.00	7.30	0.35	1.93	0.50	0.35	0.18	0.34	5.7%
	27.50	7.35	0.35	2.05	0.50	0.35	0.18	0.36	6.0%
	28.00	7.40	0.40	2.32	0.50	0.40	0.20	0.46	7.8%
	28.50	7.35	0.35	2.10	0.50	0.35	0.18	0.37	6.2%
	29.00	7.30	0.35	1.89	0.50	0.35	0.18	0.33	5.6%
	29.50	7.30	0.30	2.00	0.50	0.30	0.15	0.30	5.1%
	30.00	7.35	0.40	2.21	0.50	0.40	0.20	0.44	7.4%
	30.50	7.30	0.30	1.80	0.50	0.30	0.15	0.27	4.5%
	31.00	7.30	0.30	1.60	0.50	0.30	0.15	0.24	4.0%
	31.50	7.35	0.30	1.60	0.50	0.30	0.15	0.24	4.0%
	32.00	7.35	0.35	1.77	0.50	0.35	0.26	0.46	7.8%
	33.00	7.30	0.30	1.10	1.00	0.30	0.30	0.33	5.6%
	34.00	7.20	0.20	1.05	1.00	0.20	0.20	0.21	3.5%
	35.00	7.25	0.20	0.40	1.00	0.20	0.23	0.09	1.5%
SW	36.25	7.05	0.00	0.00	1.27		0.00	0.00	0.0%
	36.70	6.30			0.00		0.00	0.00	0.0%
	37.50	5.60			0.00		0.00	0.00	0.0%
GL	38.50	4.98			0.00		0.00	0.00	0.0%
S	39.40	4.50			0.00		0.00	0.00	0.0%
TOTALS ----------					22.11	0.4 (Max.)	4.80	5.94	100.0%

Manning's n = 0.0480
Hydraulic Radius= 0.21685924

STREAM NAME: Morrison Creek - 10/1/08 - #4
XS LOCATION: 100' d/s of bridge - 40 14' 44.0" 106 47' 11.0"
XS NUMBER: 100308-4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.80	4.26	-11.2%
6.80	4.80	11.56	141.1%
6.82	4.80	10.94	128.2%
6.84	4.80	10.33	115.4%
6.86	4.80	9.71	102.6%
6.88	4.80	9.10	89.8%
6.90	4.80	8.49	77.0%
6.92	4.80	7.88	64.3%
6.94	4.80	7.27	51.5%
6.96	4.80	6.66	38.9%
6.98	4.80	6.08	26.8%
7.00	4.80	5.53	15.4%
7.01	4.80	5.27	9.8%
7.02	4.80	5.01	4.4%
7.03	4.80	4.75	-0.9%
7.04	4.80	4.50	-6.1%
7.05	4.80	4.26	-11.2%
7.06	4.80	4.02	-16.3%
7.07	4.80	3.78	-21.2%
7.08	4.80	3.55	-26.0%
7.09	4.80	3.32	-30.7%
7.10	4.80	3.10	-35.4%
7.12	4.80	2.66	-44.4%
7.14	4.80	2.25	-53.1%
7.16	4.80	1.84	-61.5%
7.18	4.80	1.46	-69.5%
7.20	4.80	1.10	-77.2%
7.22	4.80	0.82	-82.8%
7.24	4.80	0.60	-87.4%
7.26	4.80	0.44	-90.8%
7.28	4.80	0.31	-93.5%
7.30	4.80	0.19	-96.1%

WATERLINE AT ZERO
AREA ERROR = 7.028

STREAM NAME: Morrison Creek - 10/1/08 - #4
XS LOCATION: 100' d/s of bridge - 40 14' 44.0" 106 47' 11.0"
XS NUMBER: 100308-4

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.00	35.47	2.01	2.40	71.37	37.10	100.0%	1.92	378.80	5.31
	6.03	33.04	1.10	1.37	36.19	33.89	91.3%	1.07	129.74	3.58
	6.08	32.88	1.05	1.32	34.54	33.70	90.8%	1.02	120.48	3.49
	6.13	32.72	1.01	1.27	32.90	33.51	90.3%	0.98	111.51	3.39
	6.18	32.57	0.96	1.22	31.27	33.33	89.8%	0.94	102.82	3.29
	6.23	32.41	0.91	1.17	29.64	33.14	89.3%	0.89	94.43	3.19
	6.28	32.26	0.87	1.12	28.03	32.96	88.8%	0.85	86.32	3.08
	6.33	32.12	0.82	1.07	26.42	32.78	88.4%	0.81	78.50	2.97
	6.38	31.99	0.78	1.02	24.82	32.61	87.9%	0.76	70.97	2.86
	6.43	31.86	0.73	0.97	23.22	32.44	87.5%	0.72	63.75	2.75
	6.48	31.73	0.68	0.92	21.63	32.27	87.0%	0.67	56.83	2.63
	6.53	31.61	0.63	0.87	20.05	32.11	86.5%	0.62	50.25	2.51
	6.58	31.47	0.59	0.82	18.47	31.93	86.1%	0.58	43.99	2.38
	6.63	31.33	0.54	0.77	16.90	31.75	85.6%	0.53	38.08	2.25
	6.68	31.20	0.49	0.72	15.34	31.58	85.1%	0.49	32.51	2.12
	6.73	31.06	0.44	0.67	13.78	31.40	84.6%	0.44	27.30	1.98
	6.78	30.92	0.40	0.62	12.23	31.22	84.2%	0.39	22.46	1.84
	6.83	30.78	0.35	0.57	10.69	31.04	83.7%	0.34	18.01	1.69
	6.88	30.64	0.30	0.52	9.15	30.87	83.2%	0.30	13.96	1.53
	6.93	30.50	0.25	0.47	7.62	30.69	82.7%	0.25	10.34	1.36
	6.98	28.36	0.22	0.42	6.13	28.50	76.8%	0.22	7.55	1.23
WL	7.03	25.35	0.19	0.37	4.79	25.45	68.6%	0.19	5.41	1.13
	7.08	23.01	0.16	0.32	3.59	23.09	62.2%	0.16	3.56	0.99
	7.13	20.96	0.12	0.27	2.49	21.02	56.7%	0.12	2.06	0.83
	7.18	18.82	0.08	0.22	1.49	18.86	50.8%	0.08	0.94	0.63
	7.23	11.24	0.06	0.17	0.73	11.27	30.4%	0.06	0.40	0.55
	7.28	6.43	0.05	0.12	0.32	6.46	17.4%	0.05	0.15	0.47
	7.33	3.02	0.02	0.07	0.07	3.03	8.2%	0.02	0.02	0.29
	7.38	0.43	0.01	0.02	0.00	0.44	1.2%	0.01	0.00	0.17

3/3 = 3.0

2/3 = 2.7

STREAM NAME: Morrison Creek - 10/1/08 - #4
XS LOCATION: 100' d/s of bridge - 40 14' 44.0" 106 47' 11.0"
XS NUMBER: 100308-4

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.94	cfs
CALCULATED FLOW (Qc)=	5.41	cfs
(Qm-Qc)/Qm * 100 =	9.0	%
MEASURED WATERLINE (WLm)=	7.05	ft
CALCULATED WATERLINE (WLc)=	7.03	ft
(WLm-WLc)/WLm * 100 =	0.3	%
MAX MEASURED DEPTH (Dm)=	0.40	ft
MAX CALCULATED DEPTH (Dc)=	0.37	ft
(Dm-Dc)/Dm * 100	7.1	%
MEAN VELOCITY=	1.13	ft/sec
MANNING'S N=	0.048	
SLOPE=	0.0122807	ft/ft
.4 * Qm =	2.4	cfs
2.5 * Qm=	14.8	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Q = 6.13
3/3 = 12.5
2/3 = 1.0

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

LOCATION INFORMATION

STREAM NAME:	Morrison Creek - 10/1/08 - #1
XS LOCATION:	300' u/s of bridge - 40 15' 23.7" 106 47' 44.4"
XS NUMBER:	100308-1
DATE:	3-Oct-08
OBSERVERS:	Uppendahl & Atkinson
1/4 SEC:	SW
SECTION:	3
TWP:	3 N
RANGE:	84 W
PM:	6
COUNTY:	ROUTT
WATERSHED:	YAMPA RIVER
DIVISION:	6
DOW CODE:	21294
USGS MAP:	0
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:	0.01130435

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

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

STREAM NAME: Morrison Creek - 10/1/08 - #1
XS LOCATION: 300' u/s of bridge - 40 15' 23.7" 106 47' 44.4"
XS NUMBER: 100308-1

DATA POINTS= 39

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	S	0.00	4.25			0.00		0.00	0.00	0.0%
		2.50	4.61			0.00		0.00	0.00	0.0%
1	GL	4.00	5.50			0.00		0.00	0.00	0.0%
		5.50	6.25			0.00		0.00	0.00	0.0%
	SW	7.00	6.75	0.00	0.00	0.00		0.00	0.00	0.0%
		8.00	6.80	0.05	0.00	1.00	0.05	0.05	0.00	0.0%
		9.00	6.85	0.10	0.00	1.00	0.10	0.10	0.00	0.0%
		10.00	6.85	0.15	0.26	1.00	0.15	0.17	0.04	0.7%
		11.25	6.95	0.20	0.49	1.25	0.20	0.25	0.12	2.0%
		12.50	6.80	0.05	0.99	1.26	0.05	0.06	0.06	1.0%
		13.75	7.00	0.30	0.92	1.27	0.30	0.38	0.35	5.6%
		15.00	7.10	0.35	0.97	1.25	0.35	0.44	0.42	6.9%
		16.25	7.05	0.30	0.30	1.25	0.30	0.38	0.11	1.8%
		17.50	7.00	0.30	0.71	1.25	0.30	0.38	0.27	4.3%
		18.75	6.95	0.25	0.35	1.25	0.25	0.31	0.11	1.8%
		20.00	6.95	0.25	0.79	1.25	0.25	0.31	0.25	4.0%
		21.25	7.00	0.35	0.45	1.25	0.35	0.44	0.20	3.2%
		22.50	7.10	0.35	0.40	1.25	0.35	0.39	0.16	2.6%
		23.50	7.15	0.40	0.50	1.00	0.40	0.40	0.20	3.3%
		24.50	7.15	0.35	0.92	1.00	0.35	0.35	0.32	5.3%
		25.50	7.15	0.40	0.98	1.00	0.40	0.40	0.39	6.4%
		26.50	7.00	0.25	1.16	1.01	0.25	0.25	0.29	4.7%
		27.50	7.25	0.45	1.19	1.03	0.45	0.34	0.40	6.6%
		28.00	7.15	0.35	1.37	0.51	0.35	0.18	0.24	3.9%
		28.50	7.30	0.50	1.55	0.52	0.50	0.25	0.39	6.3%
		29.00	7.15	0.40	1.63	0.52	0.40	0.20	0.33	5.3%
		29.50	7.25	0.50	1.70	0.51	0.50	0.25	0.43	6.9%
		30.00	7.25	0.50	1.10	0.50	0.50	0.25	0.28	4.5%
		30.50	7.25	0.50	1.50	0.50	0.50	0.38	0.56	9.2%
		31.50	6.95	0.20	0.65	1.04	0.20	0.20	0.13	2.1%
		32.50	7.05	0.20	0.45	1.00	0.20	0.20	0.09	1.5%
		33.50	7.10	0.30	0.00	1.00	0.30	0.35	0.00	0.0%
	SW	34.80	6.75	0.00	0.00	1.35		0.00	0.00	0.0%
		36.80	6.10			0.00		0.00	0.00	0.0%
		40.20	5.75			0.00		0.00	0.00	0.0%
		43.00	5.95			0.00		0.00	0.00	0.0%
		44.20	5.80			0.00		0.00	0.00	0.0%
	GL	45.90	5.10			0.00		0.00	0.00	0.0%
	S	46.50	4.80			0.00		0.00	0.00	0.0%
	TOTALS ----------					28.05	0.5 (Max.)	7.63	6.13	100.0%

Manning's n = 0.0826
Hydraulic Radius= 0.27213297

STREAM NAME: Morrison Creek - 10/1/08 - #1
XS LOCATION: 300' u/s of bridge - 40 15' 23.7" 106 47' 44.4"
XS NUMBER: 100308-1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.63	7.50	-1.8%
6.50	7.63	14.64	91.8%
6.52	7.63	14.05	84.1%
6.54	7.63	13.47	76.5%
6.56	7.63	12.89	68.9%
6.58	7.63	12.31	61.3%
6.60	7.63	11.73	53.7%
6.62	7.63	11.16	46.2%
6.64	7.63	10.59	38.8%
6.66	7.63	10.02	31.3%
6.68	7.63	9.46	23.9%
6.70	7.63	8.89	16.5%
6.71	7.63	8.61	12.9%
6.72	7.63	8.33	9.2%
6.73	7.63	8.05	5.5%
6.74	7.63	7.77	1.9%
6.75	7.63	7.50	-1.8%
6.76	7.63	7.22	-5.4%
6.77	7.63	6.95	-9.0%
6.78	7.63	6.67	-12.6%
6.79	7.63	6.40	-16.1%
6.80	7.63	6.14	-19.6%
6.82	7.63	5.61	-26.5%
6.84	7.63	5.10	-33.2%
6.86	7.63	4.62	-39.5%
6.88	7.63	4.16	-45.5%
6.90	7.63	3.71	-51.4%
6.92	7.63	3.27	-57.2%
6.94	7.63	2.85	-62.7%
6.96	7.63	2.45	-67.9%
6.98	7.63	2.09	-72.6%
7.00	7.63	1.76	-76.9%

WATERLINE AT ZERO
AREA ERROR = 6.745

STREAM NAME: Morrison Creek - 10/1/08 - #1
XS LOCATION: 300' u/s of bridge - 40 15' 23.7" 106 47' 44.4"
XS NUMBER: 100308-1

Constant Manning's n

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.50	40.93	1.20	1.80	49.14	41.63	100.0%	1.18	104.96	2.14
	5.75	39.84	0.98	1.55	39.24	40.44	97.1%	0.97	73.55	1.87
	5.80	38.55	0.97	1.50	37.28	39.12	94.0%	0.95	69.03	1.85
	5.85	36.89	0.96	1.45	35.39	37.44	89.9%	0.95	65.19	1.84
	5.90	35.21	0.95	1.40	33.59	35.74	85.8%	0.94	61.63	1.83
	5.95	33.52	0.95	1.35	31.87	34.03	81.8%	0.94	58.34	1.83
	6.00	32.83	0.92	1.30	30.22	33.33	80.1%	0.91	54.13	1.79
	6.05	32.24	0.89	1.25	28.59	32.73	78.6%	0.87	49.96	1.75
	6.10	31.66	0.85	1.20	26.99	32.13	77.2%	0.84	45.96	1.70
	6.15	31.37	0.81	1.15	25.42	31.82	76.4%	0.80	41.84	1.65
	6.20	31.12	0.77	1.10	23.86	31.55	75.8%	0.76	37.86	1.59
	6.25	30.86	0.72	1.05	22.31	31.27	75.1%	0.71	34.05	1.53
	6.30	30.56	0.68	1.00	20.77	30.96	74.4%	0.67	30.44	1.47
	6.35	30.26	0.64	0.95	19.25	30.64	73.6%	0.63	27.00	1.40
	6.40	29.96	0.59	0.90	17.75	30.32	72.8%	0.59	23.74	1.34
	6.45	29.65	0.55	0.85	16.25	30.00	72.1%	0.54	20.66	1.27
	6.50	29.35	0.50	0.80	14.78	29.68	71.3%	0.50	17.76	1.20
	6.55	29.05	0.46	0.75	13.32	29.36	70.5%	0.45	15.04	1.13
	6.60	28.74	0.41	0.70	11.88	29.04	69.8%	0.41	12.51	1.05
	6.65	28.44	0.37	0.65	10.45	28.72	69.0%	0.36	10.18	0.97
	6.70	28.13	0.32	0.60	9.03	28.40	68.2%	0.32	8.05	0.89
WL	6.75	27.83	0.27	0.55	7.63	28.08	67.4%	0.27	6.12	0.80
	6.80	26.73	0.23	0.50	6.27	26.97	64.8%	0.23	4.53	0.72
	6.85	24.89	0.20	0.45	4.97	25.11	60.3%	0.20	3.23	0.65
	6.90	22.31	0.17	0.40	3.82	22.52	54.1%	0.17	2.23	0.59
	6.95	20.77	0.13	0.35	2.74	20.96	50.4%	0.13	1.35	0.49
	7.00	16.06	0.11	0.30	1.84	16.24	39.0%	0.11	0.82	0.45
	7.05	12.20	0.09	0.25	1.13	12.34	29.6%	0.09	0.44	0.39
	7.10	7.86	0.08	0.20	0.63	7.98	19.2%	0.08	0.22	0.35
	7.15	5.90	0.05	0.15	0.29	5.99	14.4%	0.05	0.07	0.25
	7.20	2.65	0.04	0.10	0.12	2.71	6.5%	0.04	0.03	0.24
	7.25	1.45	0.01	0.05	0.02	1.47	3.5%	0.01	0.00	0.09
	7.30	0.03	0.00	0.00	0.00	0.03	0.1%	0.00	0.00	0.03

3/3 = 11.5

2/3 = 11.0

STREAM NAME: Morrison Creek - 10/1/08 - #1
XS LOCATION: 300' u/s of bridge - 40 15' 23.7" 106 47' 44.4"
XS NUMBER: 100308-1

SUMMARY SHEET

MEASURED FLOW (Qm)=	6.13	cfs
CALCULATED FLOW (Qc)=	6.12	cfs
(Qm-Qc)/Qm * 100 =	0.1	%
MEASURED WATERLINE (WLm)=	6.75	ft
CALCULATED WATERLINE (WLc)=	6.75	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-11.0	%
MEAN VELOCITY=	0.80	ft/sec
MANNING'S N=	0.083	
SLOPE=	0.01130435	ft/ft
.4 * Qm =	2.5	cfs
2.5 * Qm=	15.3	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

February 20, 2009

Linda Bassi, Esq.
Stream and Lake Protection Division
Colorado Water Conservation Board
1313 Sherman, Suite 721
Denver, CO 80203

Re: Morrison Creek Instream Flow Recommendation

Dear Linda,

James Larson, Dequine Family L.L.C. and Flying Diamond Resources, (the "Parties") are writing to recommend that the CWCB appropriate a water right for instream flow purposes on Morrison Creek, under ISF Rule 5 and sections 37-92-102(3) and -302, C.R.S. (2008). Morrison Creek is located in the Yampa River basin in Routt County, Water District No. 58, Water Division No. 6, Colorado. In particular, the Parties recommend the CWCB appropriate water rights for instream flow purposes on Morrison Creek from immediately below the Dequine Ditch Alt Point #1, as described in the Judgment and Decree, Case No. 95CW35, Water Division No. 6, downstream to the confluence with the Yampa River (the "Recommended Reach"). A copy of that decree is attached to this letter as Appendix A. The Recommended Reach is approximately five miles, and is shown on the Green Ridge and Blacktail Mountain USGS Quadrangle Maps. A significant portion of the Recommended Reach is located on property owned by one or more of the Parties.

A. NATURAL ENVIRONMENT TO BE PRESERVED

Morrison Creek originates in the western Gore Mountains in the Routt National Forest. The creek flows northwest to its confluence with the Yampa River. The area surrounding Morrison Creek contains varied ecology and landscape, and supports diverse riparian habitats. Much of the habitat remains in its native state, undisturbed by agriculture and development. Morrison Creek supports myriad wildlife species and provides winter range area for elk. Golden eagle and sandhill crane nesting areas have been identified along Morrison Creek. In 1993, the Colorado Division of Wildlife classified the fishery as excellent. Recent studies, however, indicate that the quality of the natural environment and fishery habitat has degraded, despite decreed instream flow water rights upstream and downstream of the Recommended Reach.

The Recommended Reach would connect decreed instream flow water rights on Silver Creek and the Yampa River. The CWCB holds instream flow water rights on Silver Creek from its headwaters to its confluence with Morrison Creek. In Case No. 1326-77, the Water Court, Water Division No. 6 entered a decree for 1 c.f.s., for instream flow purposes from the headwaters of Silver Creek to its confluence with the South Fork of Silver Creek. In Case No. 1328-77, the Water Court, Water Division No. 6 entered a decree for 5 c.f.s., for instream flow purposes on Silver Creek from the confluence of the South Fork of Silver Creek to its confluence with Morrison Creek. The CWCB also holds an instream flow water right on the Yampa River, from the confluence of Morrison Creek downstream to the inlet of Lake Catamount. That right was decreed for 72.5 c.f.s.,

absolute, from April 1 through August 14; and 47.5 c.f.s. from August 15 through March 31, in Case No. 01CW106, Water Division No. 6.

B. DRAFT HABITAT ASSESSMENT

In the interest of protecting and improving the unique aquatic habitat of Morrison Creek, the Parties engaged a private consulting firm to analyze the existing conditions and to identify a course of action to maintain and improve those conditions.

Habitech, Inc. conducted a site visit and habitat assessment on August 23, 2008. On September 16, 2008, Habitech, Inc. sent to counsel for the Parties a DRAFT Summary of Morrison Creek Site Visit and Habitat Assessment (the "Draft Assessment"). A copy of the Draft Assessment is attached hereto as Appendix B. The Draft Assessment describes the methods that were used to analyze channel stability, habitat quality and recommends instream flow rates to protect and improve aquatic habitat in Morrison Creek below its confluence with Silver Creek, following the CWCB's protocol.

The Draft Assessment concludes that current conditions are well below optimum and that trout resting areas and cover, food production and reproductive capacity are likely impaired due to high volumes of sand and fine gravels transported in Morrison Creek. The Draft Assessment concludes that future water withdrawals from Morrison Creek would likely further degrade the quality of trout habitat.

C. AMOUNT OF RECOMMENDED APPROPRIATION

Habitech, Inc. developed instream flow recommendations based upon the criteria followed by the CWCB. Those criteria are summarized on page 2 of the Draft Assessment. Based upon the recommendations of Habitech, Inc. and the information provided above, the Parties recommend the CWCB appropriate instream-flow water rights in the Recommended Reach, in at least the following amounts: 18 c.f.s. during the summer months and 4 c.f.s. during the winter months. These flow recommendations may be adjusted based on more detailed field study, including a PHABSIM analysis. The Parties would support any higher stream flow recommendations developed by the Division of Wildlife or CWCB staff.

D. RESOURCE THREATS

There are several existing and potential threats to the existing natural environment within the Recommended Reach. The Upper Yampa Water Conservancy District (the "District") has decrees and pending water rights applications for several water projects that would divert water from Morrison Creek for storage in Stagecoach Reservoir, including a new reservoir on Morrison Creek. Admittedly, an appropriation by the CWCB would be junior to those projects. Ultimately, the District may not obtain decrees for some of those projects, or may choose to pursue other projects. Under those circumstances, a new appropriation by the CWCB would preserce the Recommended Reach in its existing condition. In addition, an appropriation by the CWCB would be senior to later appropriations and protect against additional changes in the stream regimen that would result from those new appropriations or changes in existing water rights.

One of the existing threats to the Recommended Reach is a proposed reservoir on Morrison Creek. In March, 1993, Hydrosphere Resource Consultants issued the Yampa River Basin, Alternative Feasibility Study, Final Report (the "Report"). Hydrosphere prepared the Report for the CWCB, the Colorado River Water Conservation District and the Bureau of Reclamation as part of the Statewide Water Supply Initiative ("SWSI"). Among other things, the Report evaluates potential reservoir sites in the Yampa River Basin, including but not limited to a reservoir on Morrison Creek. Excerpted portions of the Report are attached hereto as Appendix C.

The Report describes the existing natural environment that would be affected by a reservoir on Morrison Creek. The Report states that "[t]he existing fishery is classified as excellent by CDOW." Hydrosphere Report, at 4-14. The Report states that "wetlands occur along the entire reach of Morrison Creek [...]." *Id.* In addition, the Report describes diverse and abundant wildlife and ecology.

Ultimately, the Report recommends "that the Morrison Creek site be eliminated primarily on environmental grounds, although it is arguably the best reservoir site from a technical and economic perspective." *Id.* at 4-29.

The Upper Yampa Water Conservancy District is now proposing to build a reservoir on Morrison Creek (the "Reservoir") near the site studied and rejected in the Report. The District has pending two applications for water rights related to the Reservoir. Case No. 07CW61 involves claims for a change of existing water rights to allow them to be stored in the Morrison Creek Reservoir. Case No. 07CW72 includes claims for new conditional water rights to be stored in the Reservoir. The applications in both cases locate the dam for the Reservoir on Morrison Creek, just below its confluence with Silver Creek.

The Reservoir would significantly alter the natural stream flow regime of Morrison Creek by storing high flows during the spring runoff for later release during summer, fall and/or winter months when stream flows would normally be much lower. The Reservoir could alter the temperature, sediment load, and other characteristics of the existing environment, and introduce foreign aquatic species, such as Northern Pike, that prey on native trout populations. In addition, the District's water court applications include claims to pump water stored in the Reservoir into the Little Morrison Creek drainage for storage in Stagecoach Reservoir. It is likely that much of the water stored in the Reservoir would be transported to Stagecoach Reservoir for storage and never released to Morrison Creek.

Case Nos. 07CW61 and 07CW72 have been consolidated for trial, beginning on October 7, 2009. There are several issues for trial that could prevent the District from obtaining decrees in those cases. Significantly, the Reservoir would inundate a portion of Silver Creek that has a decreed instream flow right, Case No. W-1328-77, Water Division No. 6. The Reservoir might also inundate a portion of the Sarvis Creek Wilderness Area, which would require federal approval. There are other issues that could prevent the District from obtaining decrees in these cases. For example, in Case No. 03CW53, the Division 6 Water Court recently dismissed the District's application for new conditional water rights based on the District's failure to satisfy its burden of proof including, but not limited to, demonstrating a need for the claimed water rights.

In addition, the District's other decreed water rights could affect the Recommended Reach. For example, the Division 6 Water court recently entered a finding of reasonable diligence and decree continuing the District's conditional water rights for diversion of 50 c.f.s. from Morrison Creek in Case No. 04CW10. Under that decree, water would be diverted from Morrison Creek and released into Little Morrison Creek for storage in Stagecoach Reservoir.

To continue those conditional water rights, the District must file an application for finding of reasonable diligence by the end of February, 2015. However, the District may choose not to develop those conditional water rights in favor of another project, or file an application for a change of water rights to divert them at a different location on Morrison Creek. According to the recent testimony of Thomas Sharp, a member of the District's board of directors, the District is considering at least six different alternatives to divert water from Morrison Creek to increase the yield of Stagecoach Reservoir. A copy of a memorandum summarizing those alternatives is attached as Appendix D. By appropriating an instream flow water right for the Recommended Reach now, the CWCB could preserve and protect the existing natural environment against degradation from new appropriations for those alternatives or changes in points of diversion for decreed water rights.

A new appropriation could also protect the Recommended Reach against depletions from future exchanges of water rights on Morrison Creek or changes in points of diversion and/or places of storage for other existing water rights. For example, the district holds several decrees for conditional water rights for the Four Counties Ditch Nos. 1 and 3 and the Four Counties Ditch No. 3 First Enlargement. The District changed those water rights to allow them to be stored in Stagecoach Reservoir. The District may, in the future, seek to change those rights to allow them to be diverted by exchange on Morrison Creek, or stored in the Morrison Creek Reservoir. A new appropriation by the CWCB would be senior to a later appropriative right of exchange on Morrison Creek, and would protect against diminished stream flows resulting from future changes of existing water rights.

In summary, there are numerous threats to the natural environment within the Recommended Reach. Although some of those projects have decreed water rights or pending applications for water rights that would senior to a new appropriation by the CWCB, the District may not build those projects or obtain those decrees. In addition, by appropriating an instream flow right in the near future, the CWCB could protect the Recommended Reach from degradation that would result from future changes of the District's existing water rights and new appropriations.

D. RECOMMENDATION

Based upon the information provided above, and the preliminary conclusions of Habitech, Inc., the Parties recommend the CWCB appropriate instream-flow water rights on Morrison Creek, from its confluence with Silver Creek to its confluence with the Yampa River, in at least the following amounts: 18 c.f.s. during the summer months and 4 c.f.s. during the winter months. The Parties further recommend that the CWCB file an application for such water rights in the near future to obtain a senior priority against future appropriations and preserve the stream conditions existing at the time of the instream-flow appropriation against future changes in water rights.

Very truly yours,

FLYING DIAMOND RESOURCES

By: Scott Steinbrecher

DEQUINE FAMILY L.L.C.

By: Scott Steinbrecher

James A. Larson

For additional information, please contact:

Charles B. White
Scott Steinbrecher
Petros & White LLC
1999 Broadway, Suite 3200
Denver, CO 80202
(303) 825-1980
scott@petros-white.com

WATER COURT, WATER DIVISION NO. 6, STATE OF COLORADO

Case No. 95CW35

REFEREE'S RULING - SURFACE (CONDITIONAL IN PART, ABSOLUTE IN PART)

IN THE MATTER OF THE APPLICATION FOR WATER RIGHTS OF:

DEQUINE FAMILY LLC OF MORRISON CREEK RANCH

IN ROUTT COUNTY, STATE OF COLORADO

The above captioned Application was filed on February 24, 1995, amended on December 1, 1995 and was referred to the Water Referee in accordance with Sections 37-92-101, et seq., C.R.S. On May 1, 1995 the Division Engineer submitted a Summary of Consultation recommending approval of the Application with certain clarifications which are incorporated herein.

No Statement of Opposition to the Application has been filed and the time for filing such statement has expired.

The Water Referee has made such investigations as are necessary to determine whether or not the statements in the Application are true and has become fully advised with respect to the subject matter of the Application.

IT IS HEREBY THE RULING OF THE WATER REFEREE:

GENERAL FINDINGS

1. The name and address of the Applicant is:

   Lou Dequine
   22100 RCR 16
   Oak Creek, CO 80467

2. The name of the structures are:

   Dequine Ditch, Dequine Ditch Alt Point #1, Dequine Ditch Alt Point #2, Dequine Spring.

3. The legal description for each point of diversion is:

   Dequine Ditch: SW 1/4 SW 1/4 of Section 11 Township 3 North, Range 84 West of the 6th P.M. at a point 500 feet East of the West Section line and 1200 feet North of the South Section line of said Section;

Dequine Ditch Alt Point #1: NW 1/4 SW 1/4 of Section 11 Township 3 North, Range 84 West of the 6th P.M. at a point 2600 feet South of the North Section line and on the West line of said Section;

Dequine Ditch Alt Point #2: NW 1/4 NW 1/4 of Section 14 Township 3 North, Range 84 West of the 6th P.M. at a point 1000 feet East of the West Section line and 600 feet South of the North Section line of said Section;

Dequine Spring: NE 1/4 SE 1/4 of Section 10 Township 3 North, Range 84 West of the 6th P.M. at a point 200 feet West of the East Section line and 1800 feet North of the South Section line of said Section.

4. The source of the water for each structure is:

Dequine Ditch: Morrison Creek of Yampa River;

Dequine Ditch Alt Point #1: Morrison Creek of Yampa River;

Dequine Ditch Alt Point #2: Morrison Creek of Yampa River;

Dequine Spring: Morrison Creek of Yampa River.

5. The date of the appropriation is:

Dequine Ditch: August 31, 1991;

Dequine Ditch Alt Point #1: August 31, 1991;

Dequine Ditch Alt Point #2: August 31, 1991;

Dequine Spring: June 1, 1968.

6. The appropriation was initiated by:

Dequine Ditch: pumped from creek into ditch;

Dequine Ditch Alt Point #1: pumped from creek into ditch;

Dequine Ditch Alt Point #2: pumped from creek into ditch;

Dequine Spring: livestock drinking water.

ABSOLUTE SURFACE WATER RIGHT

7. Water was applied to beneficial use in connection with following structure on the date indicated:

Dequine Ditch: August 31, 1991;

Dequine Ditch Alt Point #1: August 31, 1991;

Dequine Ditch Alt Point #2: August 31, 1991;

Dequine Spring: June 1, 1968.

8. The amount of water awarded absolutely is:

Dequine Ditch: 1.25 cfs, absolute;

Dequine Ditch Alt Point #1: 1.25 cfs, absolute;

Dequine Ditch Alt Point #2: 1.25 cfs, absolute;

Dequine Spring: 0.033 cfs, absolute.

9. The use of water under this absolute water right is:

Dequine Ditch: irrigation, livestock;

Dequine Ditch Alt Point #1: irrigation, livestock;

Dequine Ditch Alt Point #2: irrigation, livestock;

Dequine Spring: livestock.

10. The water right awarded herein is awarded absolutely and unconditionally, subject, however, to all earlier priority rights of others and to the integration and tabulation by the Division Engineer of such priorities and changes in accordance with the law.

CONDITIONAL SURFACE WATER RIGHTS

11. The amount of water awarded conditionally is:

Dequine Spring: no additional amount of water is awarded conditionally.

12. The use of water under this conditional water rights is:

Dequine Spring: domestic and irrigation of one acre.

13. The water rights awarded herein are conditional and are hereby continued in full force and effect until July, 2002. If Applicant desires to maintain such conditional decree, an application for a quadrennial finding of reasonable diligence shall be filed on or before the last day of July 2002 or a showing made on or before such date that the conditional water rights have become an absolute water right by reason of the completion of the appropriation.

14. The conditional water rights herein awarded are subject to all earlier priority rights of others and to the integration and tabulation by the Division Engineer of such priorities and changes in accordance with law.

It is accordingly ORDERED that this Ruling shall be filed with the Water Clerk subject to Judicial review.

It is further ORDERED that a copy of this Ruling shall be mailed to the owner of the land on which the diversion is located:

It is further ORDERED that a copy of this Ruling shall be filed with the appropriate Division Engineer and the State Engineer.

Dated June 12, 1996.

BY THE REFEREE

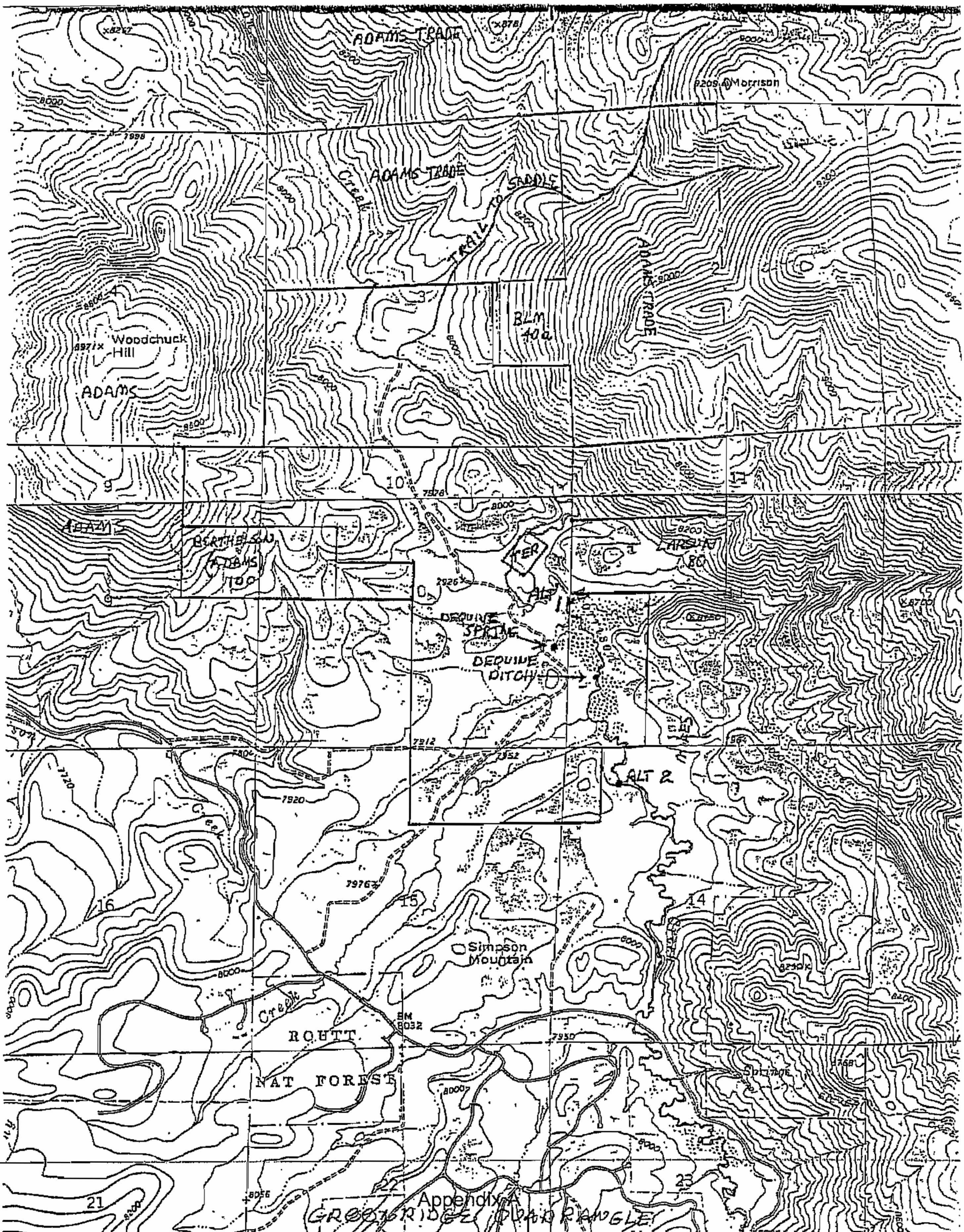
Daniel R. Birch
Water Referee
Water Division No. 6
State of Colorado

No protest was filed in this matter. The foregoing Ruling is confirmed and approved, and is made the Judgment and Decree of this Court.

Dated 7-16-96.

BY THE COURT

Richard P. Doucette
Water Judge
Water Division No. 6
State of Colorado



Appendix A

GREEN RIDGE QUADRANGLE

MORRISON CREEK — WATER YEAR 1991

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3	4.02	5	5	5	5	5	23.3	108	12.5	5.46	4.1
2	3.03	4.05	5	5	5	5	7.5	50.2	108	11.8	5.78	4.03
3	3.07	4.08	5	5	5	5	10	77.2	109	11	6.1	3.96
4	3.1	4.11	5	5	5	5	12.5	70.4	110	10.3	6.03	3.88
5	3.13	4.15	5	5	5	5	15	63.7	111	9.51	5.96	3.81
6	3.16	4.18	5	5	5	5	16.8	56.9	112	8.76	5.89	3.74
7	3.2	4.21	5	5	5	5	18.5	78.8	113	8.01	5.83	3.67
8	3.23	4.25	5	5	5	5	20.3	133	102	7.87	5.76	3.59
9	3.26	4.28	5	5	5	5	22.1	139	90.4	7.73	5.69	3.52
10	3.3	4.31	5	5	5	5	23.9	132	79.1	7.6	5.62	3.45
11	3.33	4.34	5	5	5	5	25.6	119	67.7	7.46	5.55	3.38
12	3.36	4.38	5	5	5	5	27.4	94.1	56.3	7.32	5.48	3.3
13	3.39	4.41	5	5	5	5	29.2	76	57.6	7.19	5.41	3.23
14	3.43	4.44	5	5	5	5	30.9	81.3	53.8	7.05	5.34	3.16
15	3.46	4.48	5	5	5	5	32.7	100	50	6.91	5.27	3.09
16	3.49	4.51	5	5	5	5	34.5	108	46.2	6.78	5.2	3.01
17	3.52	4.54	5	5	5	5	36.3	81.7	42.4	7.27	5.14	2.94
18	3.56	4.57	5	5	5	5	38	80.6	38.6	7.77	5.07	2.87
19	3.59	4.61	5	5	5	5	39.8	79.5	34.9	8.26	5	2.8
20	3.62	4.64	5	5	5	5	41.6	96.7	32	8.76	4.93	2.72
21	3.66	4.67	5	5	5	5	43.3	114	29.1	9.25	4.86	2.65
22	3.69	4.7	5	5	5	5	45.1	114	26.2	9.75	4.79	2.58
23	3.72	4.74	5	5	5	5	46.9	115	24.5	10.2	4.72	2.51
24	3.75	4.77	5	5	5	5	48.7	118	22.8	10.7	4.65	2.43
25	3.79	4.8	5	5	5	5	50.4	121	21.1	11.2	4.58	2.36
26	3.82	4.84	5	5	5	5	45.9	124	18.5	10.2	4.51	2.29
27	3.85	4.87	5	5	5	5	41.4	127	16	9.2	4.45	2.22
28	3.89	4.9	5	5	5	5	36.9	110	13.5	8.19	4.38	2.14
29	3.92	4.93	5	5		5	32.4	105	13.2	7.17	4.31	2.07
30	3.95	4.97	5	5		5	27.8	106	12.8	6.16	4.24	2
31	3.98		5	5		5		107		5.14	4.17	
TOTAL	108	135	155	155	140	155	906	3001	1721	267	160	91.5
MEAN	3.49	4.49	5	5	5	5	30.2	96.8	57.4	8.61	5.17	3.05
AF	215	267	307	307	278	307	1798	5952	3413	530	318	181

TOTAL = 6995 CFS-DAYS
MAX = 139 CFS
MIN = 2 CFS
MEAN FOR 365 DAYS = 19.2 CFS
VOLUME TOTAL = 13874 ACRE-FT

02/05/95

100 AF 1 DAY Apx.

50 CFS = A/F

HabiTech, Inc.

Water Resource Consultants

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Lora B. Wesche, President
Thomas A. Wesche, PhD, Principal Scientist

E-mail: lwesche@aol.com

16 September 2008

TO: Charles B. White, Petros & White, LLC
FROM: Tom Wesche
SUBJECT: **DRAFT** Summary of Morrison Creek Site Visit and Habitat Assessment

Introduction:

As you requested, I made a site visit to Morrison Creek (MC) on the Flying Horse Ranch in Routt County, CO on 23 August 2008. My purpose was to 1) assess the condition of the MC channel and trout habitat, 2) collect data to develop a preliminary estimate of MC's instream flow needs following the Colorado Water Conservation Board's (CWCB) procedures, and 3) establish a study site for conducting a Physical Habitat Simulation (PHABSIM) investigation to further identify the instream flow needs of MC for maintaining fish habitat. This **draft** memorandum summarizes my findings to date.

Methods:

I walked and surveyed MC from the downstream boundary of the ranch up to the confluence with Silver Creek. Numerous photographs were taken at waypoints marked on a Garmin GPSmap60CSx. These will be sent to you on a CD in the near future. Channel condition and stability was evaluated using the Stream Reach Inventory and Channel Stability Evaluation (SRI/CSE) procedure developed by the USDA Forest Service (Pfankuch 1975). Aquatic habitat condition was evaluated using both the EPA Rapid Assessment and the Montana Department of Environmental Quality Habitat Assessment protocols. The field data forms for these assessment tools are appended.

Following my walk-through, I established a PHABSIM study site just below the confluence of Silver Creek, following the guidance of Bovee (1997). Four cross-channel transects were selected to represent riffle, run and pool habitats and measurements of water depth, velocity, substrate and cover were made across each at a series of up to 23 locations. These measurements will likely be repeated in the spring and summer of 2009 at two other stream flow levels and habitat-flow modeling will then be performed following the guidance of the U. S. Geological Survey (2001). One of these four transects (Transect 3) was placed across a shallow riffle for preliminary instream flow analysis following the CWCB's R2CROSS procedure, as described by Nehring (1979), Wesche and Rechard (1980), Annear and Conder (1983) and Roach (2008). Transect hydraulics were modeled using the USDA Forest Service WinXSPRO program (Hardy et al 2005). The results for Transect 3 (TR3) are appended. A staff gage was installed on river right about 40 ft downstream of the bridge at the Silver Creek confluence to monitor water stage during transect measurement and to allow development of a stage-discharge relation following future site visits.

Results:
During my walk-through, I observed a number of trout, most appearing to be less than 10 inches in length. Mr. Dequine indicated the predominant game fish was brook trout (*Salvelinus fontinalis*), with lesser numbers of cutthroat trout (*Oncorhynchus clarki*) and rainbow trout (*O. mykiss*). Stream flow was measured at 7.44 cfs (staff gage reading = 1.35 ft), with conditions being low and clear.

Channel stability based on the SRI/CSE was rated as "fair" with an overall score of 101 ("fair" range, 77 - 114). Most Upper Bank attributes scored in the "good" category, while 9 of 11 Lower Bank and Channel Bottom attributes fell into the "fair" category. Of particular concern is the accelerated bar formation and stream bed deposition observed due to the apparent transport of relatively large volumes of sand and finer gravels into the study reach from the upstream Morrison Creek watershed. Sediment movement into the study reach from the Silver Creek watershed appeared to be substantially less.

Habitat quality for most parameters in the EPA and Montana assessment procedures scored as either "marginal" or "sub-optimal". Of particular concern are the marginal ratings for "aquatic structure as cover", "channel flow status", "riffle development", "benthic substrate", "embeddedness", and "sediment deposition". These ratings suggest the likely impairment of trout resting areas, food-production, and reproductive capacity due to the accelerated bar formation and sediment deposition discussed above. Such conditions could be further degraded by future water withdrawals. Overall, habitat quality was 60.5% of optimum based on the EPA procedure and 55% of optimum based on the Montana protocol.

Instream flow recommendations following the CWCB protocol are based upon the hydraulic criteria established by Nehring (1979). These criteria include maintaining a wetted perimeter of at least 50% of the bankfull condition, an average cross-section depth of 0.39 ft for a channel the width of MC, and an average cross-section velocity of 1.0 ft/sec. Protecting salmonids during the summer season is accomplished by ensuring all three criteria are met while winter protection is accomplished by meeting two of the three criteria (Roach 2008). Based upon these criteria and our hydraulic modeling results for Transect 3, a summer instream flow of about 18 cfs and a winter flow of about 4 cfs would be appropriate for trout protection on MC below the Silver Creek confluence.

Conclusions and Recommendations:
My overall assessment of the Morrison Creek channel and the habitat provided is that current conditions are well below optimum, with likely impairment of trout resting areas and cover, food production and reproductive capacity. Such reduced habitat quality is due to the relatively high volumes of sand and finer gravels being transported into the study reach from the upper MC watershed. Future water withdrawals would likely degrade trout habitat quality even further. A watershed-based restoration effort by concerned landowners and agencies could prove beneficial in reducing sediment loading to the system and improving trout habitat quality.

The instream flow recommendations presented above will provide some level of trout habitat

protection, but should be considered as preliminary at this time, pending completion of the recommended PHABSIM analysis in 2009. Recommendations developed using the PHABSIM approach will be more ecologically-based as they take into consideration the specific physical habitat requirements of the trout species and life stages residing within MC. The weighted-usable area versus flow plots developed for each species and life stage will provide greater insight into the benefits of protecting different stream flow levels and allow the trade-offs of different future water development scenarios to be more thoroughly evaluated. Further, the extended spatial (multiple transects and habitat types) and temporal (3 flow levels field-measured) coverage afforded by PHABSIM will provide more comprehensive and defensible instream flow recommendations.

Finally, based upon the degraded habitat conditions observed resulting from the excessive accumulation of finer sediments, I recommend flushing flow recommendations also be developed for MC to assure protection of at least a portion of the annual high flow runoff. Such high magnitude, short term flow events can "flush" accumulated fine sediments from the stream bed and help to improve and/or maintain overall trout habitat quality. The analysis necessary to develop such recommendations would use the hydraulic data already being collected at the PHABSIM transects in conjunction with a bed load transport model such as described by Parker (1990). The programs needed for this modeling effort are already contained within the WinXSPRO software package and would require little additional time and expense.

Literature Cited:

Annear, T. C. and A. L. Conder. 1983. Evaluation of instream flow methods for use in Wyoming. Completion Report, Wyoming Game and Fish Department, Cheyenne, WY.

Bovee, K. D. 1997. Data collection procedures for the Physical Habitat Simulation System. U. S. Geological Survey, Biological Resources Division, Mid-Continent Ecological Service Center, Fort Collins, CO.

Hardy, T., P. Panja and D. Mathias. 2005. WinXSPRO, a cross-section analyzer, user's manual, Version 3.0. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-147. Fort Collins, CO.

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

Parker, G. 1990. Surface-based bed load transport relation for gravel rivers. Journal of Hydraulic Research , IAHR 28:4.

Pfankuch, D. J. 1975. Stream reach inventory and channel stability evaluation, a watershed management procedure. USDA Forest Service, Northern Region, Missoula, MT.

Roach, W. J. 2008. Letter to L. Bassi and J. Baessler, Colorado Water Conservation Board, Denver, CO. Trout Unlimited, Colorado Water Project, Boulder, CO, February 13.

U. S. Geological Survey. 2001. Open File Report 01-340, Mid-Continent Ecological Science Center, Fort Collins, CO.

Wesche, T. A. And P. A. Rechard. 1980. A summary of instream flow methods for fisheries and related research needs. Eisenhower Consortium Bulletin 9, 122.

Stream Reach Inventory and Channel Stability Evaluation (SRI/CSE) ratings by attribute

	Attribute	Excellent		Good		Fair		Poor	
	Upper Banks								
1	Landform slope	Bank slope gradient <30%	2	Bank slope gradient 30-40%	(4)	Bank slope gradient 40 - 80%	6	Bank slope gradient 80%+	8
2	Mass wasting hazard	No evidence of past or any potential for future mass wasting into channel	3	Infrequent and/or very small. Mostly healed over. Low future potential	(6)	Moderate frequency and size, with some raw spots eroded by water during high flows.	9	Frequent or large, causing sediment nearly yearlong or imminent danger of same	12
3	Debris jam potential	Essentially absent from immediate channel area	2	Present but mostly small twigs and limbs.	4	Present, volume and size are both increasing.	(6)	Moderate to heavy amounts, predominantly larger sizes.	8
4	Vegetation bank protection	90% + plant density. Vigor and variety suggests a deep, dense, soil binding, root mass	3	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	(6)	50-70%density. Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass.	9	<50% density plus fewer species and less vigor indicate poor, discontinuous, and shallow root mass.	12
	Lower Banks								
5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ratio <7	1	Adequate. Overbank flows rare. W/D ratio 8 to 15.	2	Barely contains present peaks. Occasional overbank floods. W/D ratio 15-25.	(3)	Inadequate. Overbank flows common.W/D ratio >25	4
6	Bank rock content	65% with large, angular boulders 12"+ numerous	2	40 to 65%. mostly small boulder to cobbles 6-12"	4	20 to 40% with most in the 3-6" diameter class.	(6)	<20%rock fragments of gravel sizes, 1-3" or less.	8
7	Obstructions - Flow deflectors, sediment traps	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable	2	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	4	Moderately frequent, moderately unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	(6)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	8
8	Cutting	Little or non evident. Infrequent raw banks less than 6" high generally	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	(8)	Significant. Cuts 12 to 24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16
9	Deposition	Little or no enlargement of channel or point bars	4	Some new increase in bar formation, mostly from coarse gravels.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	(12)	Extensive deposits of predominantly fine particles. Accelerated bar development.	16
	Channel Bottom								
10	Rock Angularity	Sharp edges and corners, plan surfaces roughened	1	Rounded corners and edges, surfaces smooth and flat.	(2)	Corners and edges well rounded in two dimensions.	3	Well rounded in all dimensions, surface smooth.	4
11	Brightness	Surface dull, darkened, or stained. Generally not "bright"	1	Mostly dull, but may have up to 35% bright surfaces.	2	Mixture, 50-50% dull and bright, range: 35 - 65%	(3)	Predominantly bright, 65%+ exposed or scoured surfaces.	4
12	Consolidation or particle packing	Assorted sizes tightly packed and/or overlapping	2	Moderately packed with some overlapping.	4	Mostly a loose assortment with no apparent overlap.	(6)	No packing evident. Loose assortment, easily moved.	8
13	Bottom size distribution and percent stable materials	No changes in sizes evident. Stable materials 80-100%	4	Distribution shift slight. Stable materials 50-80%.	8	Moderate change in sizes. Stable materials 20-50%.	(12)	Marked distribution change. Stable materials 0-20%.	16
14	Scouring and deposition	Less than 5% of the bottom affected by scouring and deposition	6	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools.	(18)	More than 50% of the bottom in a state of flux or change nearly yearlong.	24
15	Clinging aquatic vegetation (moss and algae)	Abundant. Growth largely moss-like, dark green, perennial. In swift water too.	1	Common. Algal forms in low velocity & pool areas. Moss here too and swifter waters.	2	Present but spotty, mostly in backwater areas. Seasonal blooms make rocks slick.	(3)	Perennial types scarce or absent. Yellow-green, short term bloom may be present.	4
	Overall rating		50		76		75		90

Add each column, add column scores

<38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor.

Stream Name: Morrison Ck Observer: TAV Date: 8/23/08 Overall Score: 101

Notes: Flying Horse Ranch "Fair"

Q lower clear

Appendix B

EPA

SITE HABITAT QUALITY EVALUATION FORM

Reach: Morrison Ck
Site: Flying Horse Ranch
Date: 8/25/08
Observer: TAW

Weather Conditions: Warm - Clear early - Lt breeze
River Flow Notes (Qualitatively describe volume, turbidity, recent precipitation, human-caused flow alterations):
Flow low + clear

Estimated channel width:_____
Approximate length of reach evaluated:_____

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Barriers and Diversion Sinks	No physical barriers prevent or inhibit movement of fish or other aquatic organisms through the stream reach; diversion structures are absent or prevent movement of aquatic organisms into ditches or other population sinks.	Minimal physical barriers exist but mostly do not inhibit movement of fish or other aquatic organisms through the stream reach; diversion structures partially prevent movement of aquatic organisms into ditches or other population sinks.	Some physical barriers exist that partially inhibit movement of fish or other aquatic organisms through the stream reach; diversion structures may allow movement of aquatic organisms into ditches or other population sinks.	Substantial physical barriers exist that mostly or entirely prevent movement of fish or other aquatic organisms through the stream reach; diversion structures encourage movement of aquatic organisms into ditches or other population sinks.
SCORE ___	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Shallow riffles may impede passage

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
2. Aquatic Structure as Cover	Greater than 70% of substrate provides fish cover; mix of snags, submerged logs, undercut banks, in-stream rocks larger than cobbles; structures stable (predicted to remain at least 5 years).	40-70% mix of stable habitat; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed, removed, or absent.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
3. Velocity/ Depth Regimes	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (slow is <0.3 m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE ___	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1

Deep - Fast absent
Shallow - Slow abundant

Appendix B

Reach: Morrison Ck EPA
Site: Flying Horse 2/4
Date: 8/23/08
Observer: TAV

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
4. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
5. Channel Alteration	Channelization absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE ___	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by width of the stream <7 (generally 5 to 7); variety of habitat is key.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is 7 to 15.	Occasional riffles; bottom contours provide some habitat; distance between riffles divided by the width of the stream is 15 to 25.	Generally all flat water or shallow runs; poor habitat; distance between riffles divided by the width of the stream is >25.
SCORE ___	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
7. Channel Sinuosity NOTE—evaluate in office	Bends in the stream increase stream length 3 to 4 times longer than if it was straight.	Bends in the stream increase stream length 2 to 3 times longer than if it was straight.	Bends in the stream increase stream length 1 to 2 times longer than if it was straight.	Channel straight; waterway has been channelized for a long distance.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1

Appendix B

EPA 3/4

Reach: Morrison Ck
Site: Flying Heron
Date: 8/25/08
Observer: TBV

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
8. Bank Stability (score each bank, left bank is on left facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ Left Bank	10 9	8 (7) 6	5 4 3	2 1
SCORE ___ Right Bank	10 9	8 (7) 6	5 4 3	2 1

	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
9. Riparian Vegetation Cover and Disturbance (score each bank)	More than 75% of the streambank and riparian zone to 50 ft boundary covered by riparian vegetation including trees, shrubs, herbaceous vegetation, or wetland emergents; vegetative disruption by grazing or cutting minimal or absent; almost all plants allowed to grow naturally.	50-75% of the streambank and riparian zone to 50 ft boundary covered by riparian vegetation; disruption by grazing or cutting may be evident but not seriously affecting riparian vegetation structure.	25-50% of the streambank and riparian zone to 50 ft boundary covered by riparian vegetation; extensive areas of bare cobble or patches of bare soil; disruption by grazing or cutting may be evident and seriously affecting riparian vegetation structure.	Less than 25% of the streambank and riparian zone to 50 ft boundary covered by riparian vegetation; mostly bare cobble or bare soil; disruption by grazing or cutting may be present and severely affecting riparian vegetation structure.
SCORE ___ Left Bank	10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ Right Bank	10 9	8 7 (6)	5 4 3	2 1 0

Appendix B

Morrison Ck - Flying Horse Road EPA 7/4

8/23/06 TMR	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
10. Riparian Vegetation zone width (score each bank)	Width of riparian zone > 50 ft; human activities (development, crops, parks, roads) have not impacted zone.	Width of riparian zone 35 to 50 ft; human activities have impacted zone only minimally.	Width of riparian zone 15 to 35 ft; human activities have impacted zone a great deal.	Width of riparian zone, 15 ft; little or no vegetation due to human activities.
SCORE ___ Left Bank	10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ Right Bank	10 9	8 (7) 6	5 4 3	2 1 0

COMMENTS

Total Score = 121 121/200 = 60.5% of optimum

Appendix B

Montana Habitat Assessment Field Data Sheet — Riffle/Run Prevalence

Stream Morrison Ck Site Flying Horse Ranch
Date 8/22/08 Investigator TAV

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
1A. Riffle Development SCORE (5)	Well-developed riffle; riffle as wide as stream and extends two times width of stream. 9-10	Riffle as wide as stream but length less than two times width. 6-8	Reduced riffle area that is not as wide as stream and its length less than two times width. 3-5	Riffles virtually non-existent 0-
1B. Benthic Substrate SCORE (4)	Diverse Substrate dominated by cobble. 9-10	Substrate diverse, with abundant cobble but bedrock boulder, fine gravel, or sand prevalent. 6-8	Substrate dominated by bedrock, boulders, fine gravel, sand or silt; cobble present. 3-5	Monotonous fine gravel, sand, silt or bedrock substrate. 0-
2. Embeddedness SCORE (8)	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35mm 1.25")) 16-20	Gravel, cobble, or boulder particles are between 25-50% surrounded by fine sediment. 11-15	Gravel, cobble, or boulder particles are between 50-75% surrounded by fine sediment. 6-10	Gravel, cobble, or boulder particles are over 75% surrounded by fine sediment. 0-
3. Channel Alteration (channelization, straightening, dredging, other alterations) SCORE (16)	Channel alterations absent or minimal; stream pattern apparently in natural state. 16-20	Some channelization present, usually in areas of crossings, etc, evidence of past alterations (before past 20 yr) may be present, but more recent channel alteration is not present. 11-15	New embankments present on both banks; and 40 to 80% of the stream reach channelized and disrupted. 6-10	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. 0-
4. Sediment Deposition SCORE (7)	Little or no enlargement of bars and less than 5% of the bottom affected by sediment deposition. 16-20	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 11-15	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition in pools prevalent. 6-10	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 0-

MT DEQ (cont) 2/2

Morrison Ck at Flying Horse Road

8/23/08 TAW

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
5. Channel Flow Status SCORE [ ]	Water fills baseflow channel; minimal amount of channel substrate exposed. 16-20	Water fills > 75% of the baseflow channel; < 25% channel substrate exposed. 11-15	Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed. (8) 6-10	Very little water in channel, and mostly present as standing pools. 0-5
6. Bank Stability (Score each bank) Note: determine left or right side while facing downstream. SCORE [ ] (left) SCORE [ ] (right)	Banks stable; no evidence of erosion or bank failure; little apparent potential for future problems. 9-10	Moderately stable; infrequent, small areas of erosion mostly healed over. (7) (7) 6-8	Moderately unstable; moderate frequency and size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow. 3-6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of banks have erosion scars on side slopes. 0-2
7. Bank Vegetation Protection (note: reduce scores for annual crops and weeds which do not hold soil well, eg knapweed) SCORE [ ] (left) SCORE [ ] (right)	Over 90% of the streambank surfaces covered by stabilizing vegetation; vegetative disruption minimal or not evident; almost all plants allowed to grow naturally. 9-10	70-90% of the streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than one-half of potential plant height evident. 6-8 (6) (6)	50-70% of the streambank surfaces covered in vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of potential plant height remaining. 3-5	Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less. 0-2
8. Vegetated Zone Width (score zone for each side of stream) SCORE [ ] (left) SCORE [ ] (right)	Width of vegetated zone > 100 feet. 9-10	Width of vegetated zone 30-100 feet. (7) (7) 6-8	Width of vegetated zone 10-30 feet. 3-5	Width of vegetated zone < 10 feet. 0-2

TOTAL SCORE (88)

88/160 = 55% of Optimum

MDD 8/18

STAGE (ft)	#SEC	AREA (sq ft)	PERIM (ft)	WIDTH (ft)	R (ft)	DHYD (ft)	SLOPE (ft/ft)	n	VAVG (ft/s)	Q (cfs)	SHEAR (psf)
0.3	T	1.79	16.83	16.77	0.11	0.11	0.003	0.026	0.69	1.23	0.02
0.4	T	3.68	20.62	20.55	0.18	0.18	0.003	0.026	0.98	3.61	0.03
0.5	T	5.8	21.9	21.81	0.26	0.27	0.003	0.026	1.28	7.46	0.05
0.6	T	7.99	22.17	21.99	0.36	0.36	0.003	0.026	1.59	12.68	0.07
0.7	T	10.31	27.36	27.09	0.38	0.38	0.003	0.026	1.64	16.93	0.07
0.8	T	13.19	30.46	30.11	0.43	0.44	0.003	0.026	1.81	23.92	0.08
0.9	T	16.26	31.36	30.94	0.52	0.53	0.003	0.026	2.06	33.44	0.1
1	T	19.37	31.79	31.3	0.61	0.62	0.003	0.025	2.3	44.62	0.11
1.1	T	22.52	32.21	31.66	0.7	0.71	0.003	0.025	2.54	57.17	0.13
1.2	T	25.7	32.64	32.02	0.79	0.8	0.003	0.025	2.76	71.06	0.15
1.3	T	28.92	33.07	32.38	0.87	0.89	0.003	0.025	2.98	86.26	0.16
1.4	T	32.18	33.47	32.71	0.96	0.98	0.003	0.025	3.2	102.82	0.18
1.5	T	35.46	33.79	32.95	1.05	1.08	0.003	0.025	3.41	120.84	0.2
1.6	T	38.77	34.1	33.19	1.14	1.17	0.003	0.025	3.62	140.15	0.21
1.7	T	42.1	34.42	33.43	1.22	1.26	0.003	0.024	3.82	160.76	0.23
1.8	T	45.45	34.74	33.67	1.31	1.35	0.003	0.024	4.02	182.65	0.24
1.9	T	48.84	35.15	34.02	1.39	1.44	0.003	0.024	4.21	205.52	0.26
2	T	52.26	35.6	34.42	1.47	1.52	0.003	0.024	4.39	229.52	0.27

YAMPA RIVER BASIN

Alternatives Feasibility Study

COLORADO RIVER WATER CONSERVATION DISTRICT

COLORADO WATER CONSERVATION BOARD
DEPARTMENT OF NATURAL RESOURCES

BUREAU OF RECLAMATION
U.S. DEPARTMENT OF THE INTERIOR

FINAL REPORT

March 1993

HYDROSPHERE
Resource Consultants
1002 Walnut Suite 200
Boulder, CO 80302

uncertainty about current CDOW and Service policy regarding the stocking of non-native species other than salmonids in the Yampa River basin.

The data collection at each site was limited to a visual evaluation of the existing stream habitat conditions, narrative description of the potential reservoir area, and stream channel stability rating. The existing stream habitat, reservoir characteristics and narrative description were recorded on "General Stream Habitat Survey" forms. The stream channel stability was rated using the Pfankuch (1978) method and recorded on the survey form. Water temperature and water quality were evaluated using the available USGS water quality records. Fishery information was obtained from the CDOW Database. Reservoir fishery potential was evaluated using the model of McConnell, et al. (1984).

Cultural Resources

The potential for impacts on cultural and historical resources was examined by reviewing readily available information from the Colorado Historical Society. A literature search was performed to ascertain which, if any, portions of the sites had been surveyed for archaeological and historical sites. The file search was completed in August of 1991. Ten sites were identified and twelve surveys were found. The relevant survey reports were reviewed and the identified sites' locations relative to the reservoirs determined. A brief discussion was held with officers of the State Historical Preservation office to determine the general likelihood of cultural resources in the vicinity of the reservoirs.

The file search reports list the types of sites and an assessment as to the sites' eligibility for the National Register. Assessments are either from the field, i.e. the surveyor, or official, from the State Historical Preservation Office. All sites and findings are classified as one of eleven different types. The only site types identified in this file search were "other historical site" type, "isolated find", "open camp" and "open lithic". Open camp refers to sites located in an open topographic situation and consisting of features or artifacts which indicate domestic activity, defined by the presence of one or more of the following: groundstone, ceramics, fire hearths, middens, and usually containing waste flakes and chipped tools. Open lithic refers to sites containing lithic (stone) material, usually waste flakes and chipped stone tools, located in an open topographic situation.

Summary of Field Evaluations

Morrison Creek Site

Engineering Aspects. Two possible dam sites were identified along the lower reach of Morrison Creek. Only the upper site was included in the field survey; however, it appeared that the lower site has very similar characteristics. The site is situated within a narrow canyon with steep rock abutments on either side of the creek. Although a dam was at one time considered at the canyon entrance upstream of the sites viewed in the field, it apparently never received serious consideration as no engineering documentation for such a project has been located. Virtually no other background information exists for the Morrison Creek site, and USGS 7.5' quadrangle sheets provide the best available mapping.

Morrison Creek through the canyon is a high gradient stream but appears to carry only a light sediment load. No evidence of mining activity in the area was seen. This site would be best suited for either a rockfill or roller-compacted concrete dam with an overtopping spillway; the dam crest would be approximately 450 feet long. Construction access and a staging area

would need to be constructed near the site, which lies in rugged terrain. No geological hazards were noted at this level of evaluation.

Hydrology. This site is desirable from a water delivery perspective since it lies upstream of most potential demand areas. Average annual inflow is estimated to be about 59,000 acre-feet. The maximum size reservoir that the site topography would allow would be about 31,000 acre-feet, and site characteristics would logically suggest development to this capacity.

Site Development Cost. A reservoir of 31,000 acre-feet (af) total volume at the Morrison Creek site would have development costs in the range of 14 to 21 million dollars. This figure represents a cost of approximately $900 per acre foot of reservoir active storage.

Recreation. The recreation potential of a Morrison Creek reservoir is limited by distance from Craig, by the relatively poor access to the site itself, and by competition from the nearby and more accessible Stagecoach Reservoir. Although a reservoir at Morrison Creek would be very scenic when full, with relatively small amounts of drawdown it would exhibit extensive mudflats in those portions of the basin that are most accessible and visible. The reservoir would have a surface area of roughly 400 acres at the high water line. Given the poor access and good substitutes available close by, about 100,000 visits might be expected annually under current conditions.

Terrestrial Ecology. The Morrison Creek site is located in an upper montane/subalpine valley that is characterized by a high degree of ecological and landscape diversity. In addition to the diverse riparian habitats including willow shrublands, wet grassy meadows and fens, there are spruce-fir forests (some of which are old growth in character), aspen woodlands, meadows and various types of shrublands. The native habitat types show only limited evidence of past disturbance from agricultural activities.

Wildlife populations in the valley and nearby vicinity are undoubtedly diverse in terms of both game and non-game species. Large year-round populations of mule deer and elk occur. WRIS mapping information identifies the area as being within elk "winter range" as well as within elk "severe winter range". Also, the site is within greater Sandhill crane and sharp-tailed grouse "overall range". Sandhill crane and golden eagle nesting areas have been identified within the area that would be inundated.

Wetlands occur along the entire reach of Morrison Creek with the greatest extent of development occurring in the upper reaches of the areas that would be inundated by a reservoir. These wetlands consist of wet meadows dominated by grasses and sedges and willow shrublands.

Aquatic Ecology. Stream habitat in the Morrison Creek Reservoir area is predominantly riffle-run habitat with some pools on the outside of meander bends. Stream substrate in the reservoir area is cobble and gravel. There is spawning habitat at the pool-riffle interfaces. Water clarity is good even at bankfull discharge. Bank stability is good throughout the site. There is extensive bank cover on the stream with little evidence of grazing. The existing fishery is classified as excellent by CDOW. There are no limiting factors listed for this site.

The lower half of the potential reservoir area is heavily forested with large coniferous forests with tree heights exceeding 80 feet. Large organic debris from the stands is in the channel and along the stream banks. Tree rootwads and downed trees provide instream cover in many sections of the stream.

The upper reservoir area is currently hay meadows and has the potential to be exposed during reservoir operations which would elevate turbidity levels in the reservoir. The reservoir elevation is approximately 7800 feet and therefore water temperatures should remain suitable for trout. The tailwater area is relatively steep gradient stream with large boulders, step pools and cascades. Stream habitat is more limited in this section of the stream than that found in the reservoir area.

Cultural Resources. No specific surveys of the area to be inundated were identified. However, a total of six archaeological sites were identified which would be impacted by the Morrison Creek reservoir. No official determination as to the sites' eligibility to the National Register has been made. Three of the sites are open lithic sites which have a "field needs data" status, which means that a determination has been made by the surveyor that more information is necessary before an unofficial (field) or official determination can be made. An additional open lithic site and two isolated finds have "field not eligible" status, meaning the surveyor thought the sites would not be eligible for listing on the National Register. Official determination would need to be made if the site were to be considered further.

Of the sites considered at this stage, Morrison Creek reservoir had the greatest potential impact on known archaeological resources.

Walton Creek Site

Engineering Aspects. USGS 7.5' quadrangle sheets provide the best available mapping for the Walton Creek site since virtually no other background information exists. The dam axis at the Walton Creek site would be located at the narrowest section of the drainage basin approximately 4 miles above the confluence with the Yampa River. The site would require a dam approximately 1,250 feet long and 300 feet high.

Both abutments are of moderate slope consisting largely of metamorphic and igneous rock with some silty clay. Material available for dam construction in the immediate vicinity consists of rock and clay. The most probable dam construction method would be earthfill or rockfill. This site would require an overtopping type of spillway or possibly a spillway constructed along the right abutment. Side slopes within the reservoir area are moderate to very steep. No geologic hazards were noted at this level of evaluation.

Hydrology. This site is favorable in terms of water delivery, being upstream of most potential demand areas. Average annual inflow is estimated to be about 64,000 acre-feet. The maximum size reservoir that the site topography would allow would be about 25,000 acre-feet, and site characteristics would logically suggest development of this capacity. The sediment load in Walton Creek appears to be light.

Site Development Costs. A reservoir of 25,000 af total volume at the Walton Creek site would have development costs in the range of 120 to 150 million dollars, due primarily to the large dam size required. This figure represents a cost of approximately $6,400 per acre foot of reservoir active storage.

Recreation. Access to the Walton Creek site is better than that for Morrison Creek, the site itself being only a few miles off of U.S. Highway 40. Still, the site is quite remote from Craig. The reservoir would have fairly steep side slopes and a rather uniform "bathtub" shape with few opportunities for boat ramps and campgrounds. The reservoir would provide only about 200 acres of surface area when full. About 50,000 annual visits might be expected under 1991 conditions.

was added partly at the suggestion of TSG at its August 16, 1991 meeting. This suggestion was followed up when it appeared that the evaluation would lead to the elimination of all but one upper basin long-term storage site. The evaluation data for the Stagecoach Enlargement alternative was derived from the Final EIS for the Stagecoach Project.

Site Selection Recommendations

Based on the foregoing evaluations, the multi-disciplinary evaluation team developed a set of preliminary recommendations regarding the sites that should be carried forward into formulation of alternatives. The sites recommended for further consideration are listed in Table 4-6 and shown in Figure 4-3.

Table 4-6

Sites Recommended for Further Consideration

1. Stagecoach Reservoir Enlargement
2. Elk Creek Off-channel Storage
3. Elkhead Reservoir Enlargement
4. Williams Fork near Hamilton
5. East Fork Williams Fork above Willow Creek

Morrison Creek

It was recommended that the Morrison Creek site be eliminated primarily on environmental grounds, although it is arguably the best reservoir site from a technical and economic perspective. A reservoir at the Morrison Creek site would inundate a well-developed and diverse forest ecosystem, much of which is old growth in nature. The upper reaches of the reservoir would inundate relatively large areas of subalpine wetland; with cyclical operation, these wetland areas would become broad mud flats. In addition, Morrison Creek is the only stream visited which is currently rated as an excellent fishery by CDOW. The reservoir would also inundate the greatest number of known archaeological sites.

Walton Creek

It was recommended that the Walton Creek site be eliminated primarily on the basis of development cost. While the site has good inflow and few environmental constraints, the shape of the valley is such that a relatively large dam embankment is unavoidable. Other sites studied offer substantially lower cost per unit of storage.

Pilot Knob

It was recommended that the Pilot Knob site be eliminated from further consideration based on both technical and environmental grounds. From a technical perspective, the site is inferior to the enlargement of Elkhead Reservoir with which it would compete for a water supply. The site is also relatively inconvenient to get to, which limits its recreational value. From an environmental perspective, development of any long-term water storage capacity would encroach upon large wetland areas which are known Sandhill crane habitat.

Morrison Creek Diversion Status Summary

1. Diversion at Silver Creek/Morrison Creek Confluence
   - This site has excellent access.
   - For 2003, the peak flow below the confluence was 826 cfs (6/1/03). Flow averaged approximately 300 cfs from April 28th through June 12th.
   - We have considerable concern about the amount of sediment transported in Morrison Creek from Muddy Creek. This sediment will end up in Stagecoach.
   - A mile long pipeline is required from the diversion structure below the confluence to the upper Little Morrison Creek drainage. 500 feet of the pipeline would be buried at approximately 50 feet deep. 55
   - Two options considered:
     - Open trenching: cost estimated at $2,200,470
     - Boring: cost estimated at $4,572,350
   - The highest average monthly stream flow for Little Morrison Creek occurs in April and measures approximately 7 cfs. Normal flow in Little Morrison Creek would quadruple with the diverted water. There is significant concern about the probable deterioration of the existing natural Little Morrison Creek channel due to the diverted water.
   - An alternative would be to continue the pipe down county road 16 to Stagecoach thereby preserving the Little Morrison Creek channel. Miro recommends this alternative.

2. Diversion up Silver Creek
   - The proposed diversion site is located on National Forest property and borders the Sarvice Creek Wilderness Area.
   - Access to the site would be very difficult requiring a bridge and steep road constructed over a mountain.
   - The Silver Creek water runs extremely clear and thus does not have the potential sedimentation problem of Morrison Creek.
   - This option would require a 2000 foot bore through the mountain.
   - As a result of the higher diversion elevation, the pipeline (with the exception of the bore) would be at standard depth.
   - This concept has the same potential negative impact on the Little Morrison Creek drainage as the concept above.
   - No cost estimate was developed for this concept.

3. Diversion at Morrison Creek Bridge Crossing on County Road 16
   - This diversion point is above the confluence of Silver Creek and Morrison Creek. Therefore, this option does not get the benefit of the Silver Creek water.
   - This site has excellent access.
   - We have considerable concern about the amount of sediment transported in Morrison Creek from Muddy Creek. This sediment will end up in Stagecoach.

- A several mile long pipeline is required from the diversion structure to the upper Little Morrison Creek drainage. 500 feet of the pipeline would be buried at over 70 feet deep.
- This concept has the same potential negative impact on the Little Morrison Creek drainage as the concepts above.
- No cost estimate was developed for this concept.

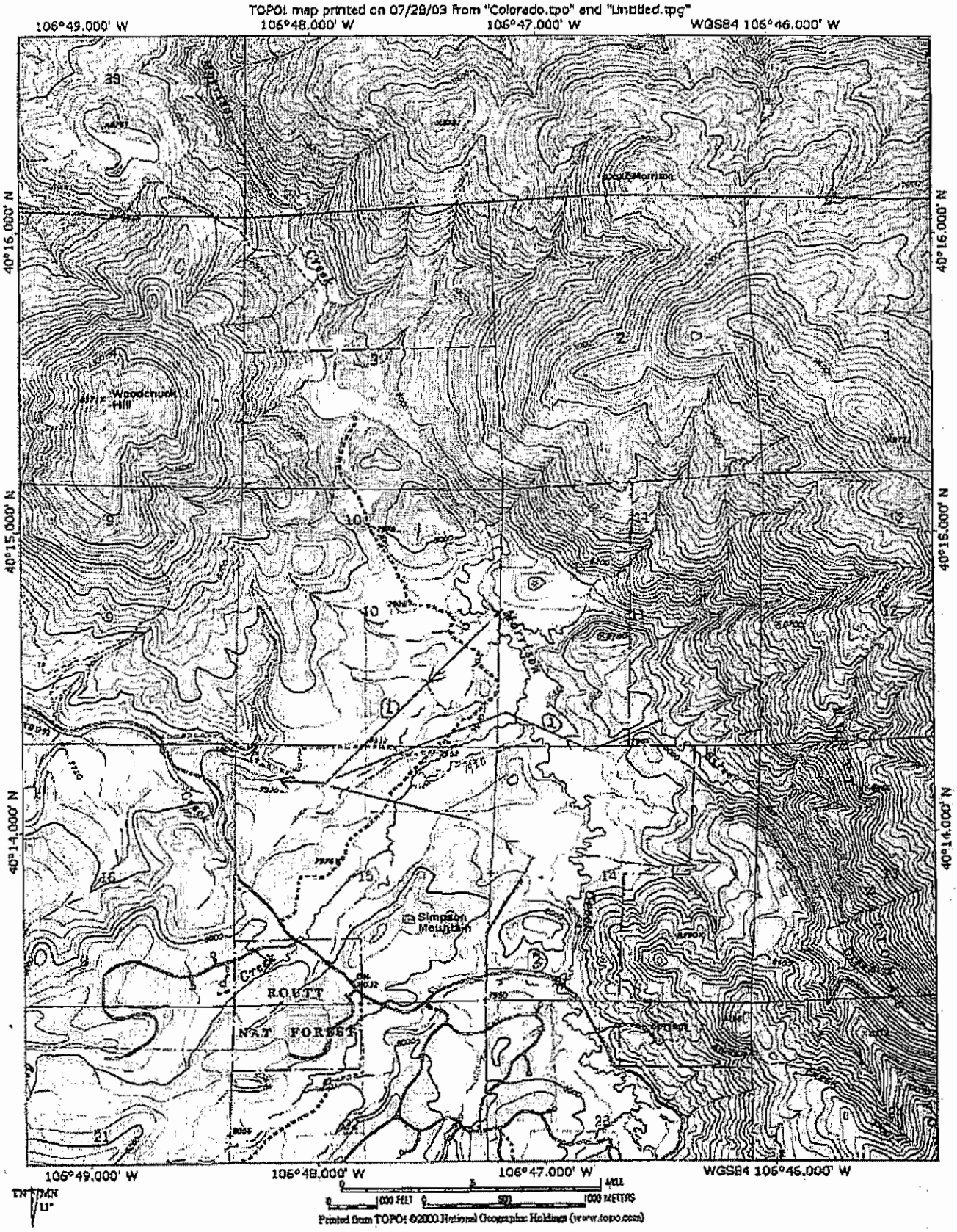
4. Morrison Creek Canyon Diversion
   - A diversion structure would be placed in Morrison Creek Canyon. A pipeline would transport the water around the hill to Stagecoach. This option may combine both an open trench pipeline as well as a bored pipeline.
   - Access to the diversion would be difficult.
   - As this diversion point is below the confluence of Silver Creek and Morrison Creek, this option would also have the potential sedimentation problem.
   - There would be a significant cut in the hillside for the road and pipeline. Commissioner Monger stated that the county would not likely approve this design due to the environmental impacts.
   - The project has been estimated to cost approximately $1,000,000.

5. Irrigation Ditch
   - This diversion point is above the confluence of Silver Creek and Morrison Creek. Therefore, this option does not get the benefit of the Silver Creek water.
   - This diversion site would have excellent access.
   - We have considerable concern about the amount of sediment transported in Morrison Creek from Muddy Creek. This sediment will end up in Stagecoach.
   - A several mile long irrigation is required from the diversion structure to the upper Little Morrison Creek drainage. This potential ditch would impact multiple property owners.
   - Likely very high maintenance costs.
   - This concept has the same potential negative impact on the Little Morrison Creek drainage as the concepts above.
   - No cost estimate was developed for this concept.

6. Pump Back from Confluence of Morrison Creek and the Yampa River
   - This diversion point is below the confluence of Morrison Creek and the Yampa River.
   - Access may be an issue as the diversion point is on private property (Bill Gay)
   - Pipeline would follow the existing road up to Stagecoach.
   - Pumps would pump excess water from Morrison Creek up to Stagecoach.
   - The ongoing operating cost would be the difference in what we get for producing electricity and what we pay for electricity as well as the additional electricity losses to overcome the frictional line losses.
   - Least environmentally damaging project overall.
   - No cost estimate has been established for this concept.

7. Morrison Creek Canyon Tunnel
   - Access to the diversion would be difficult.
   - As this diversion point is below the confluence of Silver Creek and Morrison Creek, this option would also have the potential sedimentation problem.
   - An approximately 1.25 mile tunnel would be bored through the mountain. After the tunnel, the diversion water would run down an open channel. Likely the open channel would need to be improved to handle the diversion water.
   - No cost estimate has been established for this concept.

Robert Stoddard
Monday 28 July 03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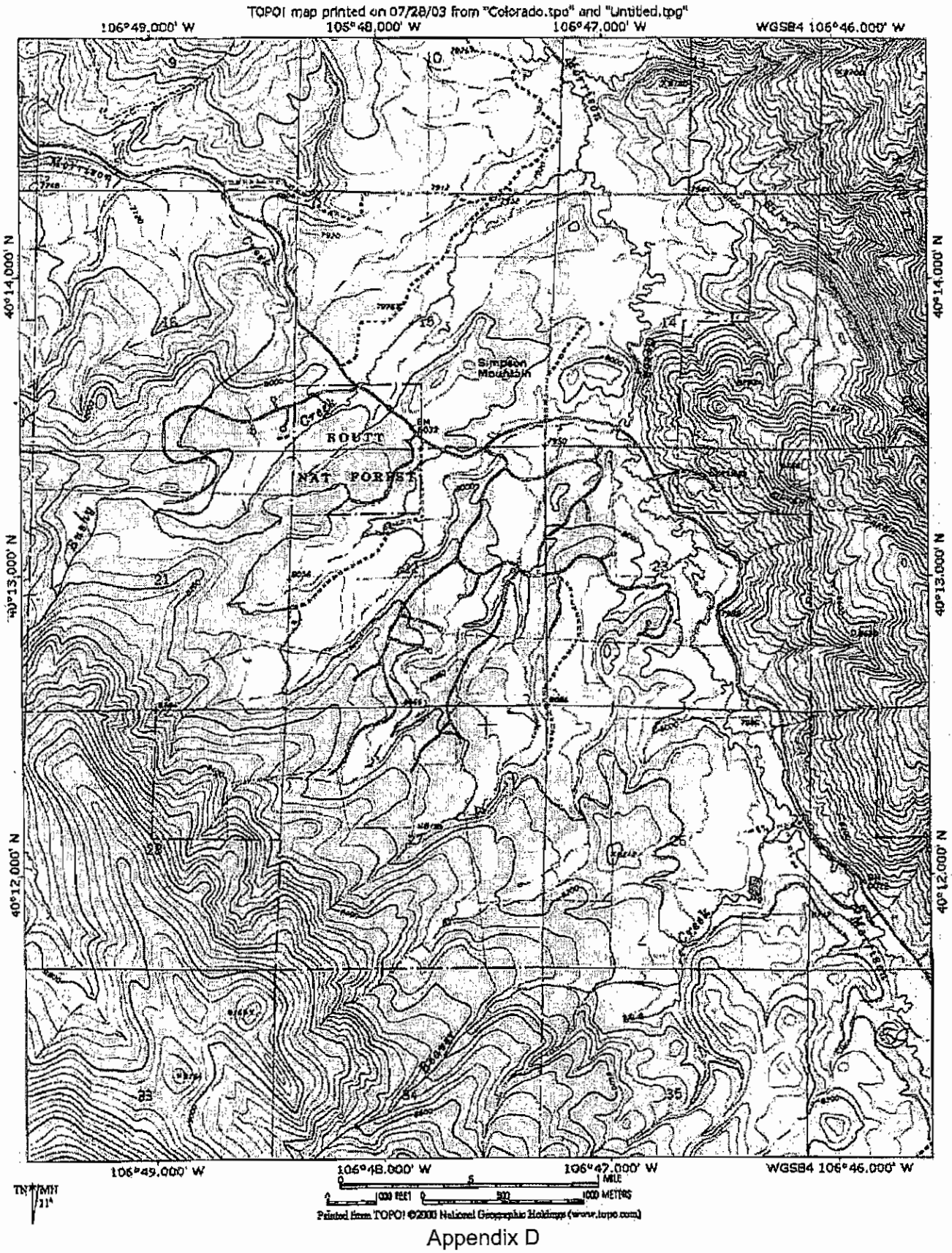
WGS84 106°46.000' W
40°16.000' N
40°15.000' N
40°14.000' N
Woodchuck Hill
Simpson Mountain
ROUTT
NAT FOREST
1000 FEET
1000 METERS
Printed from TOPO! ©2000 National Geographic Holdings (www.topo.com)

Appendix D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WGS84 106°46.000' W
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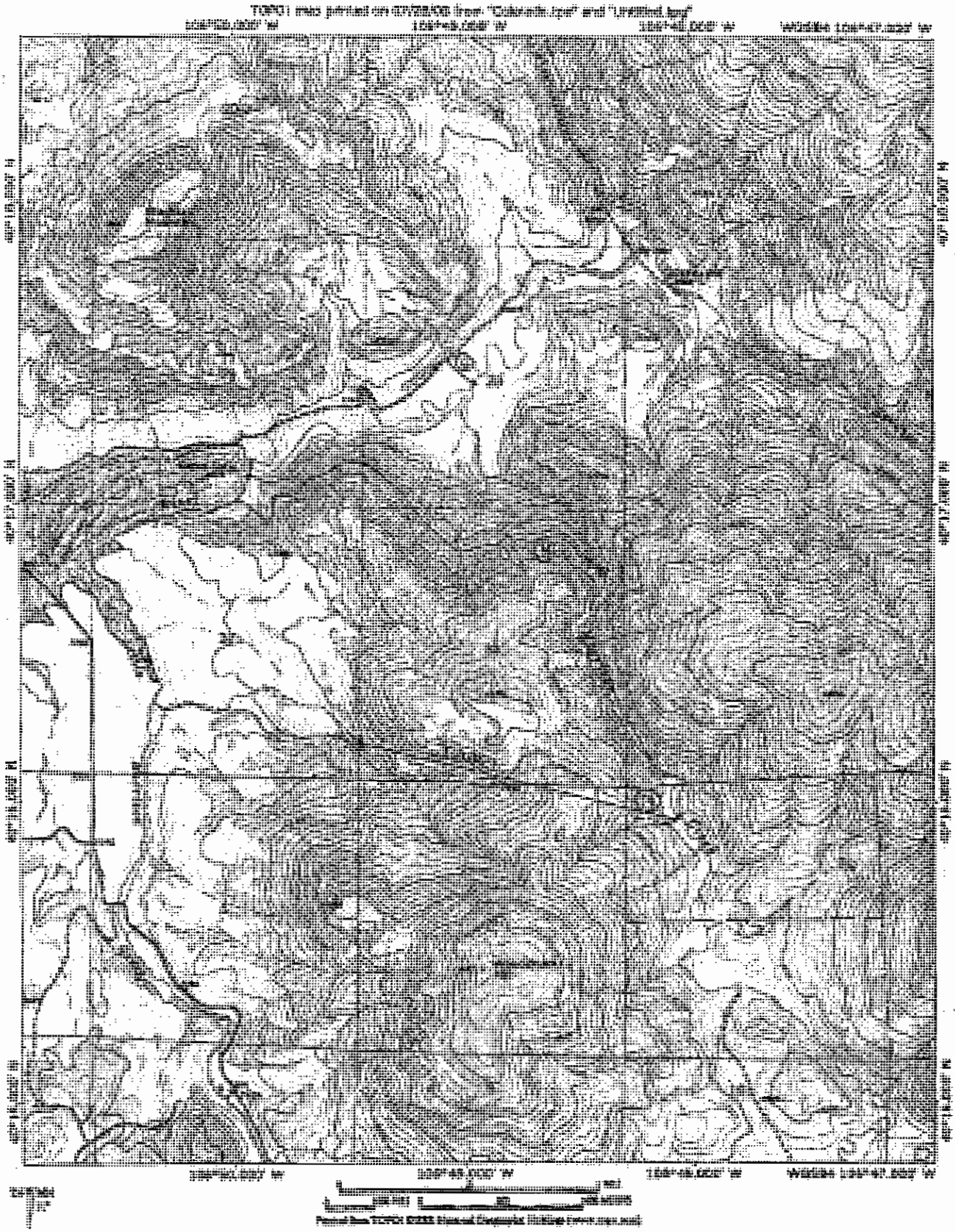
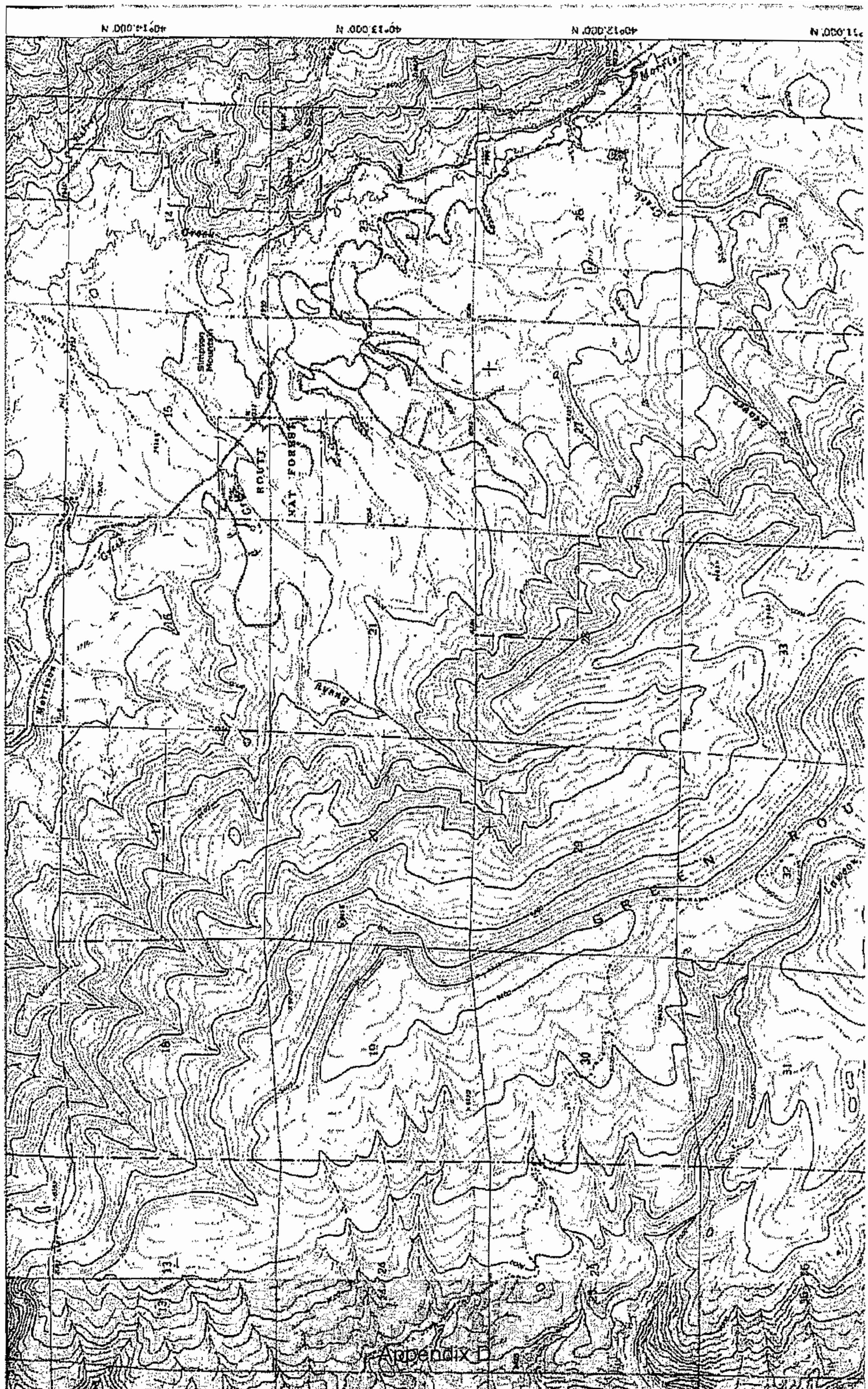
40°13.000' N
40°12.000' N
Simpson Mountain
ROUTT
NAT FOREST
Creek
Printed from TOPO! ©2000 National Geographic Holdings (www.topo.com)

Appendix D



Appendix D


40°14'000 N
40°13'000 N
40°12'000 N
Simpson Mountain
ROUTT
NAT. FOREST

Appendix D

RESERVOIR
Appendix D

Stream: Morrison Creek (Lower Segment)

Executive Summary

Water Division: 6
Water District: 58
CDOW#: 21294
CWCB ID: 10/6/A-003

Segment: Confluence with Silver Creek to Confluence with Yampa River

Lower Terminus: CONFLUENCE WITH SILVER CREEK
(Latitude 40° 14' 42.44"N) (Longitude 106° 47' 10.75"W)

Lower Terminus: CONFLUENCE WITH YAMPA RIVER
(Latitude 40° 17' 23.60"N) (Longitude 106° 48' 57.05"W)

Watershed: Upper Yampa (HUC#: 14050001**)**
Counties: Routt
Length: 4.91 miles
USGS Quads: Green Ridge, Blacktail Mountain
Flow Recommendation: 13.2 cfs (April 1 – August 15)
8.1 cfs (August 16 – 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) and a group of local land owners (Larson, Dequine Family L.L.C, and Flying Diamond Resources) recommended this segment of Morrison Creek to the CWCB for inclusion into the Instream Flow Program. Morrison Creek 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.

Morrison Creek is approximately 21.0 miles long. It begins at an elevation of 8,400 feet and generally flows northwesterly until it terminates at the confluence with the Yampa River at an elevation of 7,200 feet. Of the 4.91 mile segment addressed by this report, approximately 20.0% of the segment is located on federal lands. Morrison Creek is located within Routt County and has a total drainage area of approximately 76.52 square miles.

The subject of this report is a segment of Morrison Creek beginning at the confluence with Silver Creek and extending downstream to the confluence with the Yampa River. The proposed segment is located approximately 8.3 miles northeast of the town of Yampa. Staff has received recommendations for this segment, from the CDOW and Larson et al. Although two separate recommendations were received for this reach, the CDOW and the land owners have collaborated on the analysis of the data and have arrived at the joint recommendation discussed below.

Instream Flow Recommendation

The CDOW and Larson et al, are recommending 13.2 cfs (April 1 – August 15) and 8.1 cfs (August 16 – March 31) based on their data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence w/ Silver Creek	Confluence w/ Yampa River	4.91	80%	20%

100% of the public lands are owned by the Bureau of Land Management (BLM).

Biological Data

The CDOW, Bureau of Land Management (BLM) and local land owners have collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Morrison Creek. Morrison Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment of Morrison Creek supports a naturally reproducing brook trout (*Salvelinus fontinalis*) population. In addition, cutthroat trout (*Oncorhynchus clarki*) and rainbow trout (O. mykiss) were reported by Larson et al.

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, six 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. 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)
BLM	9/3/2005	8.8	22.0 – 3.5	Out of range	9.3
BLM	9/3/2005	8.0	20.0 – 3.2	Out of range	Out of range
BLM	7/11/2007	11.6	29.0 – 3.0	11.2	7.6
BLM	7/11/2007	12.8	32.0 – 5.1	16.0	8.8
CDOW	10/1/2008	6.1	15.3 – 2.4	12.5	11.0

CDOW	10/1/2008	5.9	14.8 – 2.4	Out of range	3.7

The summer flow recommendation, which met 3 of 3 criteria and is within the accuracy range of the R2CROSS model, is 13.2 cfs. The winter flow amount, which meets 2 of 3 criteria, is 8.1 cfs. The summer and winter flow recommendations were derived by averaging the results of the data sets.

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 **Morrison Creek - Lower** there was a Colorado DWR gage record of discharge on the stream. However, the gage station is upstream from the LT. The DWR gage is MORRISON CREEK ABOVE MILES RANCH, CO. (MORCRECO); it has a period of record (POR), of 1 year collected between 1990 and 1991. Because of the short POR this gage was not useable for this analysis. It is thus necessary to describe the normal flow regime at Morrison Creek - Lower above the LT through a "representative" gage station. The gage station selected for this purpose was SERVICE CREEK NEAR OAK CREEK, CO (USGS 09237800), a gage with an 8 year POR collected between 1965 and 1973. The gage is at an elevation of 7,000 ft above mean sea level (amsl) and has a drainage area of 38.26 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes a diversion's consumptive use. However, the existence of this

diversion does not preclude use of the data from the gage. To make the measured data transferable to Morrison Creek - Lower above the LT, the consumptive portion of this diversion was added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Morrison Creek - Lower above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Morrison Creek - Lower above the LT (76.52 mi^2) to Service Creek near Oak Creek, CO (38.26 mi^2). The resulting proportioned hydrograph was itself "adjusted" (decreased) to reflect the consumptive irrigation depletions of several diversions 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 Morrison Creek - Lower is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Service Creek near Oak Creek, CO 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 the data displayed in Table 2.

Figure 1

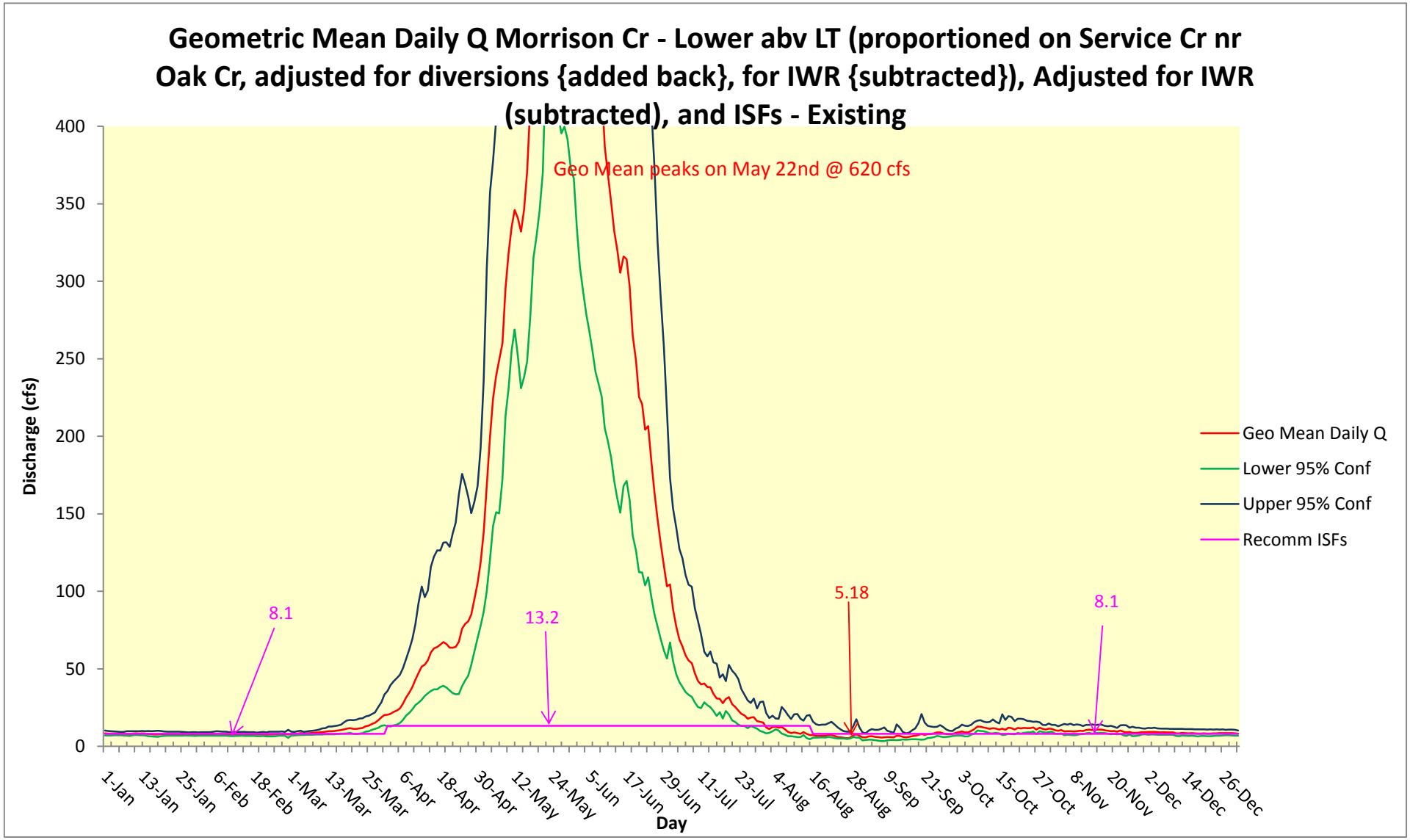

Geometric Mean Daily Q Morrison Cr - Lower abv LT (proportioned on Service Cr nr Oak Cr, adjusted for diversions {added back}, for IWR {subtracted}), Adjusted for IWR (subtracted), and ISFs - Existing
Geo Mean peaks on May 22nd @ 620 cfs
Discharge (cfs)
Day
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISFs
8.1
13.2
5.18
8.1
400
350
300
250
200
150
100
50
0
1-Jan
13-Jan
25-Jan
6-Feb
18-Feb
1-Mar
13-Mar
25-Mar
6-Apr
18-Apr
30-Apr
12-May
24-May
5-Jun
17-Jun
29-Jun
11-Jul
23-Jul
4-Aug
16-Aug
28-Aug
9-Sep
21-Sep
3-Oct
15-Oct
27-Oct
8-Nov
20-Nov
2-Dec
14-Dec
26-Dec

Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing	Recommended	Proportioned Adjusted GM (abv gage)
	ISF	ISF	Adj (-) for Irr & OoB in Morrison Cr - Lower abv LT
1-Jan		8.1	8.34
2-Jan		8.1	8.24
3-Jan		8.1	8.18
4-Jan		8.1	8.20
5-Jan		8.1	8.14
6-Jan		8.1	8.02
7-Jan		8.1	7.99
8-Jan		8.1	8.07
9-Jan		8.1	7.97
10-Jan		8.1	8.20
11-Jan		8.1	8.39
12-Jan		8.1	8.25
13-Jan		8.1	8.30
14-Jan		8.1	8.14
15-Jan		8.1	7.85
16-Jan		8.1	7.69
17-Jan		8.1	7.61
18-Jan		8.1	7.63
19-Jan		8.1	7.90
20-Jan		8.1	7.88
21-Jan		8.1	7.93
22-Jan		8.1	7.96
23-Jan		8.1	7.94
24-Jan		8.1	7.93
25-Jan		8.1	7.93
26-Jan		8.1	7.93
27-Jan		8.1	7.92
28-Jan		8.1	7.75
29-Jan		8.1	7.78
30-Jan		8.1	7.69
31-Jan		8.1	7.73
1-Feb		8.1	7.81
2-Feb		8.1	7.85
3-Feb		8.1	7.84
4-Feb		8.1	7.87
5-Feb		8.1	7.95
6-Feb		8.1	8.05
7-Feb		8.1	7.99
8-Feb		8.1	7.91
9-Feb		8.1	7.90
10-Feb		8.1	7.77
11-Feb		8.1	7.66
12-Feb		8.1	7.76
13-Feb		8.1	7.76
14-Feb		8.1	7.80
15-Feb		8.1	7.77
16-Feb		8.1	7.66
17-Feb		8.1	7.66
18-Feb		8.1	7.69

19-Feb		8.1	7.53
20-Feb		8.1	7.63
21-Feb		8.1	7.82
22-Feb		8.1	7.51
23-Feb		8.1	7.61
24-Feb		8.1	7.59
25-Feb		8.1	7.69
26-Feb		8.1	7.90
27-Feb		8.1	7.92
28-Feb		8.1	7.92
29-Feb		8.1	7.60
1-Mar		8.1	8.04
2-Mar		8.1	8.03
3-Mar		8.1	8.25
4-Mar		8.1	8.49
5-Mar		8.1	8.18
6-Mar		8.1	8.37
7-Mar		8.1	8.50
8-Mar		8.1	8.59
9-Mar		8.1	8.75
10-Mar		8.1	8.91
11-Mar		8.1	9.18
12-Mar		8.1	9.38
13-Mar		8.1	9.70
14-Mar		8.1	9.73
15-Mar		8.1	9.87
16-Mar		8.1	10.16
17-Mar		8.1	10.41
18-Mar		8.1	10.87
19-Mar		8.1	11.43
20-Mar		8.1	11.70
21-Mar		8.1	11.27
22-Mar		8.1	11.21
23-Mar		8.1	11.61
24-Mar		8.1	11.91
25-Mar		8.1	12.98
26-Mar		8.1	13.42
27-Mar		8.1	14.37
28-Mar		8.1	15.14
29-Mar		8.1	16.68
30-Mar		8.1	18.61
31-Mar		8.1	20.22
1-Apr		13.2	20.39
2-Apr		13.2	20.89
3-Apr		13.2	22.15
4-Apr		13.2	23.02
5-Apr		13.2	24.48
6-Apr		13.2	27.40
7-Apr		13.2	31.38
8-Apr		13.2	34.55
9-Apr		13.2	38.32
10-Apr		13.2	42.91
11-Apr		13.2	47.26
12-Apr		13.2	51.41

13-Apr		13.2	52.70
14-Apr		13.2	55.45
15-Apr		13.2	60.61
16-Apr		13.2	63.10
17-Apr		13.2	64.06
18-Apr		13.2	65.54
19-Apr		13.2	67.20
20-Apr		13.2	66.08
21-Apr		13.2	63.57
22-Apr		13.2	63.56
23-Apr		13.2	64.15
24-Apr		13.2	67.33
25-Apr		13.2	75.88
26-Apr		13.2	78.91
27-Apr		13.2	80.58
28-Apr		13.2	85.05
29-Apr		13.2	94.50
30-Apr		13.2	105.33
1-May		13.2	118.71
2-May		13.2	138.14
3-May		13.2	168.08
4-May		13.2	199.85
5-May		13.2	224.45
6-May		13.2	239.10
7-May		13.2	249.24
8-May		13.2	260.04
9-May		13.2	295.43
10-May		13.2	318.12
11-May		13.2	334.95
12-May		13.2	346.10
13-May		13.2	340.57
14-May		13.2	332.03
15-May		13.2	346.21
16-May		13.2	370.45
17-May		13.2	415.43
18-May		13.2	451.97
19-May		13.2	494.41
20-May		13.2	541.57
21-May		13.2	574.19
22-May		13.2	620.79
23-May		13.2	606.81
24-May		13.2	568.85
25-May		13.2	571.66
26-May		13.2	576.19
27-May		13.2	564.74
28-May		13.2	580.94
29-May		13.2	577.25
30-May		13.2	563.41
31-May		13.2	541.58
1-Jun		13.2	509.34
2-Jun		13.2	500.17
3-Jun		13.2	492.71
4-Jun		13.2	481.46
5-Jun		13.2	469.23

6-Jun		13.2	454.62
7-Jun		13.2	434.26
8-Jun		13.2	428.55
9-Jun		13.2	424.89
10-Jun		13.2	386.85
11-Jun		13.2	369.40
12-Jun		13.2	351.16
13-Jun		13.2	332.69
14-Jun		13.2	320.54
15-Jun		13.2	305.52
16-Jun		13.2	315.94
17-Jun		13.2	314.35
18-Jun		13.2	296.70
19-Jun		13.2	265.11
20-Jun		13.2	248.83
21-Jun		13.2	225.44
22-Jun		13.2	220.78
23-Jun		13.2	204.28
24-Jun		13.2	206.63
25-Jun		13.2	183.05
26-Jun		13.2	163.51
27-Jun		13.2	146.45
28-Jun		13.2	131.10
29-Jun		13.2	116.35
30-Jun		13.2	103.15
1-Jul		13.2	104.42
2-Jul		13.2	88.30
3-Jul		13.2	76.88
4-Jul		13.2	68.88
5-Jul		13.2	64.34
6-Jul		13.2	58.75
7-Jul		13.2	55.42
8-Jul		13.2	53.64
9-Jul		13.2	46.98
10-Jul		13.2	42.24
11-Jul		13.2	39.85
12-Jul		13.2	40.49
13-Jul		13.2	38.20
14-Jul		13.2	38.06
15-Jul		13.2	33.87
16-Jul		13.2	30.82
17-Jul		13.2	30.59
18-Jul		13.2	27.76
19-Jul		13.2	30.50
20-Jul		13.2	31.68
21-Jul		13.2	27.13
22-Jul		13.2	25.38
23-Jul		13.2	23.11
24-Jul		13.2	20.98
25-Jul		13.2	19.88
26-Jul		13.2	17.72
27-Jul		13.2	18.49
28-Jul		13.2	18.75
29-Jul		13.2	16.17

30-Jul		13.2	15.79
31-Jul		13.2	15.30
1-Aug		13.2	12.89
2-Aug		13.2	12.29
3-Aug		13.2	13.58
4-Aug		13.2	13.83
5-Aug		13.2	13.27
6-Aug		13.2	13.78
7-Aug		13.2	12.30
8-Aug		13.2	10.72
9-Aug		13.2	10.01
10-Aug		13.2	10.41
11-Aug		13.2	10.03
12-Aug		13.2	9.59
13-Aug		13.2	10.64
14-Aug		13.2	9.60
15-Aug		13.2	8.71
16-Aug		8.1	8.68
17-Aug		8.1	8.37
18-Aug		8.1	8.25
19-Aug		8.1	8.39
20-Aug		8.1	8.27
21-Aug		8.1	8.90
22-Aug		8.1	8.82
23-Aug		8.1	8.07
24-Aug		8.1	7.33
25-Aug		8.1	7.01
26-Aug		8.1	6.70
27-Aug		8.1	6.33
28-Aug		8.1	6.59
29-Aug		8.1	8.14
30-Aug		8.1	8.91
31-Aug		8.1	7.81
1-Sep		8.1	5.75
2-Sep		8.1	5.76
3-Sep		8.1	6.40
4-Sep		8.1	6.59
5-Sep		8.1	6.15
6-Sep		8.1	5.88
7-Sep		8.1	5.64
8-Sep		8.1	5.78
9-Sep		8.1	5.85
10-Sep		8.1	5.87
11-Sep		8.1	5.70
12-Sep		8.1	6.82
13-Sep		8.1	6.73
14-Sep		8.1	6.14
15-Sep		8.1	5.78
16-Sep		8.1	6.08
17-Sep		8.1	6.60
18-Sep		8.1	6.76
19-Sep		8.1	7.30
20-Sep		8.1	8.11
21-Sep		8.1	7.30

22-Sep		8.1	7.91
23-Sep		8.1	7.92
24-Sep		8.1	8.31
25-Sep		8.1	9.02
26-Sep		8.1	9.00
27-Sep		8.1	8.39
28-Sep		8.1	7.94
29-Sep		8.1	7.78
30-Sep		8.1	8.01
1-Oct		8.1	10.66
2-Oct		8.1	9.10
3-Oct		8.1	9.44
4-Oct		8.1	8.88
5-Oct		8.1	8.77
6-Oct		8.1	9.26
7-Oct		8.1	10.40
8-Oct		8.1	12.10
9-Oct		8.1	11.88
10-Oct		8.1	11.34
11-Oct		8.1	10.81
12-Oct		8.1	10.35
13-Oct		8.1	10.78
14-Oct		8.1	10.52
15-Oct		8.1	9.89
16-Oct		8.1	10.49
17-Oct		8.1	9.85
18-Oct		8.1	11.10
19-Oct		8.1	10.76
20-Oct		8.1	9.84
21-Oct		8.1	10.94
22-Oct		8.1	10.58
23-Oct		8.1	10.82
24-Oct		8.1	10.78
25-Oct		8.1	10.72
26-Oct		8.1	11.13
27-Oct		8.1	9.82
28-Oct		8.1	11.08
29-Oct		8.1	10.25
30-Oct		8.1	9.85
31-Oct		8.1	10.56
1-Nov		8.1	11.25
2-Nov		8.1	10.35
3-Nov		8.1	9.98
4-Nov		8.1	10.48
5-Nov		8.1	9.58
6-Nov		8.1	9.75
7-Nov		8.1	9.75
8-Nov		8.1	9.52
9-Nov		8.1	9.66
10-Nov		8.1	10.03
11-Nov		8.1	9.90
12-Nov		8.1	10.44
13-Nov		8.1	10.70
14-Nov		8.1	10.41

15-Nov		8.1	10.58
16-Nov		8.1	10.79
17-Nov		8.1	10.76
18-Nov		8.1	10.39
19-Nov		8.1	10.04
20-Nov		8.1	9.78
21-Nov		8.1	9.84
22-Nov		8.1	9.47
23-Nov		8.1	10.18
24-Nov		8.1	9.38
25-Nov		8.1	8.94
26-Nov		8.1	9.32
27-Nov		8.1	8.61
28-Nov		8.1	8.61
29-Nov		8.1	8.78
30-Nov		8.1	9.15
1-Dec		8.1	9.18
2-Dec		8.1	9.23
3-Dec		8.1	9.28
4-Dec		8.1	9.31
5-Dec		8.1	9.12
6-Dec		8.1	9.01
7-Dec		8.1	9.07
8-Dec		8.1	9.03
9-Dec		8.1	8.91
10-Dec		8.1	8.97
11-Dec		8.1	8.43
12-Dec		8.1	8.32
13-Dec		8.1	8.64
14-Dec		8.1	8.50
15-Dec		8.1	8.42
16-Dec		8.1	8.46
17-Dec		8.1	8.32
18-Dec		8.1	8.14
19-Dec		8.1	8.26
20-Dec		8.1	8.33
21-Dec		8.1	8.18
22-Dec		8.1	8.22
23-Dec		8.1	8.32
24-Dec		8.1	8.38
25-Dec		8.1	8.46
26-Dec		8.1	8.56
27-Dec		8.1	8.55
28-Dec		8.1	8.56
29-Dec		8.1	8.50
30-Dec		8.1	8.32
31-Dec		8.1	8.17

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: Morrison Creek Ditch No. 1 (1.17 cfs, 1901 appropriation) and Morrison Creek Ditch No. 2 (1.33 cfs with an 1891 appropriation). Staff has determined that

water is available for appropriation on Morrison Creek, between the confluence with Silver Creek and the confluence with the Yampa 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:

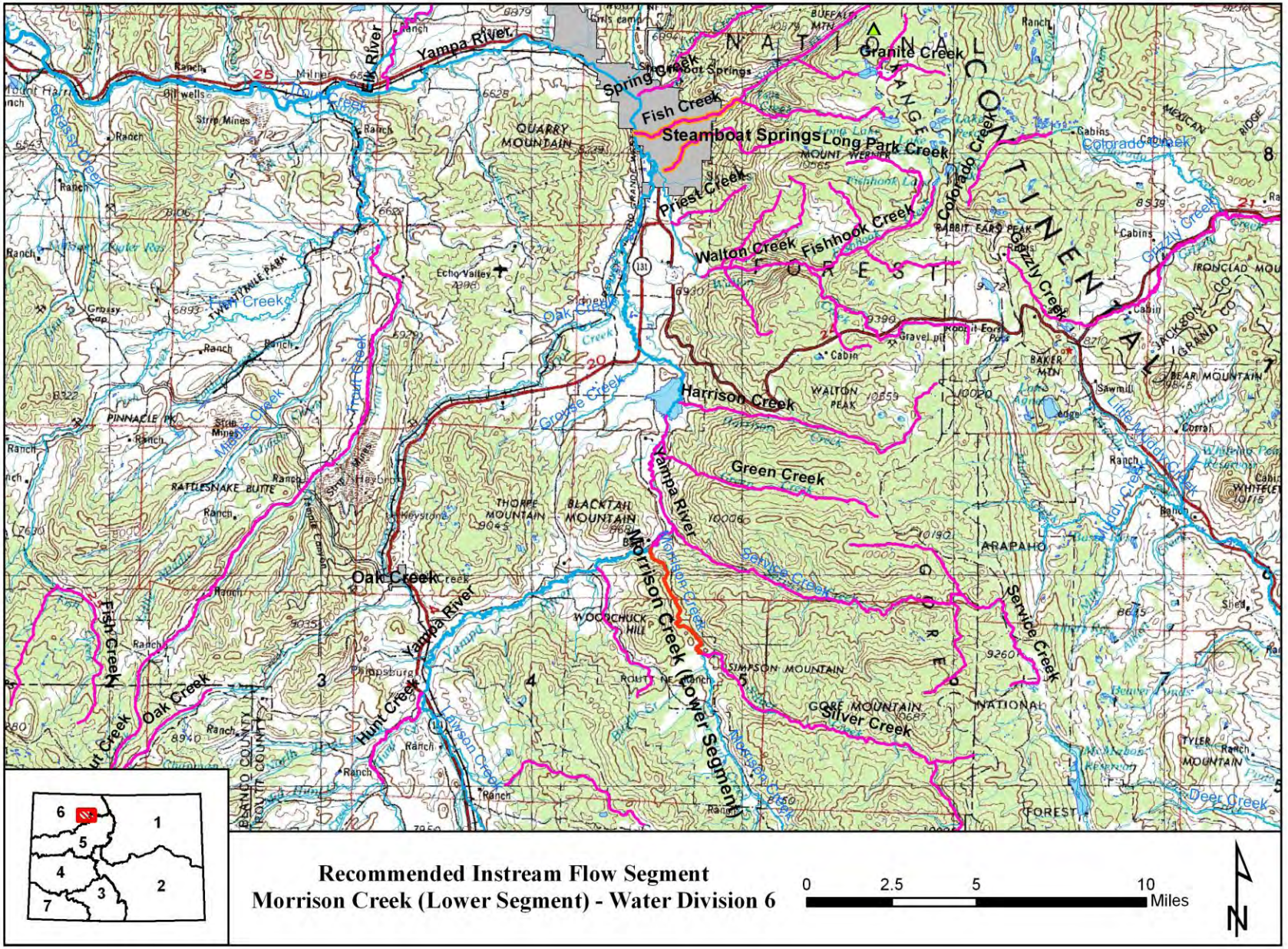
Segment: Confluence with Silver Creek to Confluence with Yampa River

Lower Terminus: CONFLUENCE WITH SILVER CREEK
(Latitude 40° 14' 42.44"N) (Longitude 106° 47' 10.75"W)
UTM North: 4456494.46 UTM East: 348062.75
NW SW S11 T3N R84W 6th PM
15' East of the West Section Line; 2550' South of the North Section Line

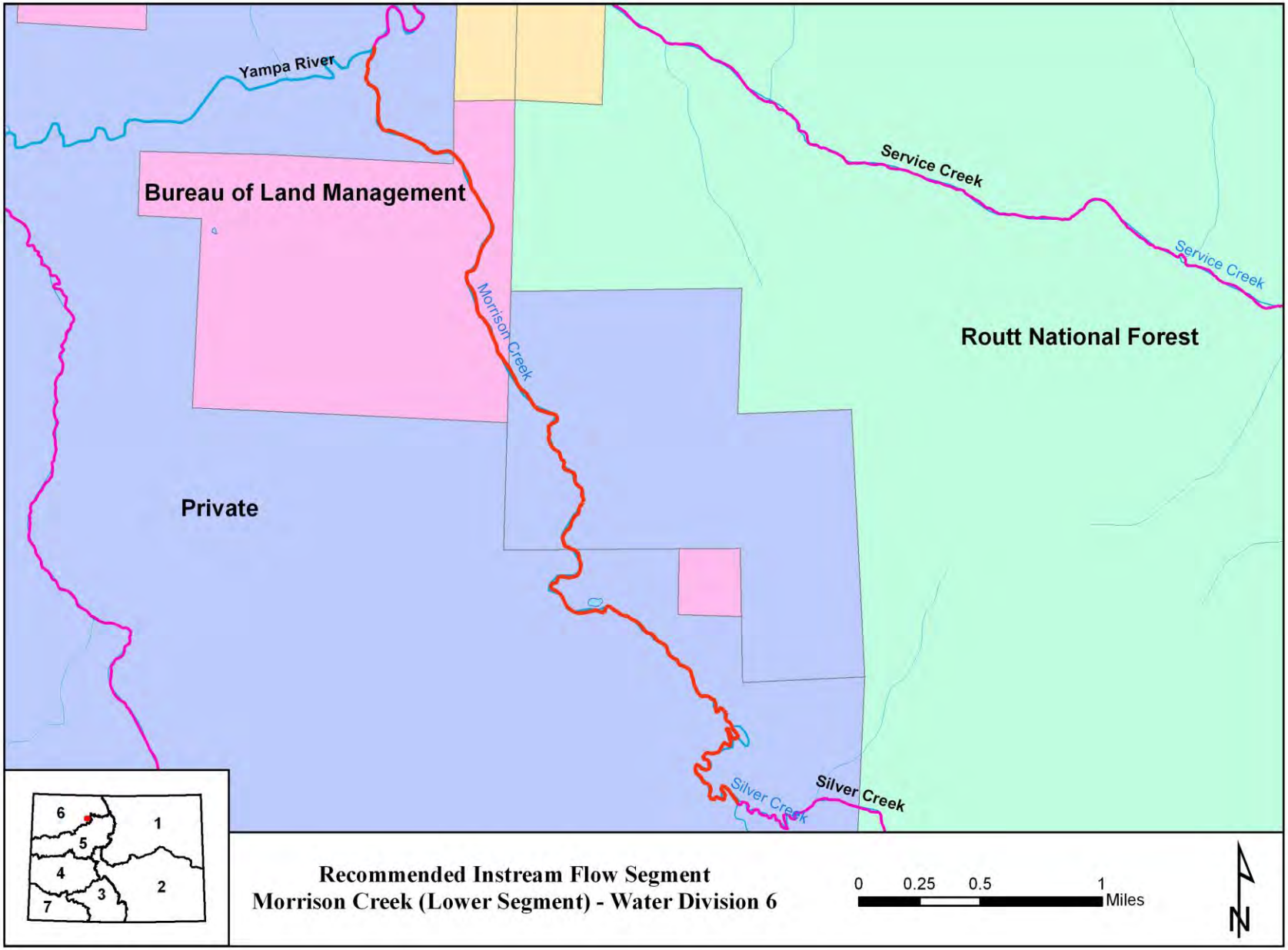
Lower Terminus: CONFLUENCE WITH YAMPA RIVER
(Latitude 40° 17' 23.60"N) (Longitude 106° 48' 57.05"W)
UTM North: 4461514.71 UTM East: 345653.01
NE SW S28 T4N R84W 6th PM
2200' East of the West Section Line; 2490' North of the South Section Line

Watershed: Upper Yampa (HUC#: 14050001**)**
Counties: Routt
Length: 4.91 miles
USGS Quads: Green Ridge, Blacktail Mountain
Flow Recommendation: 13.2 cfs (April 1 – August 15)
8.1 cfs (August 16 – March 31)

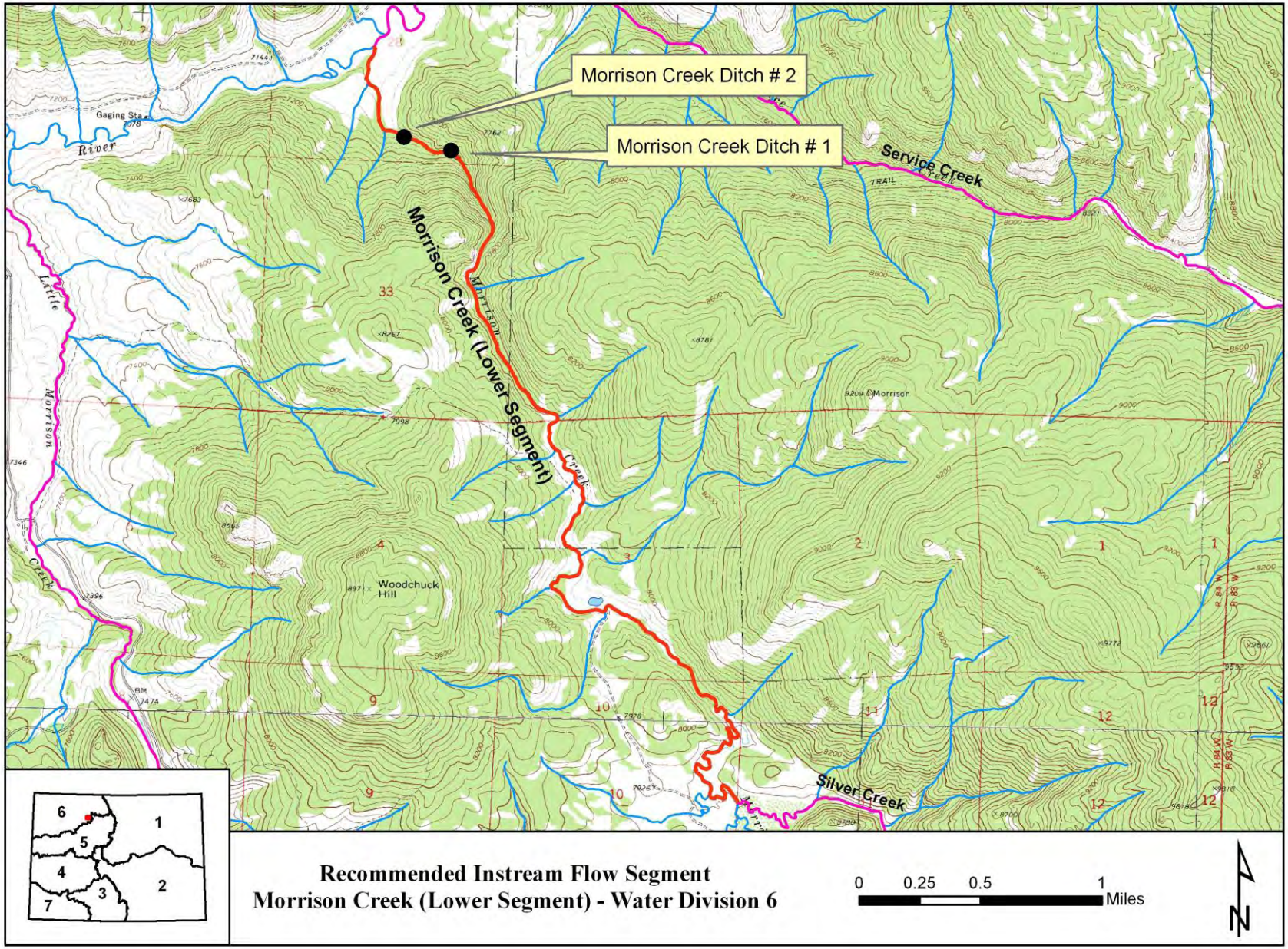
Vicinity Map



Land Use Map


Yampa River
Bureau of Land Management
Morrison Creek
Service Creek
Service Creek
Routt National Forest
Private
Silver Creek
Silver Creek
6
1
5
4
2
3
7
Recommended Instream Flow Segment
Morrison Creek (Lower Segment) - Water Division 6
0
0.25
0.5
1
Miles
N

Topographic and Water Rights Map



Stream: Morrison Creek (Upper Segment)

Executive Summary

Water Division: 6
Water District: 58
CDOW#: 21294
CWCB ID: 10/6/A-003

Segment: Confluence with Muddy Creek to Confluence with Silver Creek

Upper Terminus: CONFLUENCE WITH MUDDY CREEK
(Latitude 40° 10' 54.50"N) (Longitude 106° 45' 0.35"W)

Lower Terminus: CONFLUENCE WITH SILVER CREEK
(Latitude 40° 14' 42.44"N) (Longitude 106° 47' 10.75"W)

Watershed: Upper Yampa (HUC#: 14050001)
Counties: Routt
Length: 8.99 miles
USGS Quad: Green Ridge
Flow Recommendation: 3.1 cfs (April 1 – October 31)
1.4 cfs (November 1 – 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 Morrison Creek to the CWCB for inclusion into the Instream Flow Program. Morrison Creek 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.

Morrison Creek is approximately 21.0 miles long. It begins at an elevation of 8,400 feet and generally flows northwesterly until it terminates at the confluence with the Yampa River at an elevation of 7,200 feet. Of the 8.99 mile segment addressed by this report, approximately 23.0% of the segment is located on public lands. Morrison Creek is located within Routt County and has a total drainage area of approximately 76.52 square miles.

The subject of this report is a segment of the Morrison Creek beginning at the confluence with Sugar Creek and extending downstream to the confluence with Silver Creek. The proposed segment is located approximately 8.3 miles northeast of the town of Yampa. Staff has received only one recommendation for this segment, from the CDOW. The recommendation for this segment is discussed below.

Instream Flow Recommendation

The CDOW is recommending 3.1 cfs (April 1 – October 31) and 1.4 cfs (November 1 – March 31) based on their data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence w/ Muddy Creek	Confluence w/ Silver Creek	3.59	77%	23%

100% of the public lands are owned by the State Land Board.

Biological Data

The CDOW and Bureau of Land Management (BLM) have collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of the Morrison Creek. Morrison Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment of Morrison Creek supports a naturally reproducing brook trout (*Salvelinus fontinalis*) population.

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. 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	10/17/1997	15.7	39.2 – 6.3	Out of range	Out of range
CDOW	7/25/2005	2.3	5.8 – 0.9	1.7	1.4
CDOW	6/29/2006	7.2	17.9 – 2.9	4.5	Out of range
CDOW	9/4/2007	1.1	2.7 – 0.4	Out of range	2.7

The summer flow recommendation, which met 3 of 3 criteria and is within the accuracy range of the R2CROSS model, is 3.1 cfs. The winter flow amount, which meets 2 of 3 criteria, is 2.0 cfs

but was lowered to 1.4 cfs due to water availability constraints. The winter and summer flow recommendations were derived by averaging the results of the data sets.

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 **Morrison Creek – Upper New** there was a Colorado DWR gage record of discharge on the stream. However, the gage station is upstream from the LT. The DWR gage is MORRISON CREEK ABOVE MILES RANCH, CO. (MORCRECO); it has a period of record (POR) of 1 year collected between 1990 and 1991. Because of the short POR, this gage was not useable for this analysis. It is thus necessary to describe the normal flow regime at Morrison Creek – Upper New above the LT through a "representative" gage station. The gage station selected for this purpose was SERVICE CREEK NEAR OAK CREEK, CO (USGS 09237800), a gage with an 8 year POR collected between 1965 and 1973. The gage is at an elevation of 7,000 ft above mean sea level (amsl) and has a drainage area of 38.26 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes a diversion's consumptive use. However, the existence of this diversion does not preclude use of the data from the gage. To make the measured data transferable to Morrison Creek – Upper New above the LT, the consumptive portion of this diversion was added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Morrison Creek – Upper New above the LT by multiplying the "adjusted"

gage discharge values by an area ratio; specifically, the area of Morrison Creek – Upper New above the LT (47.25 mi^2) to Service Creek near Oak Creek, CO (38.26 mi^2). The resulting proportioned hydrograph was itself "adjusted" (decreased) to reflect the consumptive irrigation depletions of several diversions 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 Morrison Creek – Upper New is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Service Creek near Oak Creek, CO 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 the data displayed in Table 2.

Figure 1

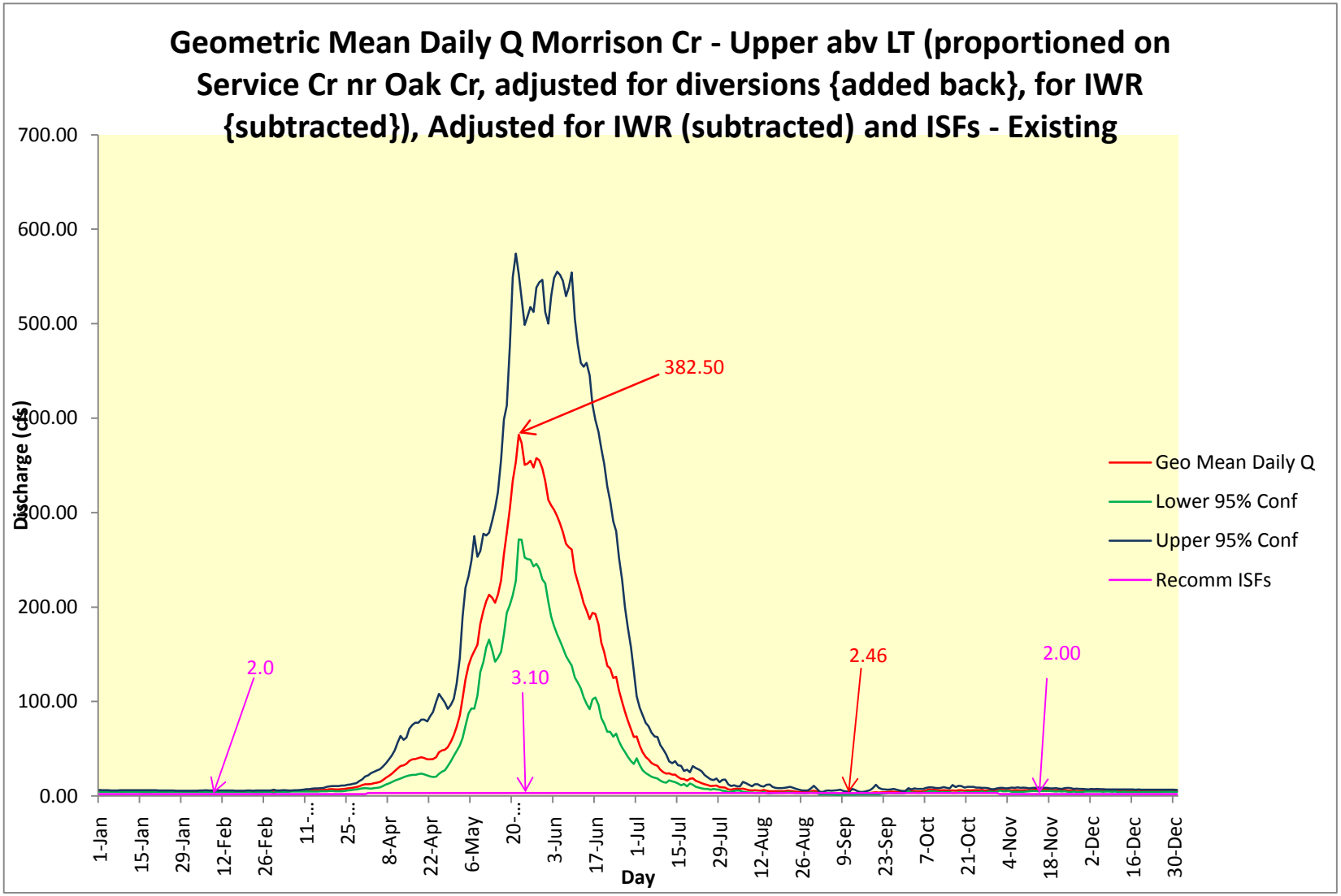

Geometric Mean Daily Q Morrison Cr - Upper abv LT (proportioned on Service Cr nr Oak Cr, adjusted for diversions {added back}, for IWR {subtracted}), Adjusted for IWR (subtracted) and ISFs - Existing
Discharge (cfs)
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
382.50
2.0
3.10
2.46
2.00
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISFs
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
11-...
25-...
8-Apr
22-Apr
6-May
20-...
3-Jun
17-Jun
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
Day

Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing	Recommended	Proportioned Adjusted GM (abv gage)
	ISF	ISF	Adj (-) for Irr & OoB in Morrison Cr – Upper New abv LT
1-Jan		1.4	5.15
2-Jan		1.4	5.09
3-Jan		1.4	5.05
4-Jan		1.4	5.06
5-Jan		1.4	5.03
6-Jan		1.4	4.95
7-Jan		1.4	4.93
8-Jan		1.4	4.98
9-Jan		1.4	4.92
10-Jan		1.4	5.06
11-Jan		1.4	5.18
12-Jan		1.4	5.10
13-Jan		1.4	5.13
14-Jan		1.4	5.03
15-Jan		1.4	4.85
16-Jan		1.4	4.75
17-Jan		1.4	4.70
18-Jan		1.4	4.71
19-Jan		1.4	4.88
20-Jan		1.4	4.87
21-Jan		1.4	4.90
22-Jan		1.4	4.92
23-Jan		1.4	4.90
24-Jan		1.4	4.90
25-Jan		1.4	4.90
26-Jan		1.4	4.89
27-Jan		1.4	4.89
28-Jan		1.4	4.78
29-Jan		1.4	4.80
30-Jan		1.4	4.75
31-Jan		1.4	4.77
1-Feb		1.4	4.82
2-Feb		1.4	4.85
3-Feb		1.4	4.84
4-Feb		1.4	4.86
5-Feb		1.4	4.91
6-Feb		1.4	4.97
7-Feb		1.4	4.94
8-Feb		1.4	4.89
9-Feb		1.4	4.88
10-Feb		1.4	4.80
11-Feb		1.4	4.73
12-Feb		1.4	4.79
13-Feb		1.4	4.79
14-Feb		1.4	4.81
15-Feb		1.4	4.80
16-Feb		1.4	4.73
17-Feb		1.4	4.73
18-Feb		1.4	4.75

19-Feb		1.4	4.65
20-Feb		1.4	4.71
21-Feb		1.4	4.83
22-Feb		1.4	4.64
23-Feb		1.4	4.70
24-Feb		1.4	4.69
25-Feb		1.4	4.75
26-Feb		1.4	4.88
27-Feb		1.4	4.89
28-Feb		1.4	4.89
29-Feb		1.4	4.69
1-Mar		1.4	4.97
2-Mar		1.4	4.96
3-Mar		1.4	5.09
4-Mar		1.4	5.24
5-Mar		1.4	5.05
6-Mar		1.4	5.17
7-Mar		1.4	5.25
8-Mar		1.4	5.30
9-Mar		1.4	5.40
10-Mar		1.4	5.50
11-Mar		1.4	5.67
12-Mar		1.4	5.79
13-Mar		1.4	5.99
14-Mar		1.4	6.01
15-Mar		1.4	6.10
16-Mar		1.4	6.27
17-Mar		1.4	6.43
18-Mar		1.4	6.71
19-Mar		1.4	7.06
20-Mar		1.4	7.23
21-Mar		1.4	6.96
22-Mar		1.4	6.92
23-Mar		1.4	7.17
24-Mar		1.4	7.35
25-Mar		1.4	8.01
26-Mar		1.4	8.29
27-Mar		1.4	8.87
28-Mar		1.4	9.35
29-Mar		1.4	10.30
30-Mar		1.4	11.49
31-Mar		1.4	12.48
1-Apr		3.1	12.44
2-Apr		3.1	12.76
3-Apr		3.1	13.53
4-Apr		3.1	14.07
5-Apr		3.1	14.98
6-Apr		3.1	16.78
7-Apr		3.1	19.24
8-Apr		3.1	21.19
9-Apr		3.1	23.51
10-Apr		3.1	26.36
11-Apr		3.1	29.04
12-Apr		3.1	31.59

13-Apr		3.1	32.36
14-Apr		3.1	34.04
15-Apr		3.1	37.16
16-Apr		3.1	38.68
17-Apr		3.1	39.16
18-Apr		3.1	40.04
19-Apr		3.1	41.04
20-Apr		3.1	40.29
21-Apr		3.1	38.73
22-Apr		3.1	38.72
23-Apr		3.1	39.08
24-Apr		3.1	41.03
25-Apr		3.1	46.26
26-Apr		3.1	48.07
27-Apr		3.1	49.00
28-Apr		3.1	51.74
29-Apr		3.1	57.56
30-Apr		3.1	64.23
1-May		3.1	73.02
2-May		3.1	85.02
3-May		3.1	103.46
4-May		3.1	123.07
5-May		3.1	138.18
6-May		3.1	147.21
7-May		3.1	153.46
8-May		3.1	160.13
9-May		3.1	181.97
10-May		3.1	195.92
11-May		3.1	206.29
12-May		3.1	213.17
13-May		3.1	209.75
14-May		3.1	204.47
15-May		3.1	213.14
16-May		3.1	228.09
17-May		3.1	255.85
18-May		3.1	278.39
19-May		3.1	304.59
20-May		3.1	333.63
21-May		3.1	353.74
22-May		3.1	382.50
23-May		3.1	373.84
24-May		3.1	350.38
25-May		3.1	352.02
26-May		3.1	354.78
27-May		3.1	347.69
28-May		3.1	357.67
29-May		3.1	355.40
30-May		3.1	346.80
31-May		3.1	333.34
1-Jun		3.1	313.32
2-Jun		3.1	307.62
3-Jun		3.1	303.01
4-Jun		3.1	296.05
5-Jun		3.1	288.46

6-Jun		3.1	279.42
7-Jun		3.1	266.83
8-Jun		3.1	263.30
9-Jun		3.1	261.02
10-Jun		3.1	237.53
11-Jun		3.1	226.73
12-Jun		3.1	215.47
13-Jun		3.1	204.06
14-Jun		3.1	196.55
15-Jun		3.1	187.26
16-Jun		3.1	193.71
17-Jun		3.1	192.70
18-Jun		3.1	181.80
19-Jun		3.1	162.29
20-Jun		3.1	152.26
21-Jun		3.1	137.80
22-Jun		3.1	134.95
23-Jun		3.1	124.77
24-Jun		3.1	126.23
25-Jun		3.1	111.70
26-Jun		3.1	99.65
27-Jun		3.1	89.12
28-Jun		3.1	79.66
29-Jun		3.1	70.58
30-Jun		3.1	62.47
1-Jul		3.1	63.08
2-Jul		3.1	53.15
3-Jul		3.1	46.12
4-Jul		3.1	41.19
5-Jul		3.1	38.45
6-Jul		3.1	35.03
7-Jul		3.1	33.00
8-Jul		3.1	31.92
9-Jul		3.1	27.87
10-Jul		3.1	25.01
11-Jul		3.1	23.56
12-Jul		3.1	23.98
13-Jul		3.1	22.57
14-Jul		3.1	22.52
15-Jul		3.1	20.01
16-Jul		3.1	18.14
17-Jul		3.1	18.02
18-Jul		3.1	16.33
19-Jul		3.1	18.05
20-Jul		3.1	18.81
21-Jul		3.1	16.01
22-Jul		3.1	14.95
23-Jul		3.1	13.56
24-Jul		3.1	12.28
25-Jul		3.1	11.65
26-Jul		3.1	10.34
27-Jul		3.1	10.84
28-Jul		3.1	11.01
29-Jul		3.1	9.42

30-Jul		3.1	9.21
31-Jul		3.1	8.94
1-Aug		3.1	6.82
2-Aug		3.1	6.66
3-Aug		3.1	7.50
4-Aug		3.1	7.73
5-Aug		3.1	7.46
6-Aug		3.1	7.82
7-Aug		3.1	6.95
8-Aug		3.1	6.03
9-Aug		3.1	5.67
10-Aug		3.1	5.97
11-Aug		3.1	5.80
12-Aug		3.1	5.56
13-Aug		3.1	6.21
14-Aug		3.1	5.57
15-Aug		3.1	5.08
16-Aug		3.1	5.09
17-Aug		3.1	4.90
18-Aug		3.1	4.88
19-Aug		3.1	4.98
20-Aug		3.1	4.93
21-Aug		3.1	5.39
22-Aug		3.1	5.34
23-Aug		3.1	4.88
24-Aug		3.1	4.43
25-Aug		3.1	4.24
26-Aug		3.1	4.05
27-Aug		3.1	3.83
28-Aug		3.1	3.99
29-Aug		3.1	4.94
30-Aug		3.1	5.41
31-Aug		3.1	4.73
1-Sep		3.1	2.56
2-Sep		3.1	2.70
3-Sep		3.1	3.06
4-Sep		3.1	3.15
5-Sep		3.1	2.89
6-Sep		3.1	2.74
7-Sep		3.1	2.54
8-Sep		3.1	2.58
9-Sep		3.1	2.63
10-Sep		3.1	2.57
11-Sep		3.1	2.46
12-Sep		3.1	3.10
13-Sep		3.1	3.04
14-Sep		3.1	2.68
15-Sep		3.1	2.56
16-Sep		3.1	2.75
17-Sep		3.1	3.06
18-Sep		3.1	3.18
19-Sep		3.1	3.52
20-Sep		3.1	4.00
21-Sep		3.1	3.52

22-Sep		3.1	3.88
23-Sep		3.1	3.88
24-Sep		3.1	4.13
25-Sep		3.1	4.55
26-Sep		3.1	4.55
27-Sep		3.1	4.20
28-Sep		3.1	3.93
29-Sep		3.1	3.83
30-Sep		3.1	4.00
1-Oct		3.1	6.56
2-Oct		3.1	4.96
3-Oct		3.1	5.17
4-Oct		3.1	4.83
5-Oct		3.1	4.76
6-Oct		3.1	5.06
7-Oct		3.1	5.77
8-Oct		3.1	6.81
9-Oct		3.1	6.68
10-Oct		3.1	6.35
11-Oct		3.1	6.02
12-Oct		3.1	5.73
13-Oct		3.1	6.00
14-Oct		3.1	5.84
15-Oct		3.1	5.45
16-Oct		3.1	5.82
17-Oct		3.1	5.43
18-Oct		3.1	6.20
19-Oct		3.1	5.99
20-Oct		3.1	5.42
21-Oct		3.1	6.10
22-Oct		3.1	5.88
23-Oct		3.1	6.02
24-Oct		3.1	6.00
25-Oct		3.1	5.96
26-Oct		3.1	6.22
27-Oct		3.1	5.41
28-Oct		3.1	6.19
29-Oct		3.1	5.67
30-Oct		3.1	5.43
31-Oct		3.1	5.96
1-Nov		1.4	6.94
2-Nov		1.4	6.39
3-Nov		1.4	6.16
4-Nov		1.4	6.47
5-Nov		1.4	5.91
6-Nov		1.4	6.02
7-Nov		1.4	6.02
8-Nov		1.4	5.88
9-Nov		1.4	5.96
10-Nov		1.4	6.19
11-Nov		1.4	6.11
12-Nov		1.4	6.44
13-Nov		1.4	6.61
14-Nov		1.4	6.43

15-Nov		1.4	6.53
16-Nov		1.4	6.66
17-Nov		1.4	6.64
18-Nov		1.4	6.42
19-Nov		1.4	6.20
20-Nov		1.4	6.04
21-Nov		1.4	6.08
22-Nov		1.4	5.85
23-Nov		1.4	6.29
24-Nov		1.4	5.79
25-Nov		1.4	5.52
26-Nov		1.4	5.75
27-Nov		1.4	5.32
28-Nov		1.4	5.32
29-Nov		1.4	5.42
30-Nov		1.4	5.65
1-Dec		1.4	5.67
2-Dec		1.4	5.70
3-Dec		1.4	5.73
4-Dec		1.4	5.75
5-Dec		1.4	5.63
6-Dec		1.4	5.57
7-Dec		1.4	5.60
8-Dec		1.4	5.57
9-Dec		1.4	5.50
10-Dec		1.4	5.54
11-Dec		1.4	5.20
12-Dec		1.4	5.14
13-Dec		1.4	5.33
14-Dec		1.4	5.25
15-Dec		1.4	5.20
16-Dec		1.4	5.23
17-Dec		1.4	5.14
18-Dec		1.4	5.03
19-Dec		1.4	5.10
20-Dec		1.4	5.15
21-Dec		1.4	5.05
22-Dec		1.4	5.08
23-Dec		1.4	5.14
24-Dec		1.4	5.18
25-Dec		1.4	5.22
26-Dec		1.4	5.28
27-Dec		1.4	5.28
28-Dec		1.4	5.29
29-Dec		1.4	5.25
30-Dec		1.4	5.14
31-Dec		1.4	5.05

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 four decreed surface diversion within this reach of stream: Balanced Rock Ditch (3.0 cfs, 1945 appropriation), Alamo Ditch No. 1 (1.25 cfs , 1907 appropriation), Silver View Ditch (1.65 cfs, 1939 appropriation) and Dequine Ditch (1.25 cfs, 1991 appropriation). Staff has determined that water is available for appropriation on Morrison Creek, between the confluence with Muddy Creek and the confluence with Silver 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:

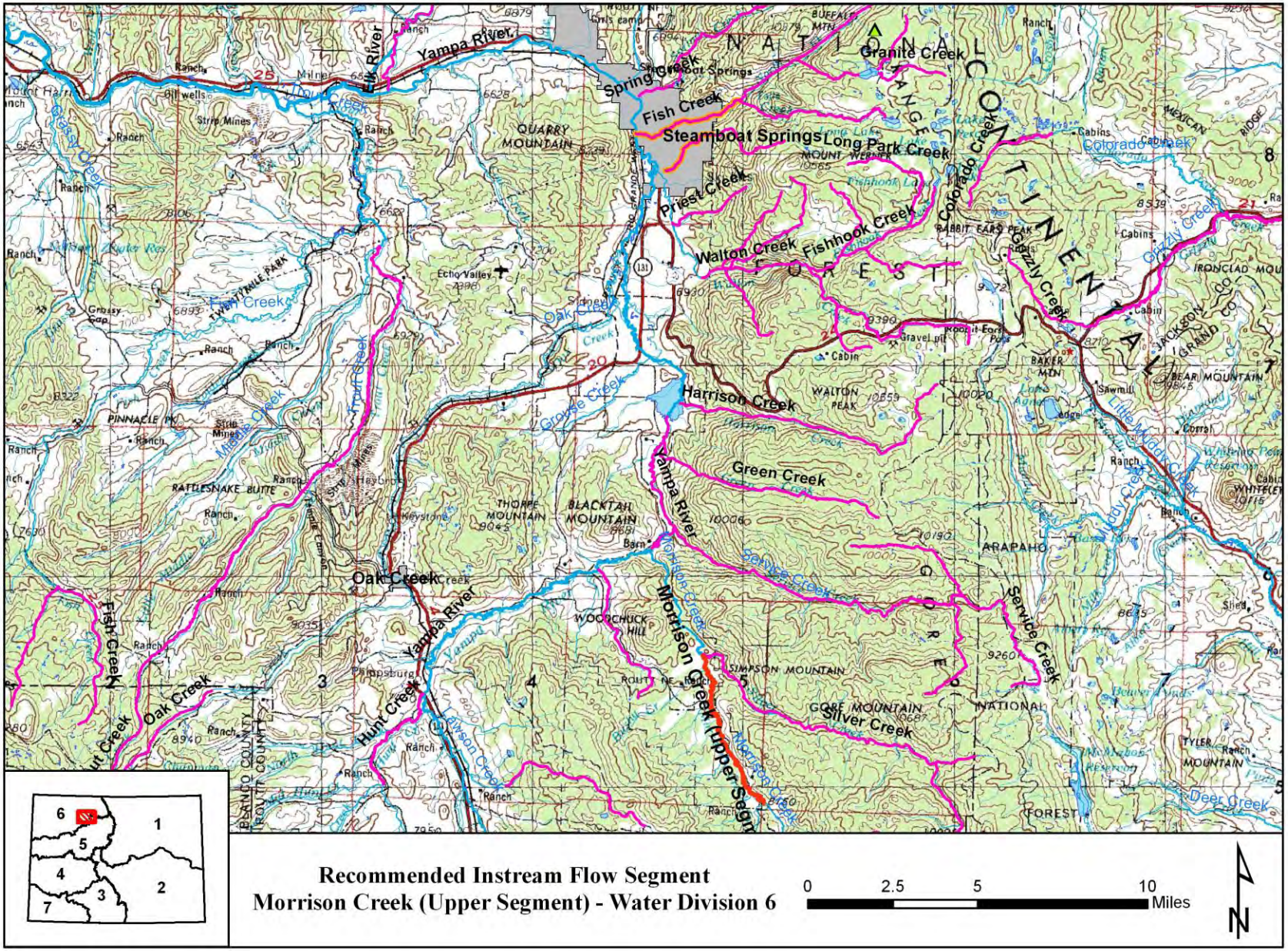
Segment: Confluence with Muddy Creek to Confluence with Silver Creek

Upper Terminus: CONFLUENCE WITH MUDDY CREEK
(Latitude 40° 10' 54.50"N) (Longitude 106° 45' 0.35"W)
UTM North: 4449404.70 UTM East: 351005.19
SE SE S36 T3N R84W 8th PM
70' West of the East Section Line; 740' North of the South Section Line

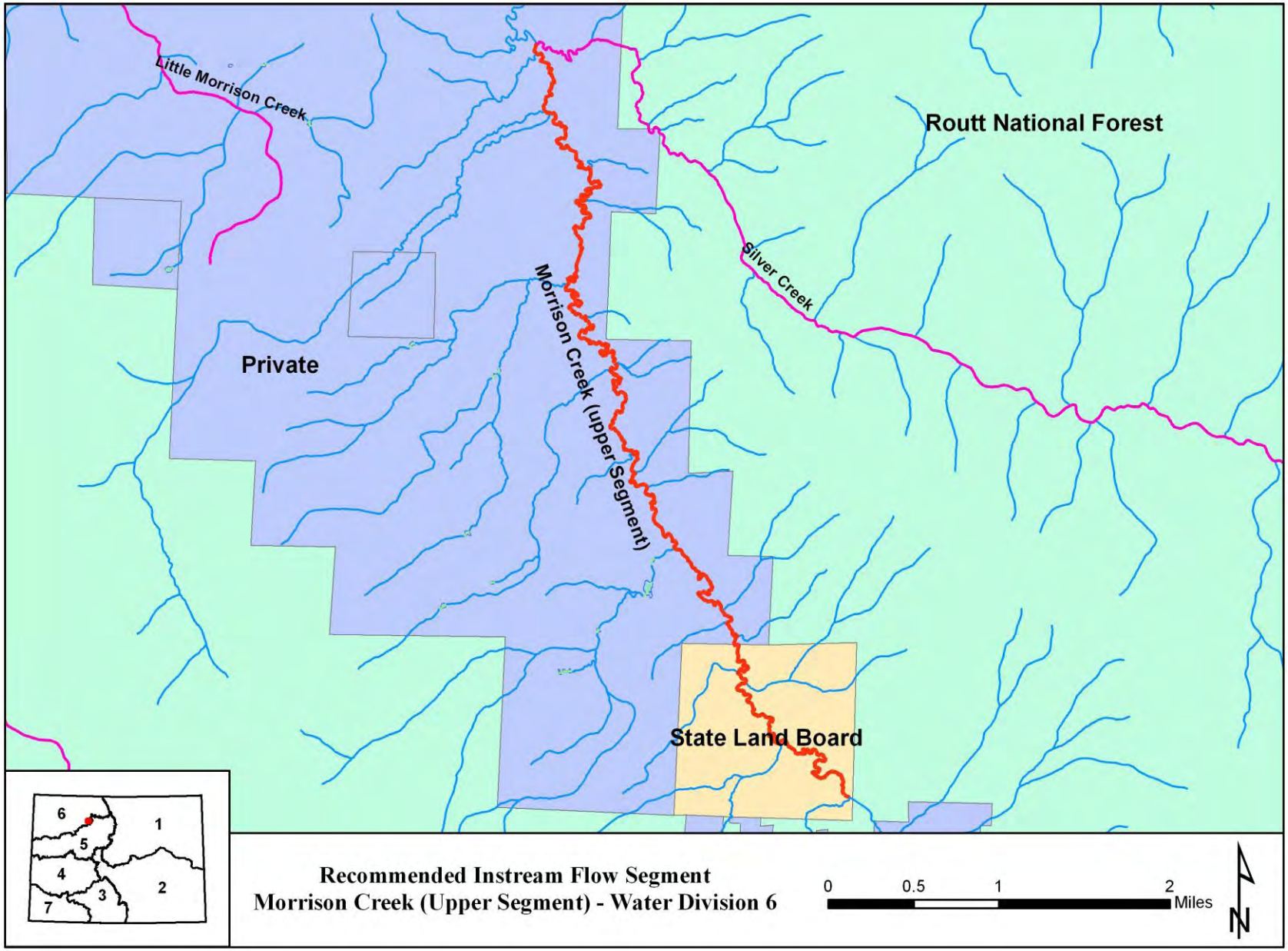
Lower Terminus: CONFLUENCE WITH SILVER CREEK
(Latitude 40° 14' 42.44"N) (Longitude 106° 47' 10.75"W)
UTM North: 4456494.46 UTM East: 348062.75
NW SW S11 T3N R84W 6th PM
15' East of the West Section Line; 2550' South of the North Section Line

Watershed: Upper Yampa (HUC#: 14050001**)**
Counties: Routt
Length: 8.99 miles
USGS Quad: Green Ridge
Flow Recommendation: 3.1 cfs (April 1 – October 31)
1.4 cfs (November 1 – March 31)

Vicinity Map



Land Use Map


Little Morrison Creek
Routt National Forest
Silver Creek
Morrison Creek (upper Segment)
Private
State Land Board
6
1
5
4
2
3
7
Recommended Instream Flow Segment
Morrison Creek (Upper Segment) - Water Division 6
0
0.5
1
2
Miles
N

Topographic and Water Rights Map

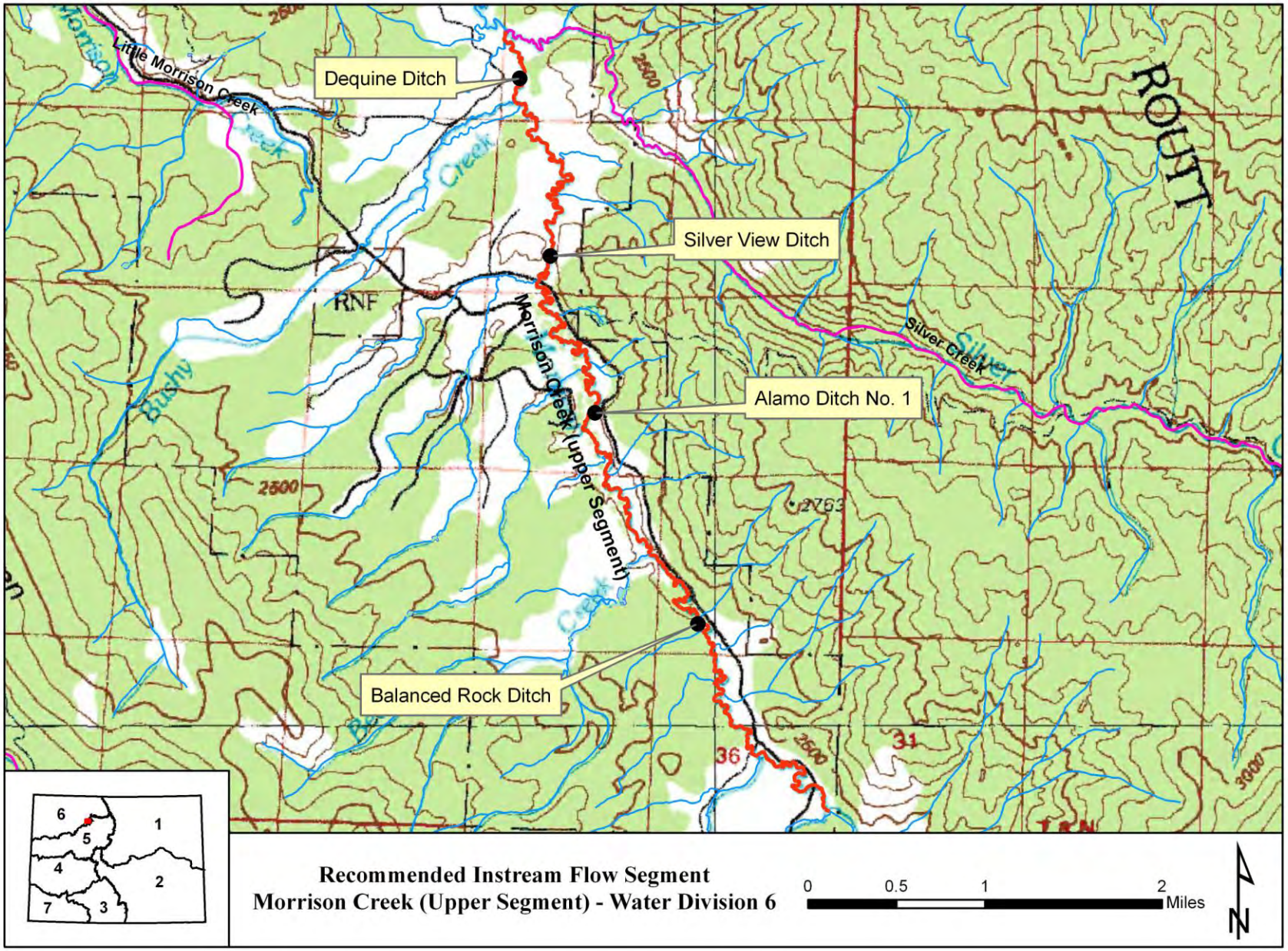


Exhibit 4

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

January 1996

Development of Instream Flow Recommendations In Colorado Using

R2CROSS

By Gregory D. Espegren
Senior Water Resource Specialist

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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 6.0, 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.

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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.

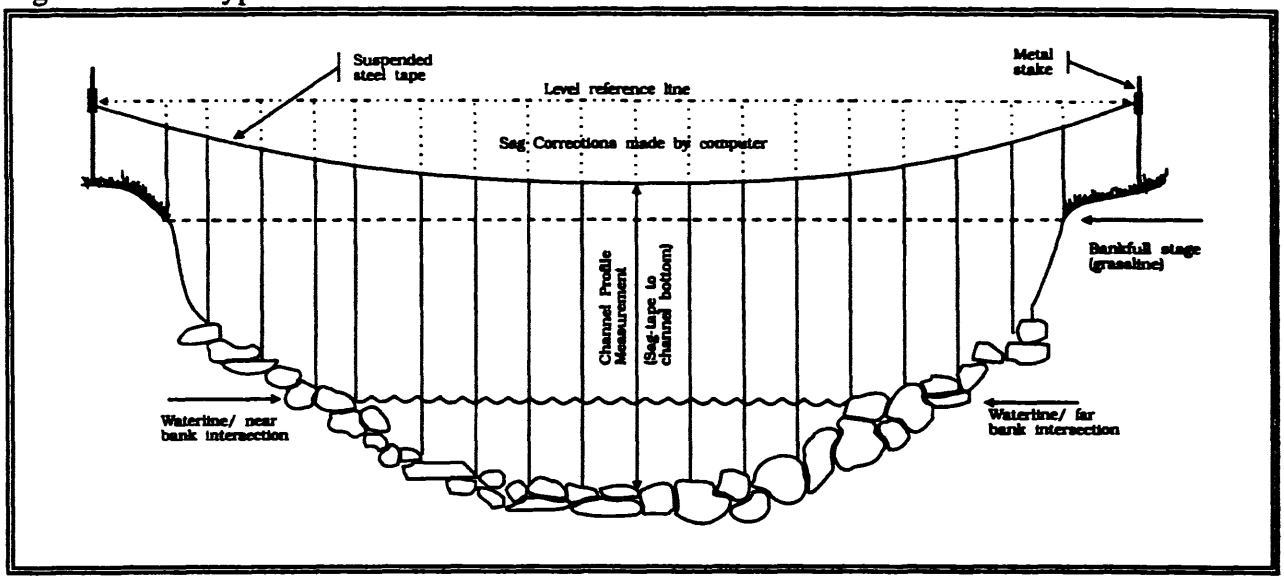
The R2CROSS program uses the standard weight of a one-foot section of the steel tape, tape tension, and the length of tape in suspension to correct horizontal distance and vertical depth measurements made from the sagging tape. The program adjusts the coordinates at each cross section vertical so that 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		
MAP(S)	USGS:				
	USFS:				

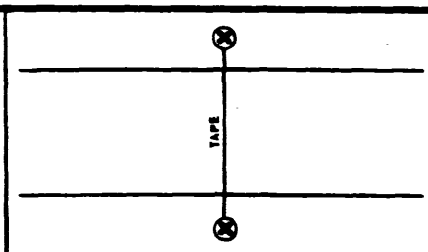
SUPPLEMENTAL DATA

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 ◇

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

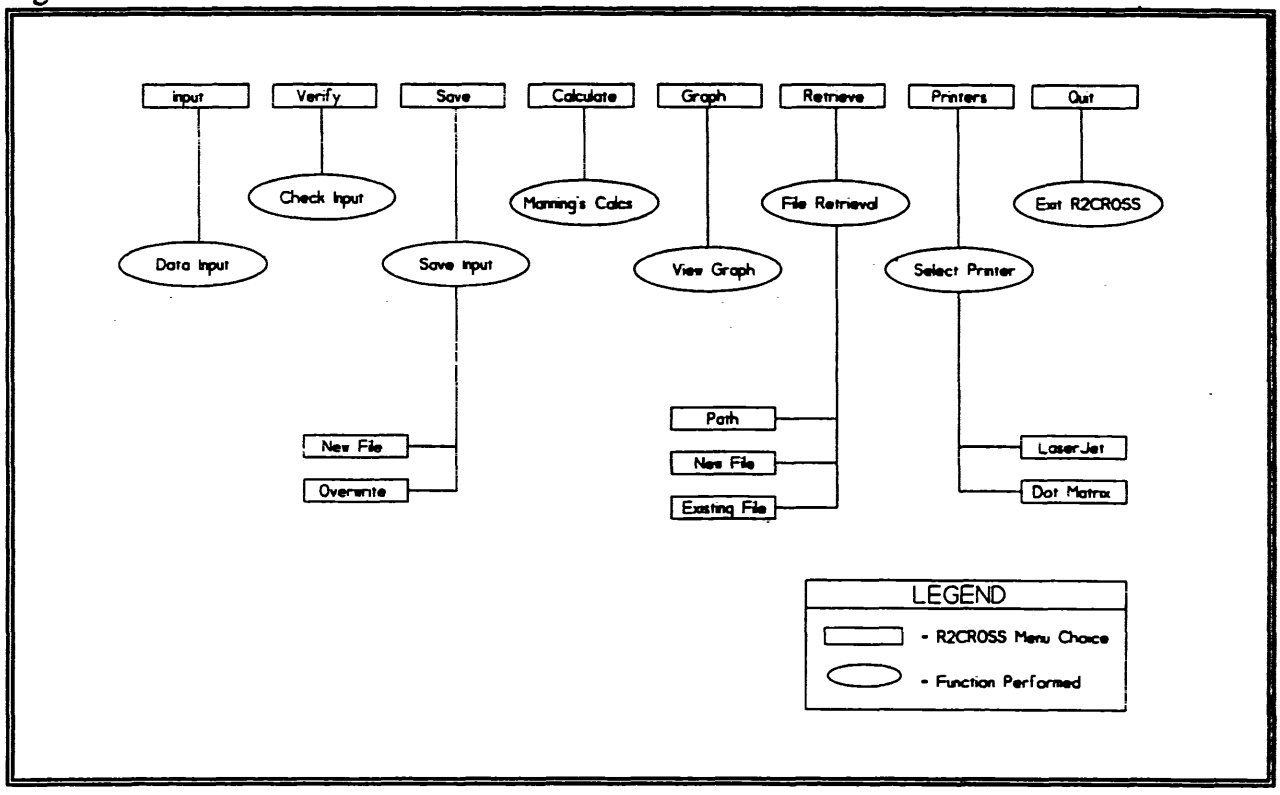


Figure E. R2CROSS proof sheet

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	RECOMMENDED INSTREAM FLOW:
CALCULATED FLOW (Qc)=	2.91 cfs	==========
(Qm-Qc)/Qm * 100 =	-0.1 %	
		FLOW (CFS) PERIOD
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	

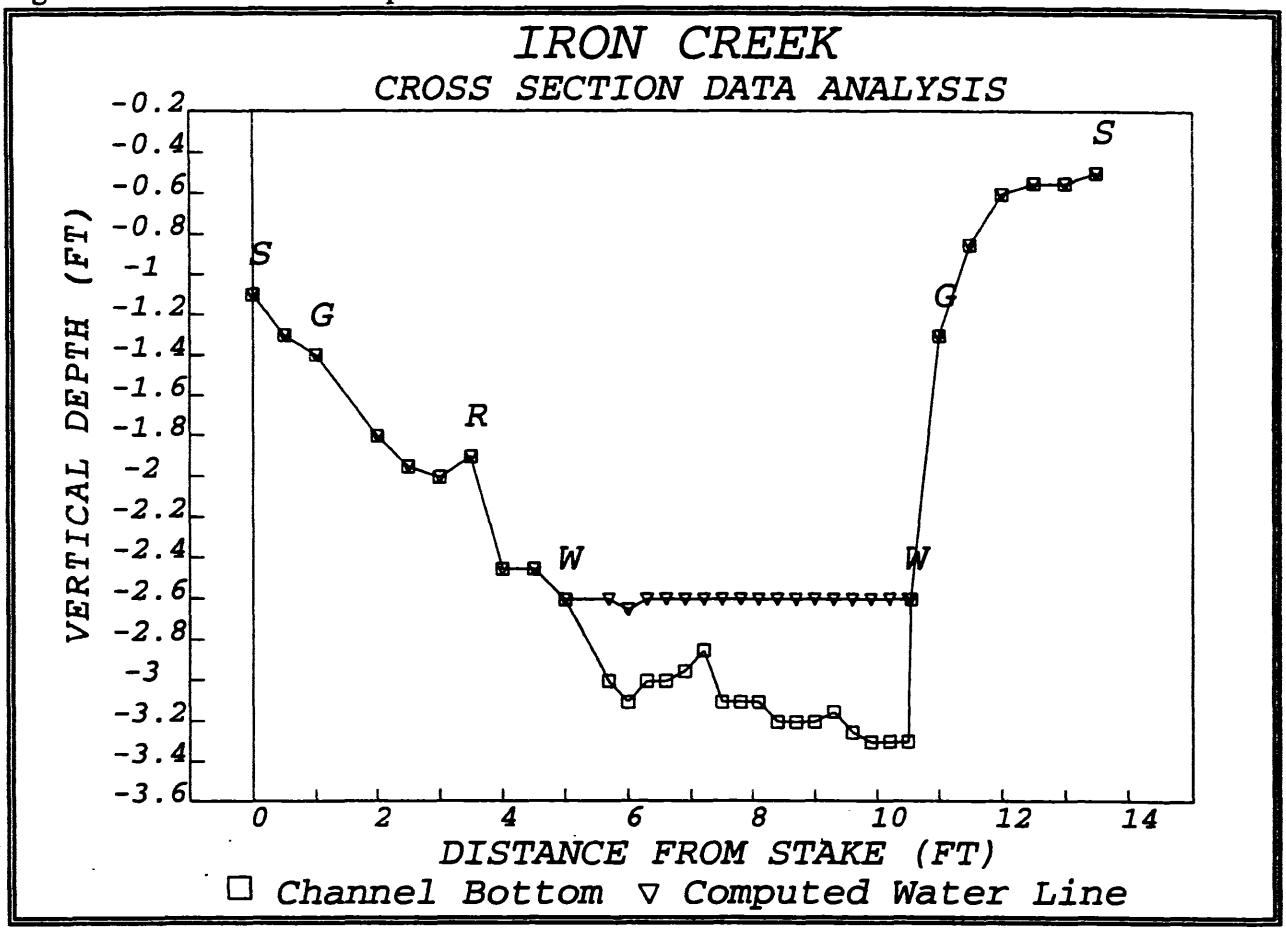
RATIONALE FOR RECOMMENDATION:
==========

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

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.

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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

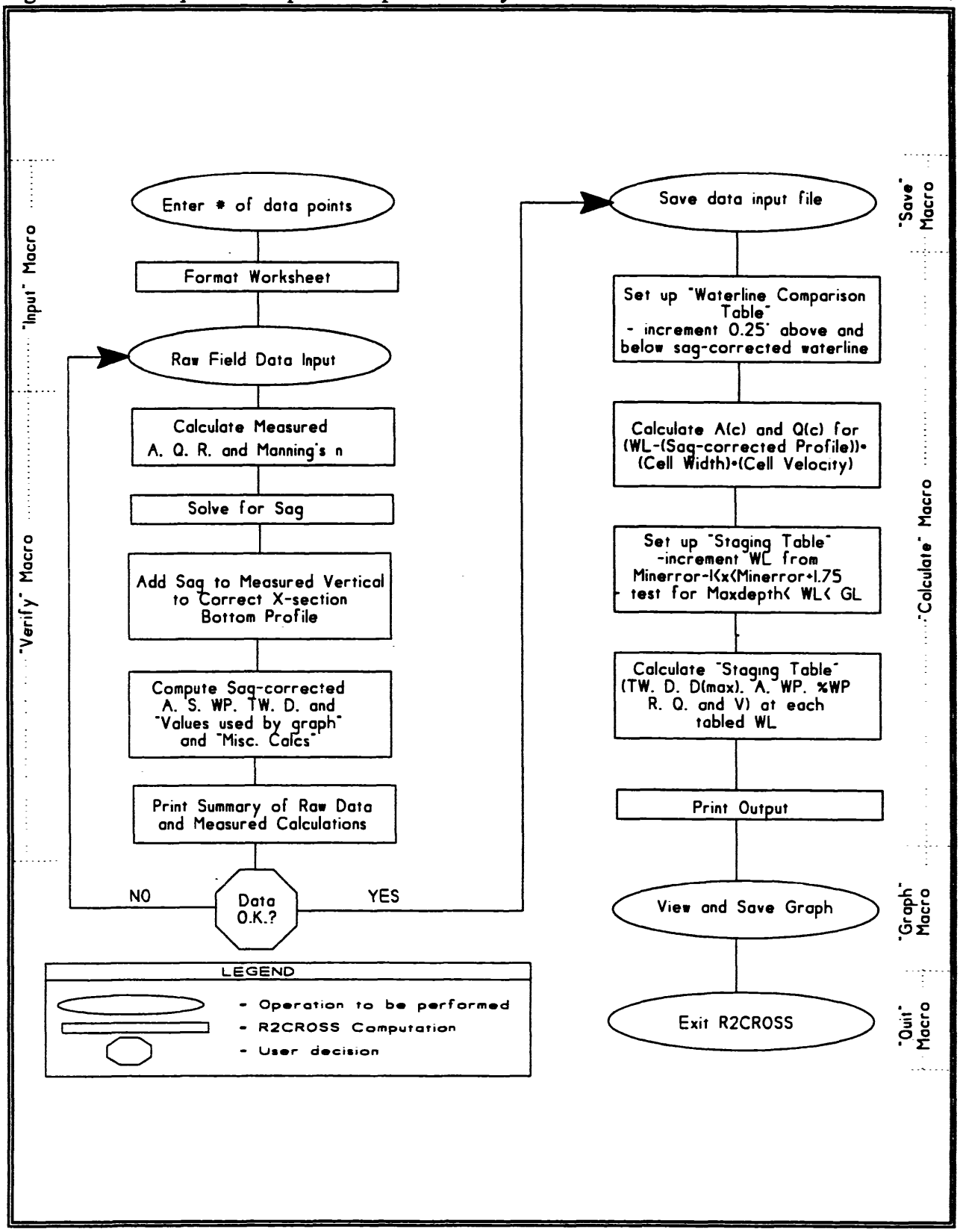

Figure M. Lotus 1-2-3 worksheet layout for R2CROSS macro

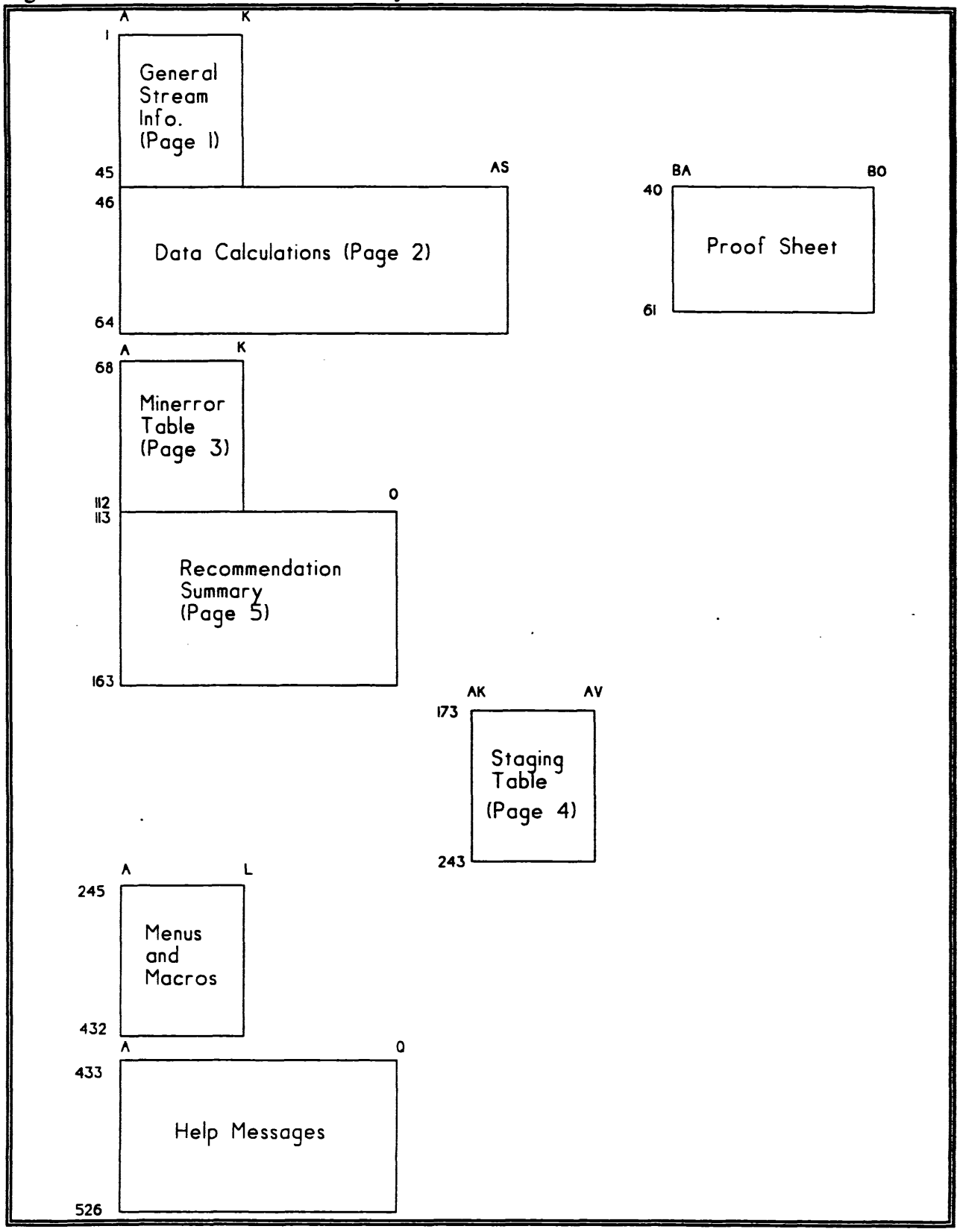

Table 4. Hydraulic Formulas used in R2CROSS staging table

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 ($\bar{x}_v$)	$\frac{Q}{A}$

Exhibit 5

RULES CONCERNING THE COLORADO INSTREAM FLOW AND NATURAL LAKE LEVEL PROGRAM

Adopted by the
Colorado Water Conservation Board
January 27, 2009

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.

Exhibit 6

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 2010 Instream Flow Appropriations Water Divisions 1, 2, 4, 6, and 7 Notice

Date: February 2, 2010

At its January 26–27, 2010 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 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 721, Denver, Colorado, 80203. Copies of the Instream Flow and Natural Lake Level Recommendation Summary Reports are also available on the CWCB website at: http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2010ProposedAppropriations/

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. Pursuant to the rules concerning the Colorado Instream Flow and Natural Lake Level Program adopted by the Colorado Water Conservation Board, 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, 2010, 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, 2010, or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September 2010 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 2010 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. 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.

Div	Stream	Watershed	County	Length (miles)	Upper Terminus	Lower Terminus	Quad Sheet(s)	Flow (CFS)
1	Black Hollow Creek	Cache la Poudre	Larimer	5.49	headwaters	confl Cache la Poudre River	Kinikinik	2.2 (5/1-9/30) 1.4 (10/1-11/15) 0.75 (11/16-4/30)
2	Baldwin Creek	Arkansas Headwaters	Chaffee	5.04	outlet Baldwin Lake	confl Chalk Creek	Saint Elmo	6.5 (5/15-8/31) 3.5 (9/1-10/31) 1.8 (11/1-2/29) 0.9 (3/1-4/15) 1.8 (4/16-5/14)
2	Middle Creek	Upper Arkansas	Custer	4.78	headwaters	confl Ophir Creek	Deer Peak, Saint Charles Peak	3.4 (4/15-6/30) 2.0 (7/1-8/31) 1.0 (9/1-4/14)
2	Middle Creek	Upper Arkansas	Custer/ Pueblo	6.72	confl Ophir Creek	Beulah Water Works Diversion	Deer Peak, Saint Charles Peak	5.1 (4/1-8/31) 2.8 (9/1-3/31)
4	Blue Creek (increase)	Upper Gunnison	Gunnison	3.53	confl Little & Big Blue Creek	confl Morrow Point Reservoir	Curecanti Needle	4.5 (4/1-7/31)
4	Willow Creek	Upper Gunnison	Gunnison	3.59	confl Sugar Creek	confl Blue Mesa Reservoir	Big Mesa	2.3 (4/1-6/30) 0.5 (7/1-3/31)
4	Alpine Gulch	Upper Gunnison	Hinsdale	5.69	headwaters	confl Henson Creek	Redcloud Peak, Lake City, Lake San Cristobal	5.0 (4/15-9/30) 1.0 (10/1-4/14)
4	Spring Creek	Upper Gunnison	Hinsdale	3.25	Hdgt. Creede Trail Ditch	confl with Cebolla Creek	Mineral Mtn.	5.0 (4/1-9/30) 3.3 (10/1-11/15) 2.0 (11/16-3/31)
4	Cebolla Creek	Upper Gunnison	Hinsdale	10.1	confl Brush Creek	confl Spring Creek	Cannibal Plateau, Mineral Mtn.	23.0 (5/1-9/30) 12.5 (10/1-11/15) 7.5 (11/16-3/31) 16.5 (4/1-4/30)
4	Cebolla Creek	Upper Gunnison	Hinsdale/ Gunnison	10.8	confl Spring Creek	USGS gage	Mineral Mtn., Rudolph Hill	26.0 (4/1-9/30) 22.0 (10/1-11/15) 13.5 (11/16-3/31)

4	Tabeguache Creek	San Miguel	Montrose	5.4	confl Fortyseven Creek	Hdgt. Templeton Ditch	Nucla, Uravan	4.75 (4/1-6/30) 1.9 (7/1-11/30) 1.6 (12/1-3/31)
4	Tabeguache Creek	San Miguel	Montrose	9.7	Hdgt. Templeton Ditch	confl San Miguel River	Nucla, Uravan	4.75 (3/15-6/30)
4	Cochetopa Creek	Tomichi	Saguache	7.54	confl Nutras Creek	Hdgt. Mesa Ditch	Elk Park, Cold Spring Park	11.3 (5/16-8/15) 7.5 (8/16-9/30) 4.5 (10/1-11/15) 2.75 (11/16-3/15) 5.0 (3/16-5/15)
4	Cochetopa Creek (increase)	Tomichi	Saguache	12.92	confl Alkali Creek	Hdgt. South Krueger Ditch	Sawtooth Mtn., Iris	6.8 (5/1-11/15)
4	East Beaver Creek	Upper Gunnison	Saguache	6.26	headwaters	confl South Beaver Creek	Spring Hill Creek	5.8 (4/1-7/31) 3.7 (8/1-10/31) 2.4 (11/1-3/31)
6	Indian Creek	North Platte Headwaters	Jackson	7.7	headwaters	Hdgt. West Arapahoe Feeder Ditch 2	Spicer Peak, Whiteley Peak	4.0 (4/1-7/15) 0.7 (7/16-3/31)
6	Big Beaver Creek (increase)	Upper White	Rio Blanco	3.94	confl Allen Creek	confl East Beaver Creek	Fawn Creek, Sawmill Mtn.	2.1 (4/1-6/30)
6	Grizzly Creek	Little Snake	Routt	2.9	confl Unnamed tributary	USFS Boundary	Bears Ears Peak	1.3 (3/15-7/15) 0.5 (7/16-3/14)
6	Morrison Creek	Upper Yampa	Routt	8.99	confl Muddy Creek	confl Silver Creek	Green Ridge	3.1 (4/1-10/31) 1.4 (11/1-3/31)
6	Morrison Creek	Upper Yampa	Routt	4.91	confl Silver Creek	confl Yampa River	Green Ridge, Blacktail Mtn.	13.2 (4/1-8/15) 8.1 (8/16-3/31)
6	South Fork Slater Creek	Little Snake	Routt/ Moffat	4.55	headwaters	confl West Prong South Fork Slater Creek	Buck Point	4.1 (4/1-6/30) 1.25 (7/1-7/31) 0.65 (8/1-9/15) 1.25 (9/16-3/31)
6	South Fork Slater Creek	Little Snake	Routt	1.98	confl West Prong South Fork Slater Creek	confl Slater Creek	Buck Point	9.0 (3/15-7/15) 2.0 (7/16-8/15) 0.8 (8/16-10/15) 5.25 (10/16-3/14)
6	West Prong South Fork Slater Creek	Little Snake	Routt/ Moffat	4.58	headwaters	Hdgt. Decker Ditch No. 1	Buck Point	4.9 (3/1-7/31) 3.5 (8/1-10/31) 2.5 (11/1-2/29)
7	Animas River	Animas River	San Juan	2.58	confl Minnie Gulch	confl Cunningham Creek	Howardsville	12.2 (5/1-10/31) 9.1 (11/1-4/30)
7	Animas River	Animas River	San Juan	1.94	confl Cunningham Creek	confl Arrastra Creek	Howardsville, Ironton	25.0 (5/1-10/31) 13.0 (11/1-4/30)

Exhibit 7

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 721
Denver, Colorado 80203
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www.cwcb.state.co.us

NOTICE

To: Instream Flow Subscription Mailing Lists

Subject: Proposed 2010 Instream Flow Appropriations
Water Divisions 1, 2, 4, 5, 6, and 7 Notice

Date: November 12, 2009

This notice complements previous notice, made pursuant to ISF Rule 5c, which identified the streams to be considered for instream flow appropriations in 2010. At the January 2010 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 water division, stream name, county, recommending entity, and water district.

Copies of the Instream Flow Stakeholder Recommendations 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 721, Denver, Colorado, 80203. In addition to the CWCB office, copies of the Instream Flow Stakeholder Recommendations are available on the CWCB website at
http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2010ProposedAppropriations/

In addition to the above Instream Flow Stakeholder 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, 2010, 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, 2010 or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the November 2010 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 2010 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.

2010 Instream Flow Appropriation Flow (ISF) Recommendations (November 3, 2009)

Water Div	Stream	County(ies)	Recommender(s)	Water District (s)
1	Black Hollow Creek	Larimer	TU	3
2	Baldwin Creek	Chaffee	CDOW	11
2	Middle Creek	Custer/ Pueblo	CDOW	15
2	Middle Creek	Custer/ Pueblo	CDOW	15
4	Little Dominguez Creek	Delta, Mesa	BLM	40, 42
4	Big Dominguez Creek	Delta, Mesa	BLM	40, 42
4	Blue Creek (increase)	Gunnison	BLM	62
4	Willow Creek	Gunnison	BLM	62
4	Alpine Gulch	Hinsdale	BLM	62
4	Spring Creek	Hinsdale	BLM	62

4	Cebolla Creek	Hinsdale/ Gunnison	BLM	62
4	Cebolla Creek	Hinsdale/ Gunnison	BLM	62
4	North Fork Tabaguache Creek	Montrose	USFS	60
4	Red Canyon Creek	Montrose	USFS	60
4	San Miguel River	Montrose	CDOW, BLM	60
4	Tabaguache Creek	Montrose	USFS	60
4	Tabaguache Creek	Montrose	BLM	60
4	Tabaguache Creek	Montrose	BLM	60
4	Cochetopa Creek	Saguache	BLM	28
4	Cochetopa Creek (increase)	Saguache	BLM	28
4	East Beaver Creek	Saguache	BLM	62
5	Colorado River	Eagle	Eagle County	52, 53
5	Colorado River	Eagle/Grand	CDOW	52, 53
5	Colorado River	Eagle/Grand	CDOW	52, 53
6	Indian Creek	Jackson	BLM	47
6	Wheeler Creek	Jackson	BLM	47
6	Big Beaver Creek (increase)	Rio Blanco	BLM	43
6	Grizzly Creek	Routt	CDOW, TU	54
6	Morrison Creek	Routt	CDOW	58
6	Morrison Creek	Routt	CDOW, James Larson, Dequine Family LLC, Flying Diamond Resources	58
6	South Fork Slater Creek	Routt	CDOW, TU	54
6	South Fork Slater Creek	Routt	CDOW, TU	54
6	West Prong South Fork Slater Creek	Moffat / Routt	CDOW, TU	54
6	West Prong South Fork Slater Creek	Routt	CDOW, TU	54
7	Animas River	San Juan	BLM	30
7	Animas River	San Juan	BLM	30

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
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Denver, Colorado 80203
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Fax: (303) 866-4474
www.cwcb.state.co.us

NOTICE

To: Instream Flow Subscription Mailing Lists

Subject: Proposed 2010 Instream Flow Appropriations

Date: March 17, 2009

Pursuant to ISF Rule 5c of the Rules Concerning the Colorado Instream Flow and Natural Lake Level Program, this notice identifies the streams to be considered for instream flow appropriations in 2010. At the January 2010 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.

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 pursuant to the ISF Rules:

(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, 2010, 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, 2010 or the first business day thereafter.

(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September 2010 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 2010 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.

Div	Stream	Watershed	County	Length (miles)	Upper Terminus	Lower Terminus	Quad Sheet(s)
1	Coal Creek	St. Vrain	Boulder	6.1	Boulder County Open Space Boundary	Louisville Wastewater Treatment outfall	Louisville, Lafayette
1	Coal Creek	St. Vrain	Boulder	1.7	Louisville Wastewater Treatment outfall	pumping station #2	Louisville, Lafayette
1	Black Hollow Creek	Cache la Poudre	Larimer	4.5	headwaters	confl Poudre River	Kinikinik
2	Baldwin Creek	Arkansas Headwaters	Chaffee	4.6	headwaters	confl Chalk Cr	St Elmo
2	Gibson Creek	Arkansas Headwaters	Custer	2.5	headwaters	confl Verde Creek	Beckwith Mt, Electric Pk
2	Middle Creek	Upper Arkansas	Custer/ Pueblo	4.7	headwaters	confl Ophir Creek	Deer Pk, St Charles Pk
2	Middle Creek	Upper Arkansas	Custer/ Pueblo	6	confl Ophir Creek	Beulah Water Works	Deer Pk, St Charles Pk
2	West Beaver Creek	Upper Arkansas	Freemont	7.5	confl Douglas Gulch	confl East Beaver Creek	Big Bull Mtn, Phantom Canyon
2	Beaver Creek	Upper Arkansas	Freemont	8.9	confl East Beaver Creek	confl Unnamed Tributary	Big Bull Mtn, Phantom Canyon
2	East Beaver Creek	Upper Arkansas	Freemont	8.8	confl Gould Creek	confl Beaver Creek	Mt Big Chief, Big Bull Mtn, Phantom Canyon
2	Baker Creek	Huerfano	Huerfano	1.8	headwaters	USFS Boundary	Trinchera Pk, Cucharas Pass

2	Bonnett Creek	Huerfano	Huerfano	3	headwaters	USFS Boundary	McParty Park, Cuchara
2	Chaparral Creek	Huerfano	Huerfano	2.9	headwaters	USFS Boundary	Cucharas Pass
2	Dodgeton Creek	Huerfano	Huerfano	2.8	headwaters	USFS Boundary	McParty Park, Cuchara
3	Mill Creek	Saguache	Saguache	0.7	USFS Boundary	hdgt Harence Ditch	Laughlin Gulch
4	Big Dominguez Creek		Delta/ Mesa		reaches pending Federal legislation	reaches pending Federal legislation	
4	Little Dominguez Creek		Delta/ Mesa		reaches pending Federal legislation	reaches pending Federal legislation	
4	Blue Creek (increase)	Upper Gunnison	Gunnison	3.5	confl Little Blue Creek	confl Morrow Point Reservoir	Curecanti Needle
4	Willow Creek	Upper Gunnison	Gunnison	3.6	confl Sugar Creek	confl Blue Mesa Reservoir	Big Mesa
4	Alpine Gulch	Upper Gunnison	Hinsdale	5.7	headwaters	confl Henson Creek	Redcloud Peak, Lake City
4	Spring Creek	Upper Gunnison	Hinsdale	3.3	hdgt Creede Trail Ditch	confl with Cebolla Creek	Mineral Mtn.
4	Cebolla Creek	Upper Gunnison	Hinsdale/ Gunnison	10.1	confl Brush Creek	confl Spring Creek	Cannibal Plateau, Mineral Mntn.
4	Cebolla Creek	Upper Gunnison	Hinsdale/ Gunnison	10.8	confl Spring Creek	USGS gage	Mineral Mtn., Rudolph Hill
4	North Fork Tabeguache Creek	San Miguel	Montrose	9	headwaters	confl Tabeguache Creek	Starvation Point, Wind Point
4	Red Canyon Creek	San Miguel	Montrose	6	headwaters	confl Horsefly Creek	Antone Spring, Sanborn Park
4	San Miguel River	San Miguel	Montrose	16.5	confl Calamity Draw	confl Dolores River	Uravan, Red Canyon, Davis Mesa
4	Tabeguache Creek	San Miguel	Montrose	11	unnamed trib	Forest Service Boundary	Ute, Starvation Point, Big Bucktail Cr, Nucla
4	Tabeguache Creek	San Miguel	Montrose	5.4	confl Fortyseven Creek	hdgt Templeton Ditch	Nucla
4	Tabeguache Creek	San Miguel	Montrose	9.7	hdgt Templeton Ditch	confl San Miguel River	Nucla, Uravan
4	Cochetopa Creek	Tomichi	Saguache	9	confl Nutras Creek	confl Pauline Creek	Elk Park, Cold Spring Park
4	Cochetopa Creek (increase)	Tomichi	Saguache	10	confl Alkali Creek	hdgt South Krueger Ditch	Sawtooth Mtn., Signal Peak
4	East Beaver Creek	Upper Gunnison	Saguache	6.3	headwaters	confl South Beaver Creek	Sawtooth Mtn., Spring Hill Creek
5	Colorado River	Colorado Headwaters	Eagle	40	Eagle/Grand Co. Line	confl Eagle River	Dotsero, Sugarloaf Mtn., Burns South, Burns North, Blue Hill, McCoy, State Bridge
5	Colorado River	Colorado Headwaters	Eagle / Grand	23.7	confl Blue River	confl Piney River	Kremmling, Radium, McCoy, State Bridge
5	Colorado River	Colorado Headwaters	Eagle	45.8	confl Piney River	confl Eagle River	State Bridge, Wolcott
5	Eagle River (increase)	Eagle	Eagle	3.8	confl Cross Creek	confl Gore Creek	Minturn
6	Indian Creek	North Platte	Jackson	7.7	headwaters	hdgt West	Spicer Peak,

		Headwaters				Arapahoe Feeder Ditch 2	Whiteley Peak
6	North Fork North Platte River	North Platte Headwaters	Jackson	7.5	headwaters	headgate Little Nellie Ditch	Boettcher Lake, Davis Peak, Pearl
6	South Fork Big Creek	Upper North Platte	Jackson	1.9	confl Wheeler Creek	Colorado-Wyoming stateline	Pearl
6	Wheeler Creek	Upper North Platte	Jackson	4.8	headwaters	confl South Fork Big Creek	Independence Mtn., Pearl
6	Big Beaver Creek (increase)	Upper White	Rio Blanco	3.9	confl Allen Creek	confl East Beaver Creek	Fawn Cr., Sawmill Mtn.
6	Moeller Creek	Upper White	Rio Blanco	3.5	headwaters	confl Fawn Creek	Fawn Creek
6	Piceance Creek	Piceance-Yellow	Rio Blanco	7.7	confl with Dry Fork	confl White River	Barcus Creek SE, White River City
6	Yellow Creek	Piceance-Yellow	Rio Blanco	11.8	Springs in NWNE S12, T1N R98W, 6PM	confl White R	Barcus Cr., Barcus Cr SE, Rough Gulch,
6	Grizzly Creek	Little Snake	Routt	2.9	confl Unnamed tributary	USFS Boundary	Bears Ears Peak
6	Morrison Creek	Upper Yampa	Routt	5	confl Muddy Creek	confl Silver Creek	Green Ridge
6	Morrison Creek	Upper Yampa	Routt	4.5	confl Silver Creek	confl Yampa River	Green Ridge, Blacktail Mtn
6	Morrison Creek	Upper Yampa	Routt	4.5	hdgt Dequine Ditch Alt Pt 1	confl Yampa River	Green Ridge, Blacktail Mtn
6	South Fork Slater Creek	Little Snake	Moffat/ Routt	3.8	headwaters	confl WP South Fork Slater Creek	Buck Point
6	South Fork Slater Creek	Little Snake	Routt	1.9	confl WP South Fork Slater Creek	confl Slater Creek	Buck Point
6	West Prong South Fork Slater Creek	Little Snake	Moffat / Routt	4.6	headwaters	Decker Ditch	Buck Point
6	West Prong South Fork Slater Creek	Little Snake	Routt	1	hdgt Decker Ditch	confl South Fork Slater Creek	Buck Point
7	Animas River	Animas River	San Juan	2.6	confl Minnie Gulch	confl Cunningham Creek	Howardsville
7	Animas River	Animas River	San Juan	2	confl Cunningham Creek	confl Arrastra Creek	Howardsville, Ironton

Exhibit 9

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 7, 2009

SUBJECT: **Agenda Item 10, November 16-18, 2009 Board Meeting**
Stream and Lake Protection – Notice of 2010 Instream Flow Recommendations in Water Divisions 1, 2, 4, 5, 6 and 7.

Discussion

Pursuant to ISF Rule 5c., the Colorado Water Conservation Board is providing notice that the following 36 stream segments are being considered for instream flow (ISF) appropriations in 2010. At the January 2010 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 2009 meeting.

Div	Stream Segment	County(ies)	Recommender(s)
1	**Black Hollow Creek** *(headwaters to confl Poudre River)*	Larimer	TU
2	**Baldwin Creek** *(headwaters to Chalk Creek)*	Chaffee	CDOW
2	**Middle Creek** *(headwaters to Ophir Creek)*	Custer / Pueblo	CDOW
2	**Middle Creek** *(Ophir Creek to Beulah Water Works)*	Custer / Pueblo	CDOW
4	**Big Dominguez Creek** *(reaches pending Federal legislation)*	Delta	BLM
4	**Little Dominguez Creek** *(reaches pending Federal legislation)*	Delta	BLM
4	**Blue Creek** (Increase to existing ISF right) *(Little Blue Creek to Morrow Point Reservoir)*	Gunnison	BLM
4	**Willow Creek** *(Sugar Creek to Blue Mesa Reservoir)*	Gunnison	BLM

4	**Alpine Gulch** *(headwaters to Henson Creek)*	Hinsdale	BLM
4	**Spring Creek** *(headgate Creede Trail Ditch to confl with Cebolla Creek)*	Hinsdale	BLM
4	**Cebolla Creek** *(Brush Creek to Spring Creek)*	Hinsdale / Gunnison	BLM
4	**Cebolla Creek** *(Spring Creek to USGS gage)*	Hinsdale / Gunnison	BLM
4	**North Fork Tabeguache Creek** *(headwaters to Tabeguache Creek)*	Montrose	USFS
4	**Red Canyon Creek** *(headwaters to Horsefly Creek)*	Montrose	USFS
4	**San Miguel River** *(Calamity Draw to Dolores River)*	Montrose	CDOW, BLM
4	**Tabeguache Creek** *(unnamed trib to Fortyseven Creek)*	Montrose	USFS
4	**Tabeguache Creek** *(confl Fortyseven Creek to Templeton Ditch)*	Montrose	BLM
4	**Tabeguache Creek** *(Templeton Ditch to confl San Miguel River)*	Montrose	BLM
4	**Cochetopa Creek** *(Nutras Creek to Pauline Creek)*	Saguache	BLM
4	**Cochetopa Creek** (Increase to existing ISF right) *(Alkali Creek to Tomichi Creek)*	Saguache / Gunnison	BLM
4	**East Beaver Creek** *(headwaters to Beaver Creek)*	Saguache	BLM
5	**Colorado River** *(Eagle/Grand Co. Line to Eagle River)*	Eagle	Eagle County
5	**Colorado River** *(Blue River to Piney River)*	Grand / Eagle	CDOW
5	**Colorado River** *(Piney River to Eagle River)*	Grand / Eagle	CDOW
6	**Indian Creek** *(headwaters to confl headgate West Arapahoe Feeder Ditch 2)*	Jackson	BLM
6	**Wheeler Creek** *(Headwaters to South Fork Big Creek)*	Jackson	BLM
6	**West Prong South Fork Slater Creek** *(Headwaters to Decker Ditch)*	Moffat Routt	CDOW, TU
6	**Big Beaver Creek** (Increase to existing ISF right) *(Allen Creek to East Beaver Creek)*	Rio Blanco	BLM
6	**Grizzly Creek** *(Unnamed tributary to USFS Boundary)*	Routt	CDOW, TU
6	**Morrison Creek** *(Muddy Creek to Silver Creek)*	Routt	DOW, James Larson, Dequine Family L.L.C, Flying Diamond Resources
6	**Morrison Creek** *(Silver Creek to Yampa River)*	Routt	
6	**South Fork Slater Creek** *(Headwaters to West Prong South Fork Slater Creek)*	Routt	CDOW, TU

6	**South Fork Slater Creek** *(West Prong South Fork Slater Creek to confl Slater Creek)*	Routt	CDOW, TU
6	**West Prong South Fork Slater Creek** *(Decker Ditch to South Fork Slater Creek)*	Routt	CDOW, TU
7	**Animas River** *(Minnie Gulch to Cunningham Creek)*	San Juan	BLM
7	**Animas River** *(Cunningham Creek to Arrastra Creek)*	San Juan	BLM

* 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/2010ProposedAppropriations/

This is an informational item, with no Board action requested.

Exhibit 10

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 6, 2008

SUBJECT: **Agenda Item 21, March 17-18, 2009, Board Meeting**
Stream and Lake Protection Section – 2010 Instream Flow Appropriations

Summary

This memo provides the Board with notice of 54 new instream flow recommendations that will be processed by staff for possible inclusion into the Instream flow and Natural Lake Level Program in 2010.

Background

On February 24, 2009, Staff held its annual Instream Flow Workshop at the REI Flagship Store in Denver. The meeting was well attended by over 40 individuals including staff, five CWCB Basin Directors and representatives from the CDOW, BLM, Trout Unlimited, USFS, Huerfano County, Denver Water, Colorado Water District, Colorado Water Trust, City of Greeley, Western Resource Advocates, and others.

The 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 2010. Each entity was given an opportunity to provide specific information regarding the natural environment to be protected and to discuss why protection is 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 2010.

Below is the list of the streams that were discussed at the workshop and are being noticed for possible appropriation by the Board in January 2010. Information regarding these streams will be available for review on the Board's web site and will be periodically updated as new information becomes available. One can access the information by going to the Stream and

Lake Protection tab, followed by New Appropriations, Instream Flow Appropriation Notices, and then 2010 Proposed Appropriations.

Div	Stream Segment	County(ies)	Recommender(s)
1	Coal Creek *(Boulder County Open Space Boundary to Louisville Wastewater Treatment outfall)*	Boulder	City of Louisville, DOW
1	Coal Creek *(Louisville Wastewater Treatment outfall to Lafayette pumping station # 2)*	Boulder	City of Louisville, DOW
1	Black Hollow Creek *(headwaters to confl Poudre River)*	Larimer	TU
2	Baldwin Creek *(headwaters to Chalk Creek)*	Chaffee	CDOW
2	Gibson Creek *(headwaters to Verde Creek)*	Custer	CDOW
2	Middle Creek *(headwaters to Ophir Creek)*	Custer / Pueblo	CDOW
2	Middle Creek *(Ophir Creek to Beulah Water Works)*	Custer / Pueblo	CDOW
2	Beaver Creek *(Douglas Gulch to East Beaver Creek)*	Fremont	CDOW
2	Beaver Creek *(East Beaver Creek to Unnamed Tributary)*	Fremont	CDOW
2	East Beaver Creek *(Gould Creek to Beaver Creek)*	Fremont	CDOW
2	Baker Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Bonnett Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Chaparral Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
2	Dodgeton Creek *(headwaters to USFS Boundary)*	Huerfano	CDOW
3	Mill Creek *(USFS boundary to BLM boundary)*	Saguache	BLM
4	Big Dominguez Creek *(reaches pending Federal legislation)*	Delta	CDOW
4	Little Dominguez Creek *(reaches pending Federal legislation)*	Delta	CDOW
4	Blue Creek (Increase to existing ISF right) *(Little Blue Creek to Morrow Point Reservoir)*	Gunnison	BLM
4	South Willow Creek *(Sugar Creek to Blue Mesa Reservoir)*	Gunnison	BLM
4	Alpine Gulch *(headwaters to Henson Creek)*	Hinsdale	BLM
4	Spring Creek *(headgate Creede Trail Ditch to confl with Cebolla Creek)*	Hinsdale	BLM
4	Cebolla Creek *(Brush Creek to Spring Creek)*	Hinsdale / Gunnison	BLM
4	Cebolla Creek *(Spring Creek to USGS gage)*	Hinsdale / Gunnison	BLM
4	North Fork Tabaguache Creek *(headwaters to Tabaguache Creek)*	Montrose	USFS
4	Red Canyon Creek *(headwaters to Horsefly Creek)*	Montrose	USFS
4	San Miguel River	Montrose	CDOW, BLM

	(Calamity Draw to Dolores River)		
4	Tabeguache Creek *(unnamed trib to Forest Service Boundary)*	Montrose	USFS
4	Tabeguache Creek *(confl Fortyseven Creek to Templeton Ditch)*	Montrose	BLM
4	Tabeguache Creek *(Templeton Ditch to confl San Miguel River)*	Montrose	BLM
4	Cochetopa Creek *(Nutras Creek to Pauline Creek)*	Saguache	BLM
4	Cochetopa Creek (Increase to existing ISF right) *(Alkali Creek to Tomichi Creek)*	Saguache / Gunnison	BLM
4	East Beaver Creek *(headwaters to Beaver Creek)*	Saguache	BLM
5	Colorado River *(Eagle/Grand Co. Line to Eagle River)*	Eagle	Eagle County
5	Eagle River (Increase to existing ISF right) *(confl Cross Creek to confl Gore Creek)*	Eagle	CDOW
5	Colorado River *(Blue River to Piney River)*	Grand / Eagle	CDOW
5	Colorado River *(Piney River to Eagle River)*	Grand / Eagle	CDOW
6	Indian Creek *(headwaters to confl headgate West Arapahoe Feeder Ditch 2)*	Jackson	BLM
6	North Fork North Platte River *(Headwaters to headgate Little Nellie Ditch)*	Jackson	BLM
6	South Fork Big Creek *(confl Wheeler Creek to Colorado-Wyoming Border)*	Jackson	BLM
6	Wheeler Creek *(Headwaters to South Fork Big Creek)*	Jackson	BLM
6	West Prong South Fork Slater Creek *(Headwaters to Decker Ditch)*	Moffat Routt	CDOW, TU
6	Big Beaver Creek (Increase to existing ISF right) *(Allen Creek to East Beaver Creek)*	Rio Blanco	BLM
6	Moeller Creek *(headwaters to confl Fawn Creek)*	Rio Blanco	CDOW
6	Piceance Creek *(confl with Dry Fork to Confl with White River)*	Rio Blanco	CDOW, BLM
6	Yellow Creek *(Springs in NWNE S12, T1N R98W, 6PM to confl White R.)*	Rio Blanco	CDOW, BLM
6	Grizzly Creek *(Unnamed tributary to USFS Boundary)*	Routt	CDOW, TU
6	Morrison Creek *(Muddy Creek to Silver Creek)*	Routt	DOW
6	Morrison Creek *(Silver Creek to Yampa River)*	Routt	DOW
6	Morrison Creek *(Dequine Ditch Alt Pt 1 to Yampa River)*	Routt	James Larson, Dequine Family L.L.C, Flying Diamond Resources
6	South Fork Slater Creek *(Headwaters to West Prong South Fork Slater Creek)*	Routt	CDOW, TU
6	South Fork Slater Creek *(West Prong South Fork Slater Creek to confl Slater Creek)*	Routt	CDOW, TU
6	West Prong South Fork Slater Creek *(Decker Ditch to South Fork Slater Creek)*	Routt	CDOW, TU
7	Animas River *(Minnie Gulch to Cunningham Creek)*	San Juan	BLM
7	Animas River *(Cunningham Creek to Arrastra Creek)*	San Juan	BLM

* CDOW (Colorado Division of Wildlife), TU (Trout Unlimited) and BLM (Bureau of Land Management)

It should be noted that the above recommendations either were received at the February 2009 workshop, or were carryover recommendations from previous years.

Staff will process these 54 segments during the next year. Staff will review, obtain, and 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.

Viehl, Rob

From: rob.viehl@state.co.us
Sent: Wednesday, July 29, 2009 3:00 PM
To: Viehl, Rob
Subject: ISF Public Meeting
Attachments: ATT200413.dat

PUBLIC MEETING NOTICE

The Stream and Lake Protection Section of the Colorado Water Conservation Board is giving a presentation at the Routt County Commissioner meeting to discuss recommendations received for potential Division 6 Instream Flow appropriations in 2010. These streams include: Big Beaver Creek, Grizzly Creek, Indian Creek, Moeller Creek, Morrison Creek, North Fork North Platte River, Piceance Creek, South Fork Big Creek, South Fork Slater Creek, West Prong South Fork Slater Creek, Wheeler Creek, and Yellow Creek. The Stream and Lake Protection staff will provide a brief presentation on the ISF program as a background for discussion. For additional information on these segments, please visit the CWCB's website at: http://cwcb.state.co.us/StreamAndLake/NewAppropriations/ISFAppropriationNotices/2010ProposedAppropriations/2010Appropriations.htm

The meeting will take place at 11:00 a.m. on August 4th, 2009, and will be held in the Routt County Courthouse Commissioners' hearing room, 522 Lincoln Avenue on the 3rd floor, Steamboat Springs. Questions about new appropriations may be directed to Jeff Baessler at 303-866-3441 ext 3202 or Jeffrey.Baessler@state.co.us

Please access the CWCB/IBCC Insider on the CWCB or IBCC websites to manage your account, including changing your default password, editing your contact data, updating your registration to the various public subscription lists, and deleting your account.

If you believe that you received this email in error, or the content is not correct, please reply to this email with specifics.