Stream: Grizzly Creek

Executive Summary

Water Division: 6
Water District: 54
CDOW#: 20521
CWCB ID: 09/6/A-002

Segment: Confluence with Unnamed Tributary to USFS Boundary

Upper Terminus: CONFLUENCE WITH UNNAMED TRIBUTARY
(Latitude 40° 46' 55.8"N) (Longitude 107° 12' 54.6"W)

Lower Terminus: USFS BOUNDARY
(Latitude 40° 49' 58.6"N) (Longitude 107° 13' 45.3"W)

Watershed: Little Snake (HUC#: 14050003)
Counties: Routt
Length: 2.9 miles
USGS Quad(s): Bears Ears Peak
Flow Recommendation: 1.3 cfs (March 15 – July 15)
0.5 cfs (July 16 – March 14)

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 Trout Unlimited (TU) recommended this segment of Grizzly Creek to the CWCB for inclusion into the Instream Flow Program. Grizzly 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.

Grizzly Creek is approximately 5.6 miles long. Grizzly Creek originates on the northern flank of Bears Ears Peaks at the confluence of two unnamed tributaries at an elevation of 8,810 feet. Over the next 2.9 miles it flows generally northward through the Routt National Forest as it drops to the forest boundary an elevation of 8,125 feet. The land on the 2.9 mile segment addressed by this report is 100 % publicly owned. Grizzly Creek is located within Routt County and has a total drainage area of approximately 9.6 square miles.

The subject of this report is a segment of Grizzly Creek beginning at the confluence with Unnamed Tributary and extending downstream to the U.S. Forest Service Boundary. The proposed segment is located approximately 20 miles north of Hayden. Staff has received one joint recommendation for this segment, from the CDOW and TU. The recommendation for this segment is discussed below.

Instream Flow Recommendation

The CDOW & TU recommended 1.3 cfs (March 15 – July 15) and 0.5 cfs (July 16 – March 14) based on their data collection efforts and CWCB Staff's water availability analysis.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence with Unnamed Tributary	USFS Boundary	2.9	0%	100%

100% of the public lands are owned by the USFS.

Biological Data

In July and September of 2007, October 2008 and July 2009 TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of Colorado River cutthroat trout; however more recent information indicates that brook trout are the predominant fish species in Grizzly Creek.

Field Survey Data

TU and 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/TU	7/10/2007	0.20	0.5 – 0.1	?	0.25
CDOW/TU	9/5/2007	0.16	0.4 – 0.1	?	Outside of range
CDOW/TU	10/2/2008	0.47	1.2 - 0.2	Outside of range	0.7
CDOW/TU	7/8/2009	2.42	6.0 – 1.0	1.3	Outside of range

? = Criteria never met in R2CROSS Staging Table.

The summer flow recommendation which met 3 of 3 criteria is 1.3 cfs. The winter flow recommendation, which meets 2 or 3 criteria and is within the accuracy range of the R2Cross model is 0.5 cfs. This recommendation was derived by averaging the results of the two 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 **Grizzly Creek** no such gage is available at the LT. In fact, there is no gage on Grizzly Creek. It is thus necessary to describe the normal flow regime at Grizzly Creek above the LT through a "representative" gage station. The gage station selected for this purpose was NORTH FORK ELKHEAD CREEK NEAR ELKHEAD, CO. (USGS 09245500), a gage with a 15 year period of record (POR) collected between 1958 and 1974. The gage is at an elevation of 7,005 ft above mean sea level (amsl) and has a drainage area of 21.0 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive use of upstream diversions. However, the existence of these diversions is not a major limitation upon the use of the data from the gage. To make the measured data transferable to Grizzly Creek above the LT, the consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Grizzly Creek above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Grizzly Creek above the LT (9.61 mi^2) to N Fk Elkhead Creek near Elkhead CO (21.0 mi^2). In

this instance, due to the absence of existing significant upstream consumptive irrigation uses or transbasin diversions on Grizzly Creek above the LT, the resulting proportioned "adjusted" hydrograph was not further "adjusted" (decreased). Nevertheless, the final hydrograph represents the existing distribution of flow over time.

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

The next step in producing a representation of the discharge at Grizzly Creek above the LT was to compute the Geometric Mean of the area-prorated data values from the N Fk Elkhead Creek near Elkhead 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. In this particular case, the short period of record lends even greater merit to the use of this statistical tool. 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

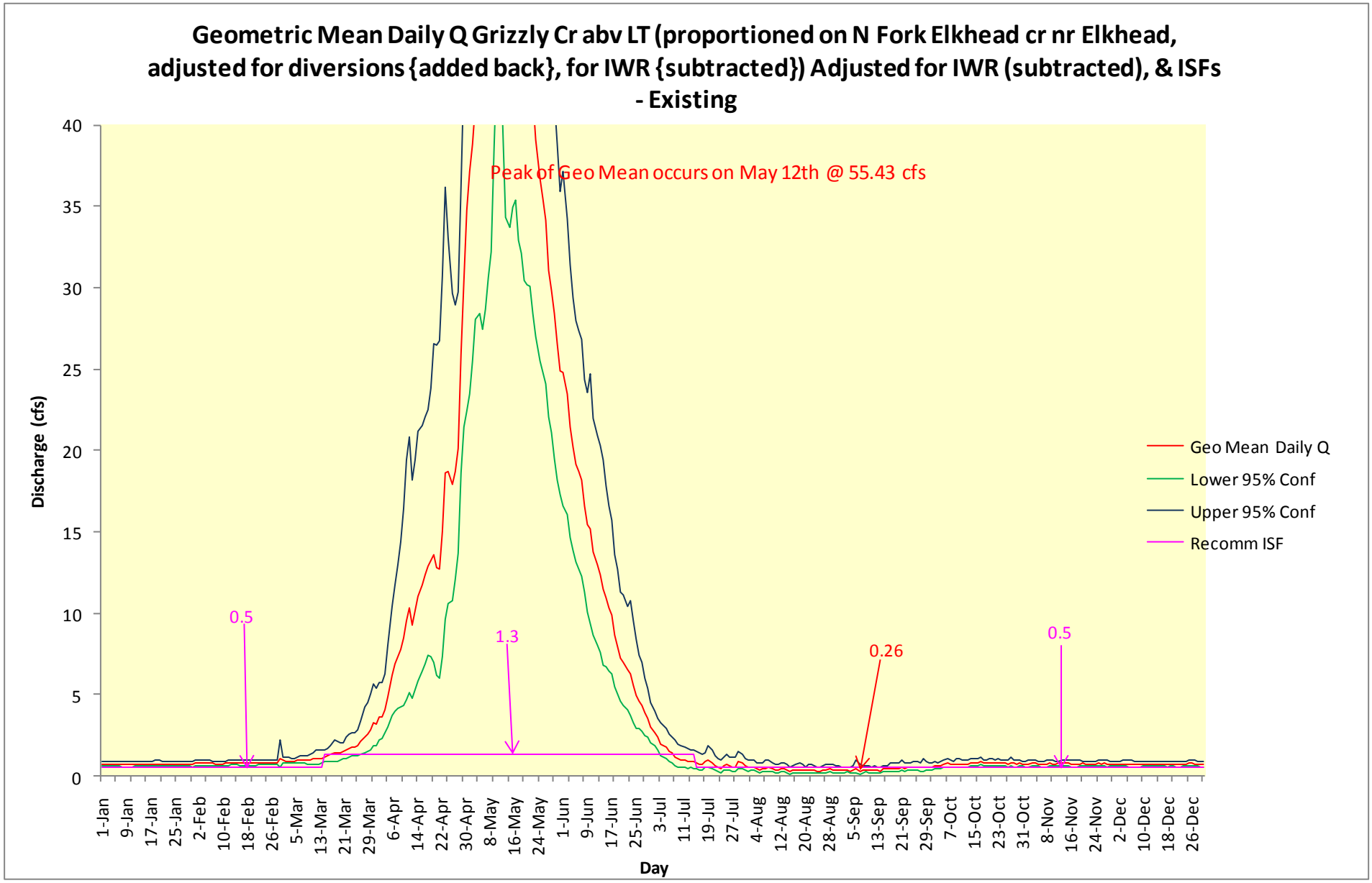

Geometric Mean Daily Q Grizzly Cr abv LT (proportioned on N Fork Elkhead cr nr Elkhead, adjusted for diversions {added back}, for IWR {subtracted}) Adjusted for IWR (subtracted), & ISFs - Existing
Peak of Geo Mean occurs on May 12th @ 55.43 cfs
Discharge (cfs)
Day
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISF
0.5
1.3
0.26
0.5

Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing ISF	Recommended ISF	Proportioned Adjusted GM (abv gage) Adj (-) for Irr & OoB in Grizzly Cr abv LT
1-Jan		0.50	0.72
2-Jan		0.50	0.73
3-Jan		0.50	0.71
4-Jan		0.50	0.72
5-Jan		0.50	0.71
6-Jan		0.50	0.73
7-Jan		0.50	0.73
8-Jan		0.50	0.71
9-Jan		0.50	0.70
10-Jan		0.50	0.70
11-Jan		0.50	0.73
12-Jan		0.50	0.74
13-Jan		0.50	0.75
14-Jan		0.50	0.75
15-Jan		0.50	0.75
16-Jan		0.50	0.75
17-Jan		0.50	0.74
18-Jan		0.50	0.75
19-Jan		0.50	0.75
20-Jan		0.50	0.76
21-Jan		0.50	0.75
22-Jan		0.50	0.75
23-Jan		0.50	0.75
24-Jan		0.50	0.74
25-Jan		0.50	0.75
26-Jan		0.50	0.76
27-Jan		0.50	0.76
28-Jan		0.50	0.76
29-Jan		0.50	0.75
30-Jan		0.50	0.74
31-Jan		0.50	0.73
1-Feb		0.50	0.78
2-Feb		0.50	0.79
3-Feb		0.50	0.80
4-Feb		0.50	0.81
5-Feb		0.50	0.81
6-Feb		0.50	0.79
7-Feb		0.50	0.77
8-Feb		0.50	0.76
9-Feb		0.50	0.75
10-Feb		0.50	0.76

11-Feb	0.50	0.78
12-Feb	0.50	0.79
13-Feb	0.50	0.81
14-Feb	0.50	0.83
15-Feb	0.50	0.82
16-Feb	0.50	0.81
17-Feb	0.50	0.80
18-Feb	0.50	0.80
19-Feb	0.50	0.80
20-Feb	0.50	0.80
21-Feb	0.50	0.81
22-Feb	0.50	0.81
23-Feb	0.50	0.80
24-Feb	0.50	0.80
25-Feb	0.50	0.81
26-Feb	0.50	0.82
27-Feb	0.50	0.83
28-Feb	0.50	0.85
29-Feb	0.50	1.06
1-Mar	0.50	0.95
2-Mar	0.50	0.93
3-Mar	0.50	0.93
4-Mar	0.50	0.93
5-Mar	0.50	0.93
6-Mar	0.50	0.94
7-Mar	0.50	0.97
8-Mar	0.50	0.99
9-Mar	0.50	0.98
10-Mar	0.50	1.00
11-Mar	0.50	1.04
12-Mar	0.50	1.07
13-Mar	0.50	1.10
14-Mar	0.50	1.11
15-Mar	1.3	1.18
16-Mar	1.3	1.23
17-Mar	1.3	1.32
18-Mar	1.3	1.42
19-Mar	1.3	1.39
20-Mar	1.3	1.42
21-Mar	1.3	1.47
22-Mar	1.3	1.61
23-Mar	1.3	1.73
24-Mar	1.3	1.82
25-Mar	1.3	1.81
26-Mar	1.3	1.88
27-Mar	1.3	2.12
28-Mar	1.3	2.43
29-Mar	1.3	2.60
30-Mar	1.3	2.87

31-Mar	1.3	3.28
1-Apr	1.3	3.19
2-Apr	1.3	3.60
3-Apr	1.3	3.67
4-Apr	1.3	4.05
5-Apr	1.3	4.88
6-Apr	1.3	6.22
7-Apr	1.3	6.87
8-Apr	1.3	7.36
9-Apr	1.3	7.82
10-Apr	1.3	8.47
11-Apr	1.3	9.58
12-Apr	1.3	10.31
13-Apr	1.3	9.31
14-Apr	1.3	10.12
15-Apr	1.3	11.07
16-Apr	1.3	11.76
17-Apr	1.3	12.35
18-Apr	1.3	12.93
19-Apr	1.3	13.25
20-Apr	1.3	13.61
21-Apr	1.3	12.83
22-Apr	1.3	12.70
23-Apr	1.3	14.97
24-Apr	1.3	18.67
25-Apr	1.3	18.71
26-Apr	1.3	17.88
27-Apr	1.3	18.69
28-Apr	1.3	20.16
29-Apr	1.3	25.97
30-Apr	1.3	30.46
1-May	1.3	34.72
2-May	1.3	37.12
3-May	1.3	38.86
4-May	1.3	41.31
5-May	1.3	41.20
6-May	1.3	41.51
7-May	1.3	40.32
8-May	1.3	41.50
9-May	1.3	43.92
10-May	1.3	49.06
11-May	1.3	54.47
12-May	1.3	55.43
13-May	1.3	52.10
14-May	1.3	46.24
15-May	1.3	45.39
16-May	1.3	47.83
17-May	1.3	50.12
18-May	1.3	48.50

19-May	1.3	48.73
20-May	1.3	46.15
21-May	1.3	47.00
22-May	1.3	45.15
23-May	1.3	41.74
24-May	1.3	39.07
25-May	1.3	36.73
26-May	1.3	35.49
27-May	1.3	34.17
28-May	1.3	31.10
29-May	1.3	29.87
30-May	1.3	28.45
31-May	1.3	26.55
1-Jun	1.3	24.89
2-Jun	1.3	24.81
3-Jun	1.3	23.46
4-Jun	1.3	21.44
5-Jun	1.3	20.18
6-Jun	1.3	19.19
7-Jun	1.3	18.67
8-Jun	1.3	18.17
9-Jun	1.3	16.62
10-Jun	1.3	15.43
11-Jun	1.3	15.18
12-Jun	1.3	13.78
13-Jun	1.3	12.95
14-Jun	1.3	12.39
15-Jun	1.3	11.47
16-Jun	1.3	10.97
17-Jun	1.3	10.31
18-Jun	1.3	9.93
19-Jun	1.3	8.63
20-Jun	1.3	7.99
21-Jun	1.3	7.22
22-Jun	1.3	6.96
23-Jun	1.3	6.51
24-Jun	1.3	6.28
25-Jun	1.3	5.59
26-Jun	1.3	4.97
27-Jun	1.3	4.64
28-Jun	1.3	4.37
29-Jun	1.3	3.86
30-Jun	1.3	3.57
1-Jul	1.3	3.03
2-Jul	1.3	2.70
3-Jul	1.3	2.38
4-Jul	1.3	1.99
5-Jul	1.3	1.91
6-Jul	1.3	1.74

7-Jul	1.3	1.52
8-Jul	1.3	1.38
9-Jul	1.3	1.17
10-Jul	1.3	1.07
11-Jul	1.3	0.99
12-Jul	1.3	0.97
13-Jul	1.3	0.88
14-Jul	1.3	0.92
15-Jul	1.3	0.88
16-Jul	0.50	0.84
17-Jul	0.50	0.75
18-Jul	0.50	0.69
19-Jul	0.50	0.88
20-Jul	0.50	1.01
21-Jul	0.50	0.81
22-Jul	0.50	0.66
23-Jul	0.50	0.51
24-Jul	0.50	0.46
25-Jul	0.50	0.64
26-Jul	0.50	0.69
27-Jul	0.50	0.63
28-Jul	0.50	0.56
29-Jul	0.50	0.53
30-Jul	0.50	0.86
31-Jul	0.50	0.78
1-Aug	0.50	0.62
2-Aug	0.50	0.55
3-Aug	0.50	0.57
4-Aug	0.50	0.58
5-Aug	0.50	0.45
6-Aug	0.50	0.37
7-Aug	0.50	0.46
8-Aug	0.50	0.47
9-Aug	0.50	0.52
10-Aug	0.50	0.46
11-Aug	0.50	0.39
12-Aug	0.50	0.40
13-Aug	0.50	0.47
14-Aug	0.50	0.45
15-Aug	0.50	0.37
16-Aug	0.50	0.26
17-Aug	0.50	0.34
18-Aug	0.50	0.37
19-Aug	0.50	0.34
20-Aug	0.50	0.38
21-Aug	0.50	0.32
22-Aug	0.50	0.35
23-Aug	0.50	0.36
24-Aug	0.50	0.36

25-Aug	0.50	0.30
26-Aug	0.50	0.29
27-Aug	0.50	0.38
28-Aug	0.50	0.37
29-Aug	0.50	0.43
30-Aug	0.50	0.39
31-Aug	0.50	0.37
1-Sep	0.50	0.38
2-Sep	0.50	0.34
3-Sep	0.50	0.36
4-Sep	0.50	0.37
5-Sep	0.50	0.31
6-Sep	0.50	0.38
7-Sep	0.50	0.42
8-Sep	0.50	0.26
9-Sep	0.50	0.37
10-Sep	0.50	0.40
11-Sep	0.50	0.34
12-Sep	0.50	0.33
13-Sep	0.50	0.34
14-Sep	0.50	0.34
15-Sep	0.50	0.32
16-Sep	0.50	0.44
17-Sep	0.50	0.43
18-Sep	0.50	0.49
19-Sep	0.50	0.49
20-Sep	0.50	0.45
21-Sep	0.50	0.48
22-Sep	0.50	0.57
23-Sep	0.50	0.49
24-Sep	0.50	0.51
25-Sep	0.50	0.54
26-Sep	0.50	0.57
27-Sep	0.50	0.58
28-Sep	0.50	0.51
29-Sep	0.50	0.58
30-Sep	0.50	0.57
1-Oct	0.50	0.54
2-Oct	0.50	0.55
3-Oct	0.50	0.61
4-Oct	0.50	0.60
5-Oct	0.50	0.65
6-Oct	0.50	0.73
7-Oct	0.50	0.78
8-Oct	0.50	0.74
9-Oct	0.50	0.70
10-Oct	0.50	0.75
11-Oct	0.50	0.75
12-Oct	0.50	0.74

13-Oct	0.50	0.75
14-Oct	0.50	0.76
15-Oct	0.50	0.79
16-Oct	0.50	0.79
17-Oct	0.50	0.84
18-Oct	0.50	0.87
19-Oct	0.50	0.81
20-Oct	0.50	0.80
21-Oct	0.50	0.83
22-Oct	0.50	0.79
23-Oct	0.50	0.79
24-Oct	0.50	0.82
25-Oct	0.50	0.80
26-Oct	0.50	0.79
27-Oct	0.50	0.74
28-Oct	0.50	0.84
29-Oct	0.50	0.77
30-Oct	0.50	0.76
31-Oct	0.50	0.78
1-Nov	0.50	0.75
2-Nov	0.50	0.73
3-Nov	0.50	0.76
4-Nov	0.50	0.77
5-Nov	0.50	0.77
6-Nov	0.50	0.72
7-Nov	0.50	0.70
8-Nov	0.50	0.71
9-Nov	0.50	0.74
10-Nov	0.50	0.77
11-Nov	0.50	0.76
12-Nov	0.50	0.76
13-Nov	0.50	0.77
14-Nov	0.50	0.79
15-Nov	0.50	0.79
16-Nov	0.50	0.80
17-Nov	0.50	0.75
18-Nov	0.50	0.75
19-Nov	0.50	0.75
20-Nov	0.50	0.76
21-Nov	0.50	0.77
22-Nov	0.50	0.76
23-Nov	0.50	0.74
24-Nov	0.50	0.74
25-Nov	0.50	0.75
26-Nov	0.50	0.77
27-Nov	0.50	0.76
28-Nov	0.50	0.77
29-Nov	0.50	0.75
30-Nov	0.50	0.74

1-Dec	0.50	0.74
2-Dec	0.50	0.74
3-Dec	0.50	0.75
4-Dec	0.50	0.76
5-Dec	0.50	0.76
6-Dec	0.50	0.74
7-Dec	0.50	0.73
8-Dec	0.50	0.70
9-Dec	0.50	0.68
10-Dec	0.50	0.69
11-Dec	0.50	0.72
12-Dec	0.50	0.73
13-Dec	0.50	0.71
14-Dec	0.50	0.73
15-Dec	0.50	0.73
16-Dec	0.50	0.73
17-Dec	0.50	0.72
18-Dec	0.50	0.73
19-Dec	0.50	0.73
20-Dec	0.50	0.75
21-Dec	0.50	0.74
22-Dec	0.50	0.71
23-Dec	0.50	0.71
24-Dec	0.50	0.73
25-Dec	0.50	0.75
26-Dec	0.50	0.77
27-Dec	0.50	0.77
28-Dec	0.50	0.76
29-Dec	0.50	0.73
30-Dec	0.50	0.72
31-Dec	0.50	0.72

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 no decreed surface diversions within this reach of stream. Staff has determined that water is available for appropriation on Grizzly Creek, between the confluence with an unnamed tributary to the USFS boundary, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation

Staff recommends the Board form its intent to appropriate on the following stream reach:

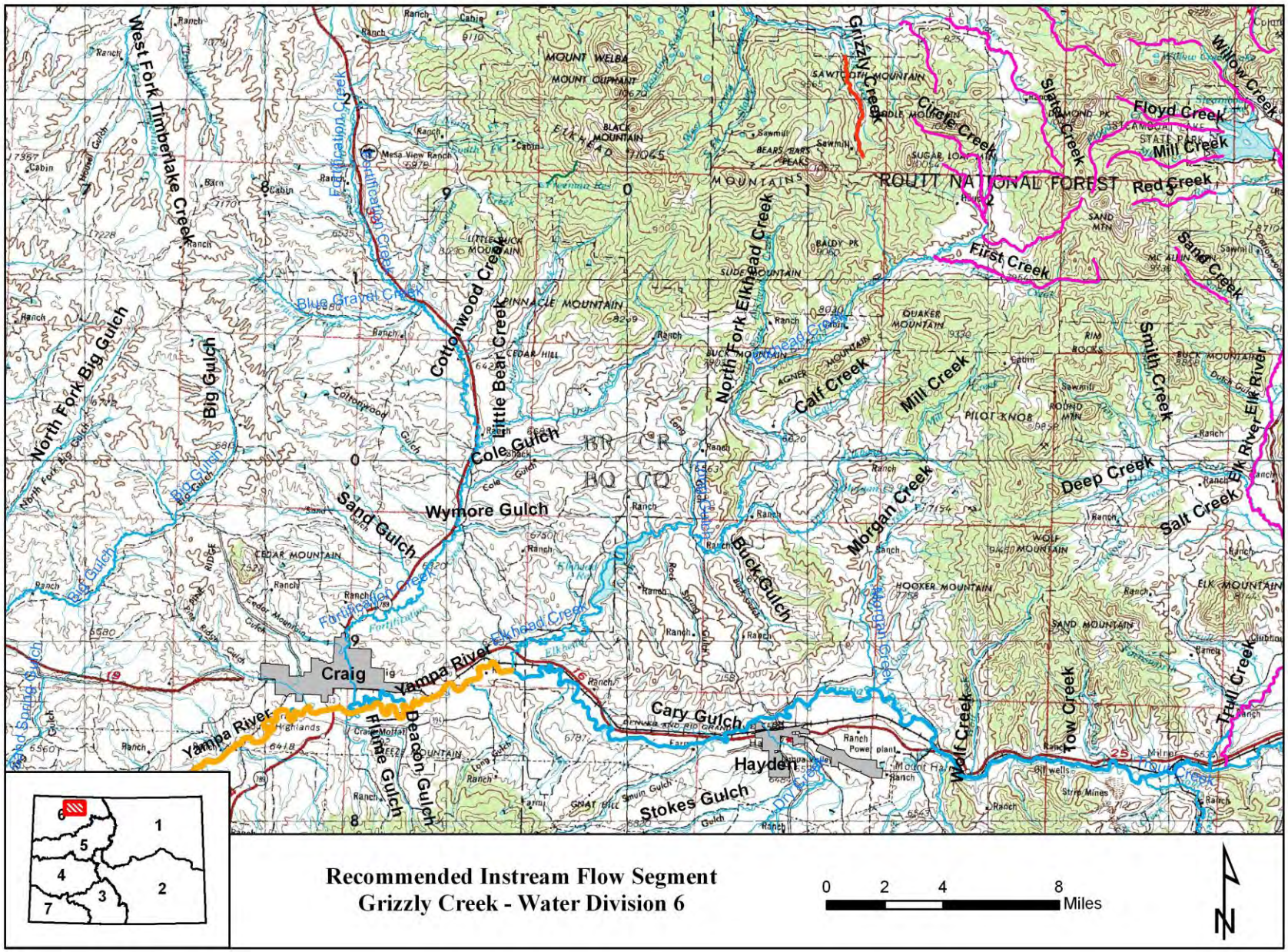
Segment: Confluence with Unnamed Tributary to USFS Boundary

Upper Terminus: CONFLUENCE WITH UNNAMED TRIBUTARY
(Latitude 40° 46' 55.8"N) (Longitude 107° 12' 54.6"W)
UTM North: 4516936.0 UTM East: 313082.1
NE SW S36 T10N R88W 6PM
1450' East of the West Section Line; 2230' North of the South Section Line

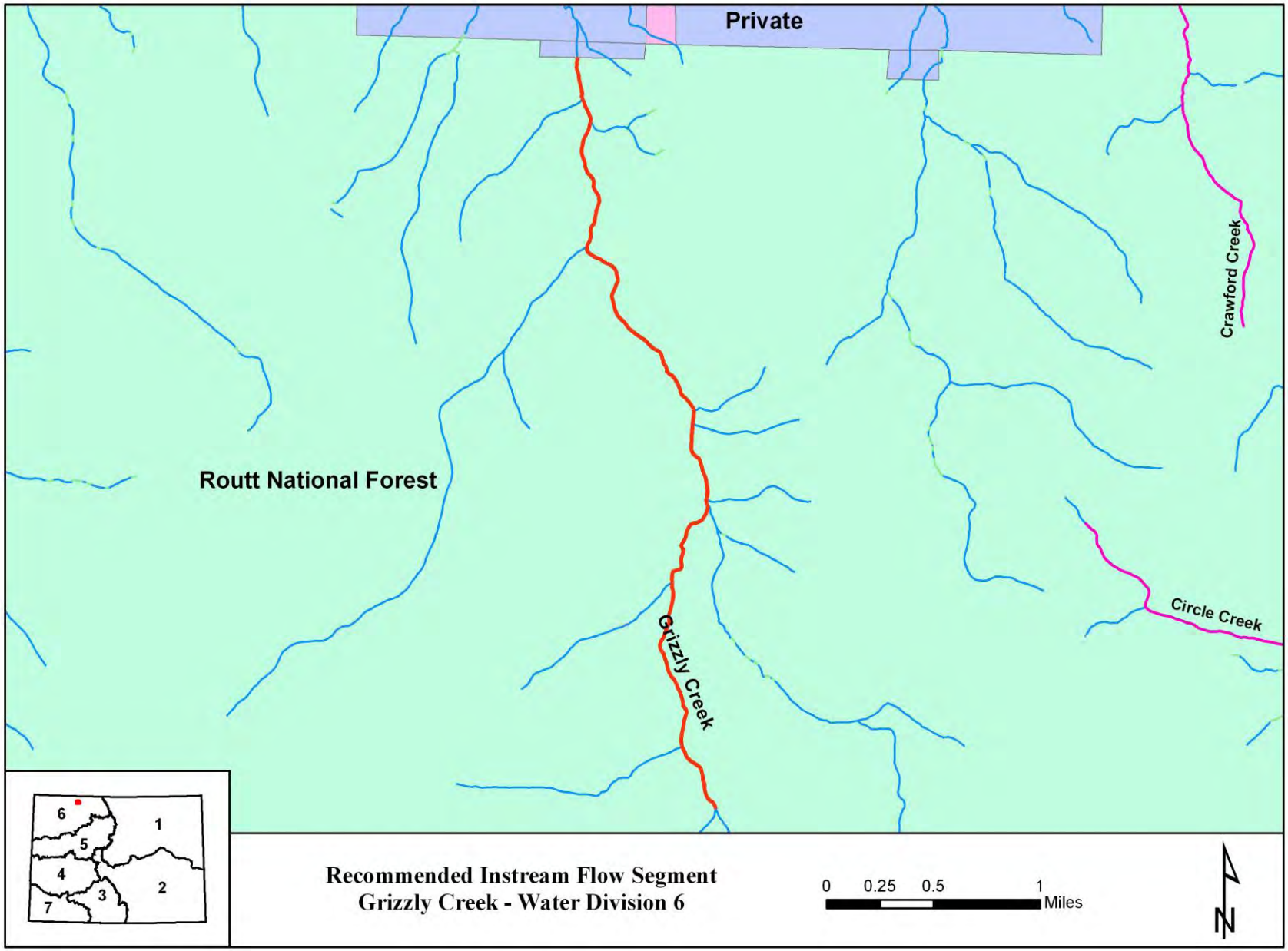
Lower Terminus: USFS BOUNDARY
(Latitude 40° 49' 58.6"N) (Longitude 107° 13' 45.29"W)
UTM North: 4522603.56 UTM East: 312037.24
NW NE S14 T10N R88W 6PM
2390' West of the East Section Line; 415'South of the North Section Line

Watershed: Little Snake (HUC#: 14050003)
Counties: Routt
Length: 2.9 miles
USGS Quad(s): Bears Ears Peak
Flow Recommendation: 1.3 cfs (March 15 – July 15)
0.5 cfs (July 16 – March 14)

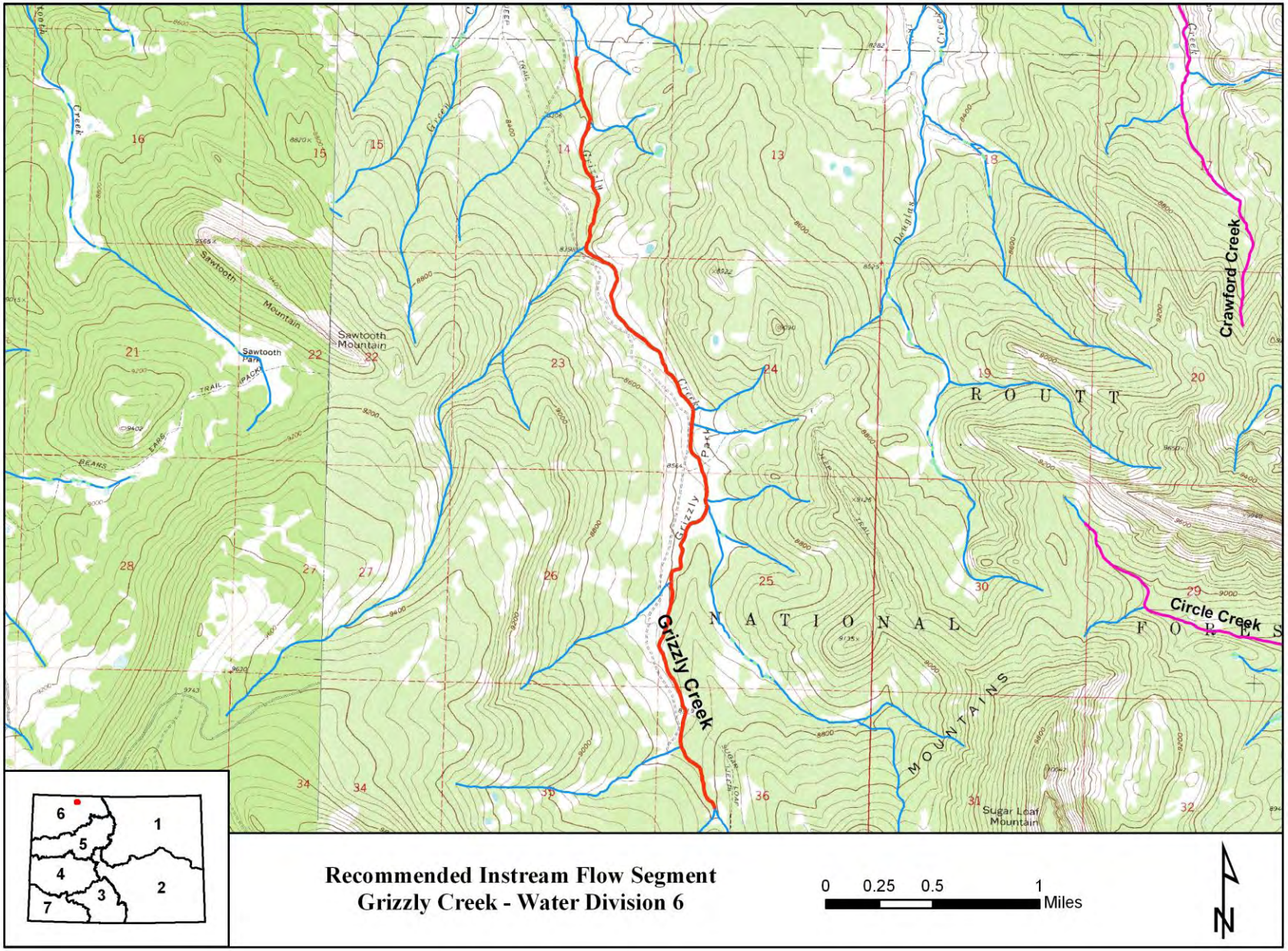
Vicinity Map



Land Use Map


Private
Routt National Forest
Crawford Creek
Circle Creek
Grizzly Creek
6
1
5
4
2
3
7
Recommended Instream Flow Segment
Grizzly Creek - Water Division 6
0 0.25 0.5 1
Miles
N

Topographic & Water Rights Map



Greg Espegren
Aquatics Specialist
Colorado Water Project
1320 Pearl Street, Suite 320
Boulder, CO 80302
303.440.2937

January 4, 2010

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

Dear Ms. Bassi and Mr. Baessler,

Trout Unlimited (TU) in conjunction with the Colorado Division of Wildlife (CDOW) is submitting this instream flow recommendation for Grizzly Creek, located in Routt County, Water Division 6.

Location and Land Status. Grizzly Creek originates on the northern flank of Bears Ears Peaks at the confluence of two unnamed tributaries at an elevation of 8810 feet. Over the next 2.9 miles it flows generally northward through the Routt National Forest as it drops to the forest boundary an elevation of 8125 feet. The proposed ISF reach covers this entire 2.9 mile segment and is located entirely on Forest Service Land (Fig. 1).

Biological Summary and R2CROSS Analysis. In July and September of 2007, October 2008, and July 2009, TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs (see Table 1). Previous survey data collected by CDOW indicated the stream supports healthy populations of Colorado River cutthroat trout however more recent information indicates that brook trout are the predominant fish species in Grizzly Creek.

Table 1. Summary of R2CROSS datasets

DATE	MEASURED FLOW (cfs)	MODELING RANGE (cfs)	FLOW MEETING 3 CRITERIA	FLOW MEETING 2 CRITERIA
07/10/07	0.20	0.5 - 0.1	*Not met in table*	**0.25**
09/05/07	0.15	0.4 - 0.1	*Not met in table*	*0.45*
10/02/08	0.47	1.2 - 0.2	*2.10*	**0.70**
07/08/09	2.42	6.0 - 1.0	**1.30**	*0.85*
Average of flows within modeling range			**1.30**	**0.50**

Note: Table entries appearing in italicized font indicated flows that were either not met in R2CROSS staging table or outside of 0.4 to 2.5 times measured flow R2CROSS modeling window.

Stream cross sectional data were analyzed using the R2CROSS program, and the output was evaluated using the methods described in Nehring (1979) and Espegren (1996). The R2CROSS models how average depth, percent wetted perimeter and average velocity vary with discharge. According to the criteria established by Nehring (1979), the relevant minimum requirements are an average depth of 0.2 feet, a wetted perimeter of 50%, and an average velocity of 1.0 ft/sec. Protecting salmonids during the summer season is accomplished by insuring all three criteria are met while during the winter protection can be accomplished by protecting 2 of three criteria. Thus, the fishery of Grizzly Creek can be protected with minimum summer flows of 1.3 cfs and minimum winter flows of 0.50 cfs. TU and CDOW recommend that the CWCB appropriate the following flow amounts to preserve the natural environment of Grizzly Creek to a reasonable degree:

- From **March 15 through July 15** a flow appropriation of **1.30 cfs** is recommended to maintain the three principal criteria of average depth, average velocity, and percent wetted perimeter;

- From **July 16 through March 14** a flow appropriation of **0.50 cfs** is recommended to maintain the average depth and wetter perimeter criteria.

Water Availability. The preliminary instream flow recommendation we submitted in February 2008 was based on an aerial apportionment of USGS gage 09245500 on the North Fork of Elkhead Creek, CO. Subsequent to that preliminary analysis, the CWCB provided us with a geometric mean analysis of daily flows on Grizzly Creek. We used the CWCB's water availability analysis to adjust the seasonality and quantities of the instream flow recommendation so that the estimated daily flow through Grizzly Creek typically exceeds the recommended instream flow. These seasonal adjustments are reflected in the final instream flow recommendation above.

Relationship to Existing State Policy. TU and the CDOW are forwarding this stream flow recommendation to the CWCB to meet the State of Colorado's policy "that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities." C.R.S. 33-1-101(1). Further, the CDOW Strategic Plan states "Healthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The Division desires to protect and enhance the quality and quantity of aquatic habitats." TU and CDOW recommend that Grizzly Creek be considered for inclusion in the Instream Flow Program because doing so would help meet these stated policies. Specifically, establishing minimum flows through this reach would preserve the natural environment of the stream to a reasonable degree.

Attached, please find 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 feel free to contact me at (303) 440-2937.

Trout Unlimited thanks the Colorado Division of Wildlife and the Colorado Water Conservation Board Staff for their support in preparing this recommendation.

Sincerely,

Greg Espegren
Trout Unlimited
Aquatic Specialist

Cc: Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
Mark Uppendahl, CDOW Instream Flow Program Coordinator

STATE OF COLORADO

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

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

For Wildlife-
For People

January 9, 2009

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

Re: Colorado Division of Wildlife Instream Flow Recommendations for Grizzly Creek.

Dear Linda,

The purpose of this letter is to formally transmit the Colorado Division of Wildlife's (CDOW) Instream Flow Recommendations for Grizzly Creek. The CDOW, in conjunction with Trout Unlimited (TU), has collected data, including stream cross section information and natural environment data, needed to quantify the instream flow requirements for this reach of Grizzly Creek. CDOW & TU have conducted a preliminary evaluation of the stream hydrology to determine if water is physically available for an instream flow appropriation. Grizzly 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.

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

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

This stream reach is important to the CDOW because it supports a healthy naturally reproducing population of brook trout (Salvelinus fontinalis). The information contained in the attached report forms the basis for the instream flow recommendation to be considered by the Board. It is the CDOW staff's opinion that the information is sufficient for the Board to begin the findings required in Rule 5 (i) of the Instream Flow Rules.

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

Sincerely,

Mark Uppendahl
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 Fish Biologist – w/o attachments
Boyd Wright, CDOW Aquatic Biologist – w/o attachments
Bill De Verge, CDOW AWM Area 6 – w/o attachments
Greg Espegren, Trout Unlimited

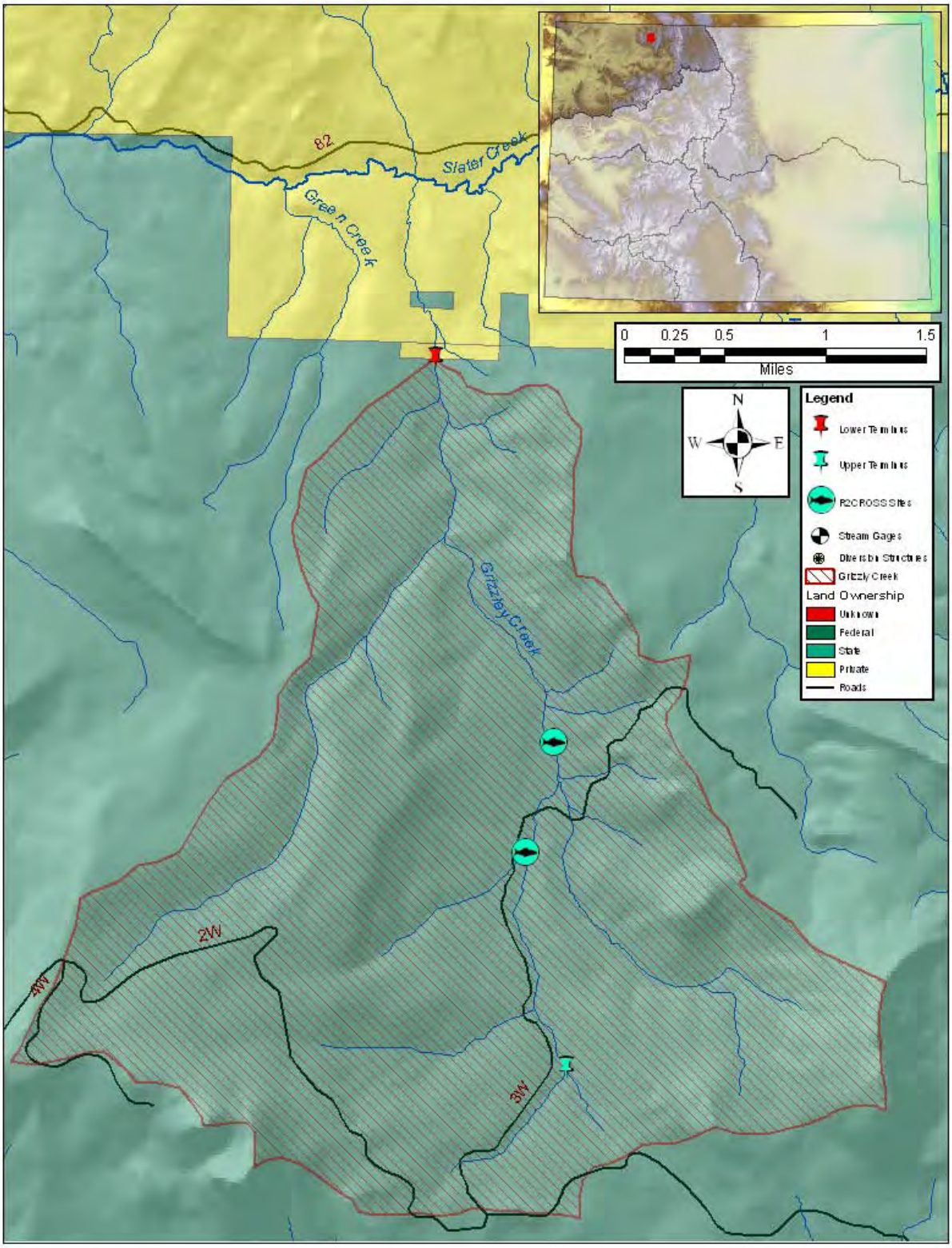


Figure 1. Map of Grizzly Creek watershed. Positions of upper and lower termini of the proposed instream flow reach are noted as is the location of the R2CROSS cross section. Additionally, locations known diversion structures are plotted. The watershed's location within Division 6 is indicated by the red box on the inset map of Colorado.

Greg Espegren
Aquatics Specialist
Colorado Water Project
1320 Pearl Street, Suite 320
Boulder, CO 80302
303.440.2937

January 5, 2009

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

Dear Ms. Bassi and Mr. Baessler,

Trout Unlimited (TU) in conjunction with the Colorado Division of Wildlife (CDOW) is submitting this instream flow recommendation for Grizzly Creek, located in Routt County, Water Division 6.

Location and Land Status. Grizzly Creek originates on the northern flank of Bears Ears Peaks at the confluence of two unnamed tributaries at an elevation of 8810 feet. Over the next 2.9 miles it flows generally northward through the Routt National Forest as it drops to the forest boundary an elevation of 8125 feet. The proposed ISF reach covers this entire 2.9 mile segment and is located entirely on Forest Service Land (Fig. 1).

Biological Summary and R2CROSS Analysis. In July and September of 2007 and October of 2008, TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of Colorado River cutthroat trout however more recent information indicates that brook trout are the predominant fish species in Grizzly Creek.

Stream cross sectional data were analyzed using the R2CROSS program, and the output was evaluated using the methods described in Nehring (1979) and Espegren (1996). The R2CROSS models how average depth, percent wetted perimeter and average velocity vary with discharge. According to the criteria established by Nehring (1979), the relevant minimum requirements are an average depth of 0.2 feet, a wetted perimeter of 50%, and an average velocity of 1.0 ft/sec. Our initial surveys indicate that, on average, 2 of 3 criteria can be protected with an ISF right of 0.35 cfs. Streamflows during the summer of 2007 and fall of 2008 were extremely low and consequently our estimates of the discharge necessary to protect 3 of 3 criteria were out of range.

Therefore, based on the best available scientific data, TU and CDOW recommend that the CWCB appropriate the following flow amount to preserve the natural environment of Buzzard Creek to a reasonable degree:

- From **Jan 1 through Dec 31** a flow appropriation of **0.35 cfs** is recommended to maintain an average depth of 0.2 ft and 50% percent wetted perimeter;

Attached in Appendix A, please find copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. The modeling results for the 2 of 3 criteria from this survey effort are within the confidence interval produced by the R2CROSS model. Since the 3 of 3 criteria modeling result from this survey effort was not within the confidence interval produced by the R2CROSS model, TU and CDOW may collect additional field data in the future in support of a summertime flow enlargement . If you have any questions regarding the attached information or the instream flow recommendations, please feel free to contact me at (303) 440-2937.

Relationship to Existing State Policy. TU and the CDOW are forwarding this stream flow recommendation to the CWCB to meet the State of Colorado's policy "that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities." C.R.S. 33-1-101(1). Further, the CDOW Strategic Plan states "Healthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The Division desires to protect and enhance the quality and quantity of aquatic habitats." TU and CDOW recommend that Grizzly Creek be considered for inclusion in the Instream Flow Program because doing so would help meet these stated policies. Specifically, establishing minimum flows through this reach would preserve the natural environment of the stream to a reasonable degree.

TU believes that the information provided to the Board is the best scientific data available and that it forms the basis for the Board to make its statutory findings pursuant to C.R.S. 37-92-102(3)(c). Therefore, we recommend that the CWCB make the required findings and appropriate the above-referenced instream flow amount on Grizzly Creek. TU thanks the CDOW and CWCB staffs for their support in preparing this recommendation.

Sincerely,

Greg Espegren
Trout Unlimited
Aquatic Specialist

Cc: Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
Mark Uppendahl, CDOW Instream Flow Program Coordinator

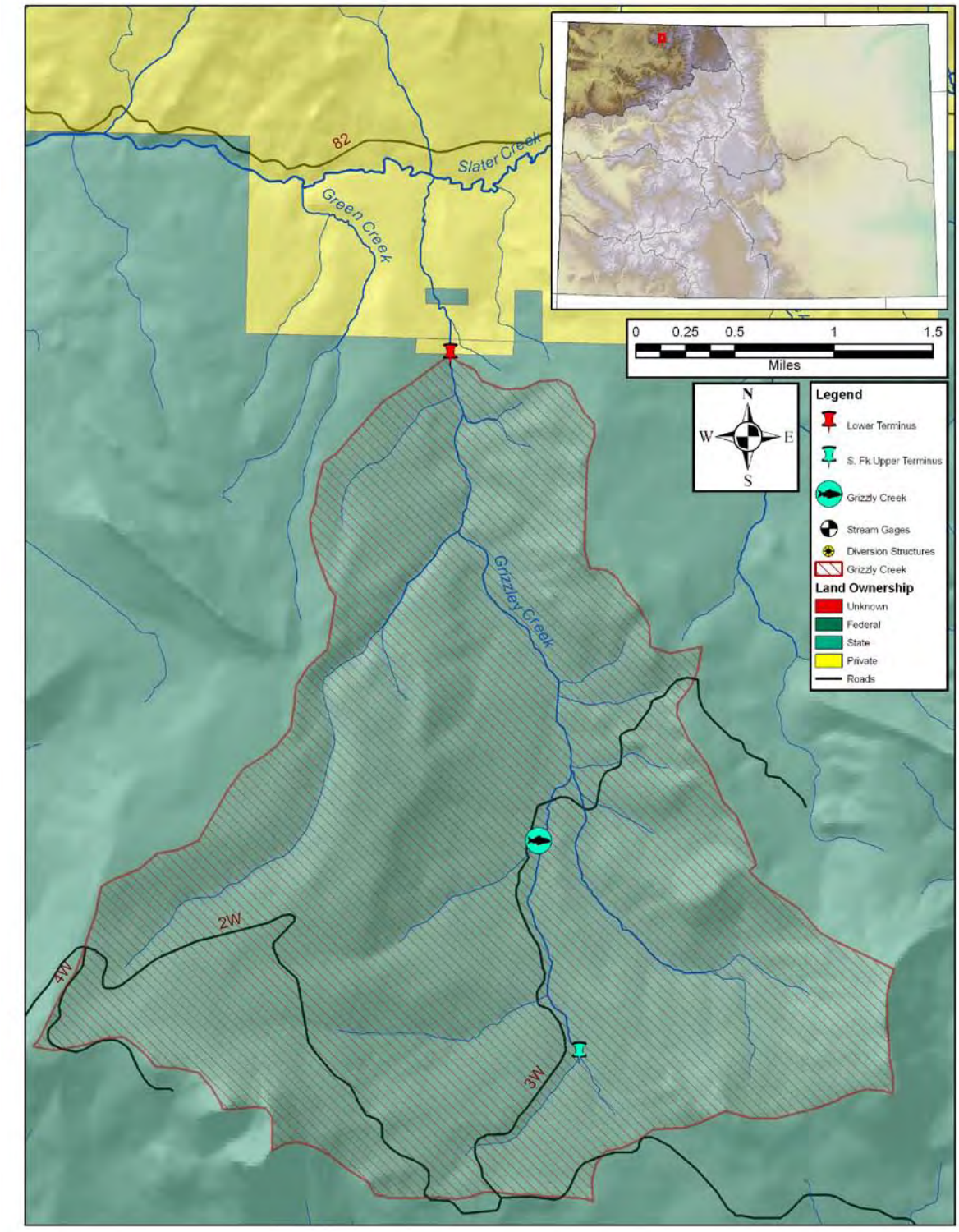


Figure 1. Map of Grizzly Creek watershed. Positions of upper and lower termini of the proposed instream flow reach are noted as is the location of the R2CROSS cross section. Additionally, locations known diversion structures are plotted. The watershed's location within Division 6 is indicated by the red box on the inset map of Colorado.

John Roach, Ph.D.
Aquatics Specialist
Colorado Water Project
1320 Pearl Street, Suite 320
Boulder, CO 80302
303.440.2937

February 13, 2008

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

Dear Ms. Bassi and Mr. Baessler,

Trout Unlimited in conjunction with the Colorado Division of Wildlife (CDOW) is submitting this instream flow recommendation for Grizzly Creek, located in Routt County, District 6.

Location and Land Status. Grizzly Creek originates on the northern flank of Bears Ears Peaks at the confluence of two unnamed tributaries at an elevation of 8810 feet. Over the next 2.9 miles it flows generally northward through the Routt National Forest as it drops to the forest boundary an elevation of 8125 feet. The proposed ISF reach covers this entire 2.9 mile segment and is located entirely on Forest Service Land (Fig. 1).

Biological Summary and R2CROSS Analysis. In July and September of 2007 TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of Colorado River cutthroat trout.

Stream cross sectional data were analyzed using the R2CROSS program, and the output was evaluated using the methods described in Nehring (1979) and Espegren (1996). The R2CROSS models how average depth, percent wetted perimeter and average velocity vary with discharge. According to the criteria established by Nehring (1979), the relevant minimum requirements are an average depth of 0.2 feet, a wetted perimeter of 50%, and an average velocity of 1.0 ft/sec. Our initial survey indicates that, on average, 2 of 3 criteria (i.e., average depth and wetted perimeter) can be protected with a ISF right of 0.25 cfs. The estimate of the flow required to protect 2 of 3 criteria by the second survey was out of range and was not used in developing our ISF request. Unfortunately, because flows were so low during the summer of 2007, we are unable to model the discharge necessary to ensure an average velocity of 1.0 ft/s with the existing data. Therefore, Trout Unlimited and CDOW are planning to return to Grizzly Creek during the summer of 2008 to collect additional data. Based on the results of that sampling effort, we will adjust our ISF recommendation.

In the mean time, Trout Unlimited and CDOW recommend that the CWCB begin procedures to appropriate a year-round ISF right of 0.25 cfs, adjusted for water availability. Because current estimates of water availability suggest that 0.25 cfs may not be available during the winter months, we are recommending the following flow amounts be appropriated to preserve the natural environment of Grizzly Creek to a reasonable degree:

- From **Jan 1 through Dec 31** a flow appropriation of **0.25 cfs** is recommended to maintain an average depth of 0.2 ft and 50% percent wetted perimeter;

Summer flows should be adjusted upwards once sufficient data are available to estimate the discharge needed to ensure an average velocity of 1.0 ft/s during this period. Additionally, should we be able to establish cross-sections further downstream, it is likely that both the summer and winter flow recommendation will increase. The modeling results for the 2 of 3 criteria from this survey effort are within the confidence interval produced by the R2CROSS model (See Appendix A).

Water Availability. The USGS maintained a gage (USGS gage 09245500) on the North Fork of Elkhead Creek (North Fork Elkhead Creek near Elkhead, CO) between October, 1958 and October, 1973. This watershed is due south of Grizzly Creek and thus experiences similar climatic conditions. Although the gaged portion of Elkhead Creek's watershed (21.3 mi^2) is over twice the size of the Grizzly Creek watershed (9.65 mi^2), it is not nearly as large as the gaged portion of Slater Creek (91.6 mi^2) and has considerably fewer diversions than Slater Creek (4 versus 36, respectively). As such, North Fork Elkhead Creek is a better reference watershed.

Although there are four diversion structures in North Fork Elkhead Creek's watershed (See Structure Summary Reports in Appendix B), there were only records of diversions through Ellis & Kitchen Ditch. Because the daily diversion records for this ditch spanned the period from April 1, 1933 through September 30, 2006 our preliminary water availability analysis adjusted flows through North Fork Elkhead Creek by adding the amount of water diverted through this ditch to the daily records at the USGS gage. Because some of this water may return to the creek above the gage, this estimate may be somewhat high. However, because the diversion structure is relatively low in the watershed, we believe these return flows are relatively small compared to the withdrawals.

We used an aerial apportionment approach to estimate the discharge passing through the proposed ISF reach on Grizzly Creek. In short, we assumed that the average water contributed to daily stream flows per square mile of Grizzly Creek's watershed was the same as that contributed per square of North Fork Elkhead Creek's watershed. This allowed us to estimate how much water would have flowed through Grizzly Creek in the absence of any diversions. There are no known diversion structures within the Grizzly Creek watershed and thus no adjustments to the modeled flows through Grizzly Creek were needed.

This analysis was used to adjust the recommended ISF so that our estimate of average daily flows through Grizzly Creek during the period of record (10/1/58 to 10/2/73) typically exceeded the recommended flows (Fig. 3) and that 50% of monthly flows were approximately equal to or greater than the recommended flows throughout the year (Table 1).

This water availability analysis is somewhat coarse, it is likely that our flow estimates through the reach are lower than expected. Because the Elkhead Creek watershed is on a south-facing slope, it is likely to have a slightly different hydrograph than watersheds which are north-facing and, consequently, the amount and timing of flows measured on Elkhead Creek will be slightly different than those measured through Grizzly Creek. Furthermore, because the Elkhead Creek gage is low in the watershed, it is possible there are intervening stream segments that are either losing or not gaining as quickly as the upper reaches. This would also serve to lower the estimate of stream flow through the proposed instream reach. For these reasons, we expect a more robust instream flow analysis by the CWCB will show a greater amount of water is available for appropriation.

Relationship to Existing State Policy. Trout Unlimited and the CDOW are forwarding this stream flow recommendation to the CWCB to meet the State of Colorado's policy "that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities." C.R.S. 33-1-101(1). Further, the CDOW Strategic Plan states "Healthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The Division desires to protect and enhance the quality and quantity of aquatic habitats." TU and CDOW recommend that Grizzly Creek be considered for inclusion in the Instream Flow Program because doing so would help meet these stated policies. Specifically, establishing minimum flows through this reach would preserve the natural environment of the stream to a reasonable degree.

Attached in Appendix A, please find copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. Attached in Appendix B, please find copies of the Structure Summary Reports for the structures in the watershed. If you have any questions regarding the attached information or the instream flow recommendations, please feel free to contact me at (303) 440-2937.

Trout Unlimited thanks the Colorado Division of Wildlife and the Colorado Water Conservation Board Staff for their support in preparing this recommendation.

Sincerely,

W. John Roach, Ph.D.
Trout Unlimited
Aquatic Specialist

Cc: Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
Mark Uppendahl, CDOW Instream Flow Program Coordinator

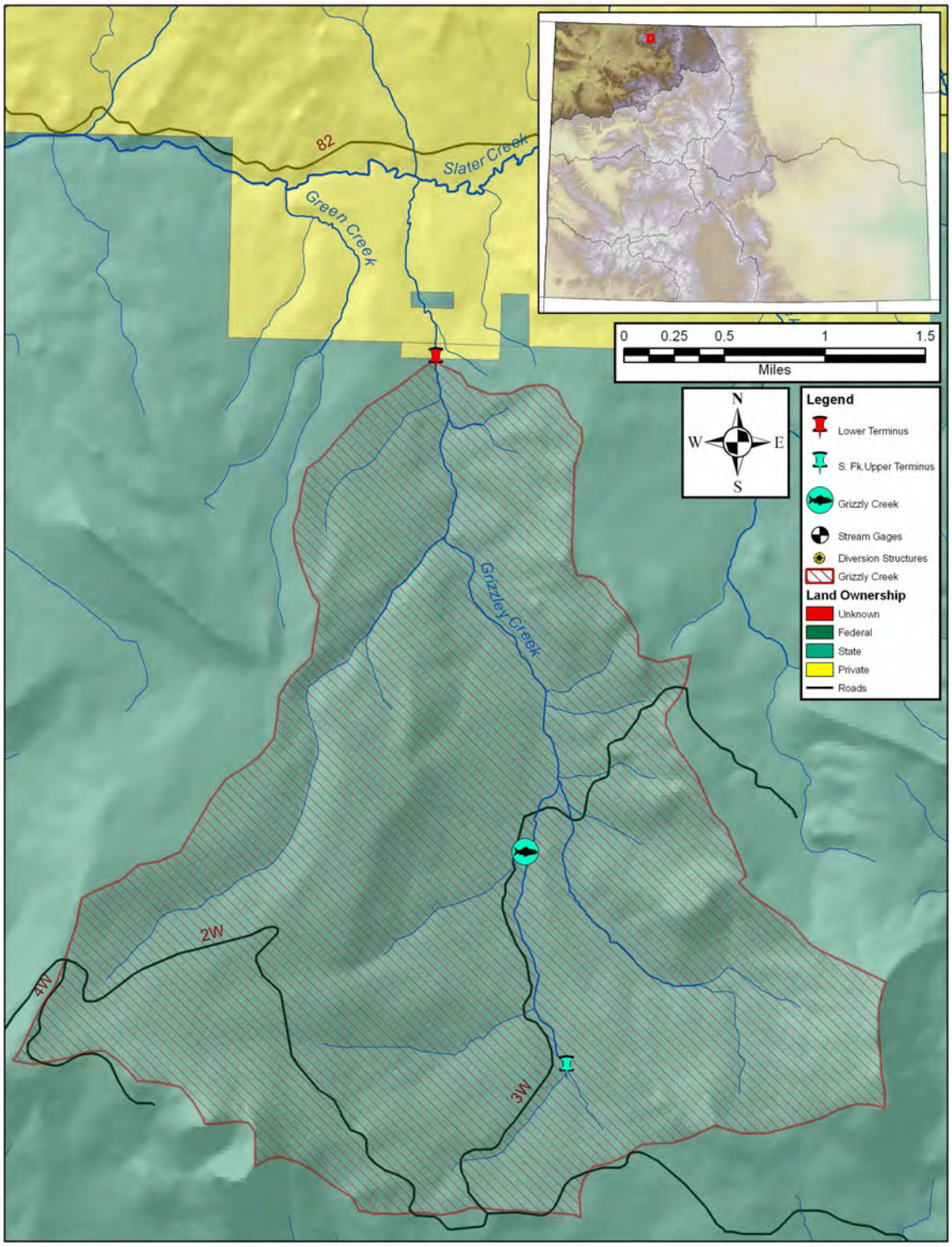


Figure 1. Map of Grizzly Creek watershed. Positions of upper and lower termini of the proposed instream flow reach are noted as is the location of the R2CROSS cross section. Additionally, locations known diversion structures are plotted. The watershed's location within Division 6 is indicated by the red box on the inset map of Colorado.

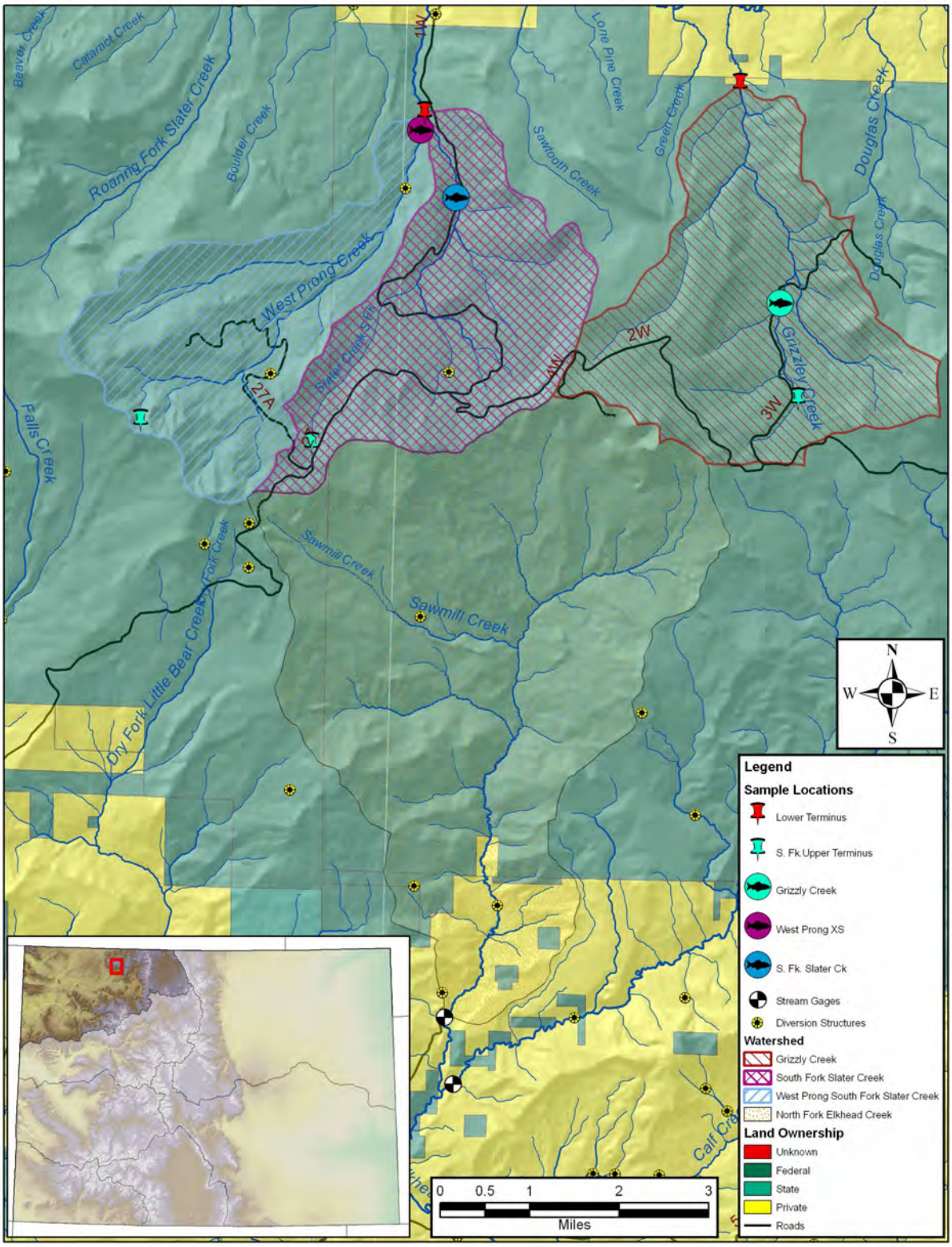


Figure 2. Map of Grizzly Creek and adjacent watersheds, including the North Fork Elkhead Creek. Because there is no gage on the West Prong, the North Fork of Elkhead Creek was used as a reference watershed for determining water availability.

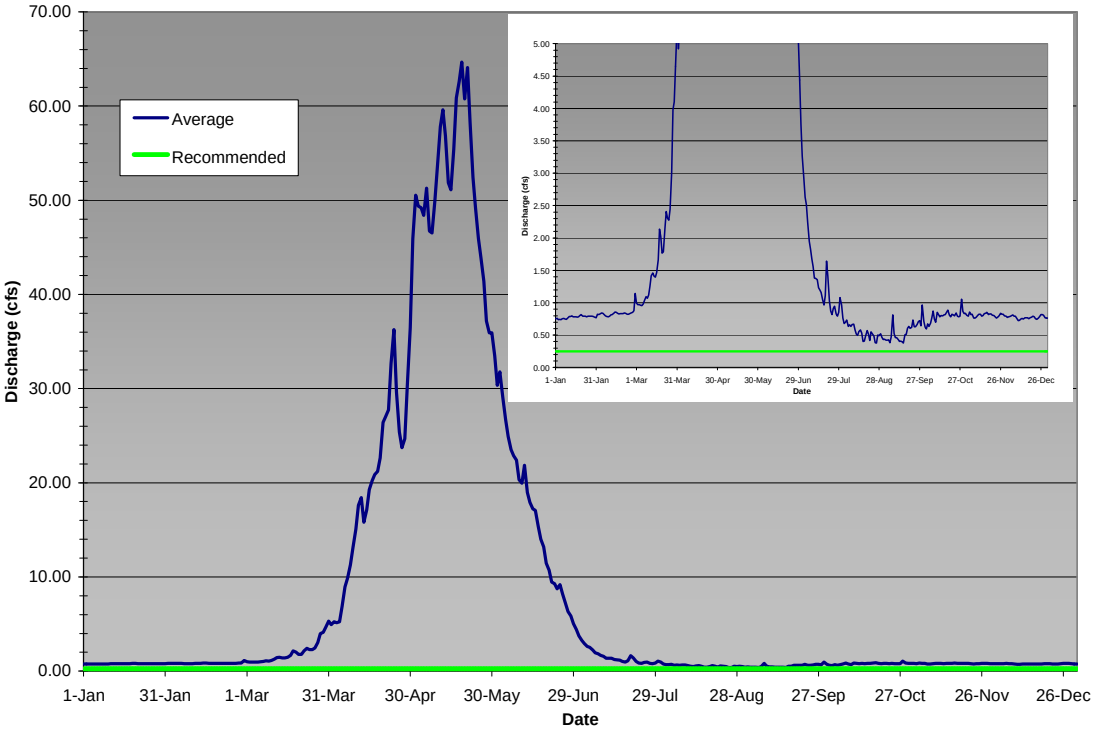


Figure 3. Recommended instream flow appropriations (green line) as compared to estimated average daily discharge past LT of proposed ISF reach on Grizzly Creek. To ease comparisons, the inset plot shows flows under 10 cfs.

Table 1. Summary statistics of estimated mean daily discharge through Grizzly Creek. For each month, the discharge that 50% of the flows were equal to or greater than is highlighted Yellow indicates summer months and blue indicates winter months.

Monthly Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
# days	465	424	465	450	465	450	430	367	396	467	450	465	**5294**
Avg Day	0.78	0.83	1.95	19.31	50.67	16.11	1.56	0.55	0.57	0.79	0.81	0.77	**7.89**
Max Day	2	2	21	177	196	88	8	3	5	5	3	2	**196**
Min Day	0.23	0.36	0.36	1.09	6.34	1.18	0.05	0.02	0.00	0.09	0.18	0.18	**0.00**
# months	15	14	15	15	15	15	14	12	13	15	15	15	**12**
Sdev Month	0.25	0.25	1.35	15.35	22.19	10.94	0.99	0.34	0.29	0.38	0.29	0.25	
Skew Month	-0.07	0.08	1.56	1.14	0.89	0.58	0.48	0.75	0.70	1.47	1.12	-0.23	
Min Month	0.36	0.45	0.52	4.43	24.74	4.16	0.22	0.05	0.13	0.37	0.39	0.37	
Max Month	1.16	1.21	5.59	53.96	100.56	33.89	3.51	1.18	1.16	1.80	1.55	1.12	
Percentiles*													
1%	1.36	1.36	13.29	112.26	173.66	77.00	6.34	1.95	2.53	2.32	1.90	1.36	104.14
5%	1.18	1.27	7.24	69.80	122.94	44.36	4.42	1.40	1.63	1.72	1.49	1.18	44.36
10%	1.11	1.13	3.85	42.10	102.75	38.48	3.44	1.09	1.04	1.36	1.18	1.09	27.16
20%	1.00	1.09	1.82	29.42	72.42	26.25	2.49	0.86	0.81	1.09	1.00	1.00	7.24
50%	0.81	0.91	1.18	9.96	38.93	11.32	1.13	0.44	0.42	0.68	0.72	0.81	**1.00**
80%	0.54	0.59	0.81	3.33	23.09	4.42	0.36	0.14	0.23	0.45	0.54	0.53	0.54
90%	0.45	0.50	0.77	2.08	18.56	2.53	0.18	0.09	0.09	0.36	0.45	0.45	0.36
95%	0.36	0.45	0.45	1.56	14.48	1.88	0.09	0.05	0.05	0.32	0.41	0.41	0.23
99%	0.36	0.45	0.36	1.13	9.96	1.27	0.05	0.05	0.05	0.18	0.27	0.27	0.06

* Percentiles estimate the value (discharge) in the record associated with a given percentile. They provide an estimate of the percentage of days on which a given flow is exceeded. Percentiles were calculated using the PERCENTILE function in MicroSoft Excel.

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

LOCATION INFORMATION

STREAM NAME:	Grizzly Creek - d/s of previous X-Sect
XS LOCATION:	40 48 23.9; 107 13 05.6
XS NUMBER:	81002
DATE:	2-Oct-08
OBSERVERS:	Uppendahl & Espegren (TU)
1/4 SEC:	0
SECTION:	0
TWP:	10 N
RANGE:	88 W
PM:	6
COUNTY:	Routt
WATERSHED:	Slater Creek
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:	0.045

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

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

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9; 107 13 05.6
XS NUMBER: 81002

DATA POINTS= 27

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TS	0.00	5.88			0.00		0.00	0.00	0.0%
BS	0.01	6.37			0.00		0.00	0.00	0.0%
1 GL	1.00	6.83			0.00		0.00	0.00	0.0%
	1.20	8.31			0.00		0.00	0.00	0.0%
	2.00	8.60			0.00		0.00	0.00	0.0%
	3.00	8.73			0.00		0.00	0.00	0.0%
WL	4.00	8.84	0.00	0.00	0.00		0.00	0.00	0.0%
	4.30	8.91	0.05	0.05	0.31	0.05	0.02	0.00	0.2%
	4.60	9.00	0.10	0.29	0.31	0.10	0.03	0.01	1.9%
	4.90	9.00	0.10	0.05	0.30	0.10	0.03	0.00	0.3%
	5.20	9.01	0.10	0.05	0.30	0.10	0.03	0.00	0.3%
	5.50	9.07	0.20	0.20	0.31	0.20	0.06	0.01	2.6%
	5.80	9.12	0.25	1.43	0.30	0.25	0.08	0.11	22.8%
	6.10	9.10	0.25	0.92	0.30	0.25	0.08	0.07	14.7%
	6.40	9.10	0.28	0.72	0.30	0.28	0.08	0.06	12.6%
	6.70	9.10	0.20	0.83	0.30	0.20	0.06	0.05	10.6%
	7.00	9.07	0.30	0.77	0.30	0.30	0.09	0.07	14.8%
	7.30	8.98	0.20	1.11	0.31	0.20	0.06	0.07	14.2%
R	7.60	9.00	0.15	0.25	0.30	0.15	0.05	0.01	2.4%
	7.90	9.10	0.20	0.18	0.32	0.20	0.07	0.01	2.7%
WL	8.30	8.87	0.00	0.00	0.46		0.00	0.00	0.0%
	8.50	8.50			0.00		0.00	0.00	0.0%
	9.00	7.97			0.00		0.00	0.00	0.0%
	10.50	7.81			0.00		0.00	0.00	0.0%
1 GL	11.00	6.70			0.00		0.00	0.00	0.0%
BS	11.80	6.23			0.00		0.00	0.00	0.0%
TS	11.81	5.53			0.00		0.00	0.00	0.0%
TOTALS ----------					4.43	0.3 (Max.)	0.72	0.47	100.0%

Manning's n = 0.1449
Hydraulic Radius= 0.16326984

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9; 107 13 05.6
XS NUMBER: 81002

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.72	0.75	3.4%
8.61	0.72	2.08	188.0%
8.63	0.72	1.95	170.5%
8.65	0.72	1.83	153.4%
8.67	0.72	1.71	136.8%
8.69	0.72	1.59	120.7%
8.71	0.72	1.48	105.0%
8.73	0.72	1.37	89.8%
8.75	0.72	1.26	75.1%
8.77	0.72	1.16	60.8%
8.79	0.72	1.06	47.2%
8.81	0.72	0.97	34.0%
8.82	0.72	0.92	27.6%
8.83	0.72	0.88	21.4%
8.84	0.72	0.83	15.3%
8.85	0.72	0.79	9.3%
8.86	0.72	0.75	3.4%
8.87	0.72	0.70	-2.4%
8.88	0.72	0.66	-8.2%
8.89	0.72	0.62	-13.9%
8.90	0.72	0.58	-19.5%
8.91	0.72	0.54	-25.0%
8.93	0.72	0.46	-35.8%
8.95	0.72	0.39	-46.4%
8.97	0.72	0.31	-56.6%
8.99	0.72	0.24	-66.6%
9.01	0.72	0.18	-75.3%
9.03	0.72	0.13	-81.8%
9.05	0.72	0.09	-87.6%
9.07	0.72	0.05	-92.7%
9.09	0.72	0.02	-97.0%
9.11	0.72	0.00	-99.7%

WATERLINE AT ZERO
AREA ERROR = 8.861

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9, 107 13 05.6
XS NUMBER: 81002

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"	6.83	9.94	1.77	2.29	17.57	12.52	100.0%	1.40	47.94	2.73
	7.86	8.88	0.86	1.26	7.65	9.92	79.3%	0.77	13.99	1.83
	7.91	8.41	0.86	1.21	7.21	9.40	75.1%	0.77	13.16	1.82
	7.96	7.93	0.86	1.16	6.81	8.88	70.9%	0.77	12.40	1.82
	8.01	7.80	0.82	1.11	6.41	8.69	69.4%	0.74	11.40	1.78
	8.06	7.75	0.78	1.06	6.03	8.57	68.4%	0.70	10.37	1.72
	8.11	7.69	0.73	1.01	5.64	8.45	67.5%	0.67	9.37	1.66
	8.16	7.64	0.69	0.96	5.26	8.33	66.5%	0.63	8.42	1.60
	8.21	7.59	0.64	0.91	4.88	8.21	65.6%	0.59	7.50	1.54
	8.26	7.53	0.60	0.86	4.50	8.09	64.6%	0.56	6.62	1.47
	8.31	7.48	0.55	0.81	4.12	7.97	63.7%	0.52	5.78	1.40
	8.36	7.29	0.51	0.76	3.75	7.75	61.9%	0.48	5.03	1.34
	8.41	7.11	0.48	0.71	3.39	7.54	60.2%	0.45	4.34	1.28
	8.46	6.92	0.44	0.66	3.04	7.32	58.5%	0.42	3.69	1.21
	8.51	6.74	0.40	0.61	2.70	7.11	56.8%	0.38	3.08	1.14
	8.56	6.58	0.36	0.56	2.37	6.91	55.2%	0.34	2.52	1.07
	8.61	6.36	0.32	0.51	2.04	6.65	53.1%	0.31	2.02	0.99
	8.66	5.95	0.29	0.46	1.74	6.21	49.6%	0.28	1.62	0.93
	8.71	5.53	0.26	0.41	1.45	5.76	46.0%	0.25	1.26	0.87
	8.76	5.08	0.23	0.36	1.18	5.27	42.1%	0.22	0.95	0.80
	8.81	4.60	0.20	0.31	0.94	4.76	38.0%	0.20	0.70	0.74
"WL"	8.86	4.22	0.17	0.26	0.72	4.34	34.7%	0.17	0.48	0.66
	8.91	3.93	0.13	0.21	0.52	4.03	32.2%	0.13	0.29	0.55
	8.96	3.67	0.09	0.16	0.33	3.76	30.0%	0.09	0.14	0.43
	9.01	2.42	0.07	0.11	0.16	2.47	19.8%	0.07	0.06	0.36
	9.06	1.76	0.03	0.06	0.06	1.79	14.3%	0.03	0.01	0.23
	9.11	0.19	0.00	0.01	0.00	0.19	1.5%	0.00	0.00	0.06

3/3 = 2.1
2/3 = 1.7

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9; 107 13 05.6
XS NUMBER: 81002

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.47	cfs
CALCULATED FLOW (Qc)=	0.48	cfs
(Qm-Qc)/Qm * 100 =	-1.2	%
MEASURED WATERLINE (WLm)=	8.86	ft
CALCULATED WATERLINE (WLc)=	8.86	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.26	ft
(Dm-Dc)/Dm * 100	13.6	%
MEAN VELOCITY=	0.66	ft/sec
MANNING'S N=	0.145	
SLOPE=	0.045	ft/ft
.4 * Qm =	0.2	cfs
2.5 * Qm=	1.2	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9; 107 13 05.6
XS NUMBER: 81002

Jarrett Variable Manning's n Correction Applied

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.83	9.94	1.77	2.29	17.57	12.52	100.0%	1.40	67.45	3.84
	7.86	8.88	0.86	1.26	7.65	9.92	79.3%	0.77	17.88	2.34
	7.91	8.41	0.86	1.21	7.21	9.40	75.1%	0.77	16.81	2.33
	7.96	7.93	0.86	1.16	6.81	8.88	70.9%	0.77	15.84	2.33
	8.01	7.80	0.82	1.11	6.41	8.69	69.4%	0.74	14.48	2.26
	8.06	7.75	0.78	1.06	6.03	8.57	68.4%	0.70	13.06	2.17
	8.11	7.69	0.73	1.01	5.64	8.45	67.5%	0.67	11.71	2.08
	8.16	7.64	0.69	0.96	5.26	8.33	66.5%	0.63	10.42	1.98
	8.21	7.59	0.64	0.91	4.88	8.21	65.6%	0.59	9.19	1.88
	8.26	7.53	0.60	0.86	4.50	8.09	64.6%	0.56	8.03	1.78
	8.31	7.48	0.55	0.81	4.12	7.97	63.7%	0.52	6.93	1.68
	8.36	7.29	0.51	0.76	3.75	7.75	61.9%	0.48	5.97	1.59
	8.41	7.11	0.48	0.71	3.39	7.54	60.2%	0.45	5.09	1.50
	8.46	6.92	0.44	0.66	3.04	7.32	58.5%	0.42	4.27	1.40
	8.51	6.74	0.40	0.61	2.70	7.11	56.8%	0.38	3.52	1.30
	8.56	6.58	0.36	0.56	2.37	6.91	55.2%	0.34	2.83	1.20
	8.61	6.36	0.32	0.51	2.04	6.65	53.1%	0.31	2.23	1.09
	8.66	5.95	0.29	0.46	1.74	6.21	49.6%	0.28	1.76	1.01
	8.71	5.53	0.26	0.41	1.45	5.76	46.0%	0.25	1.34	0.93
	8.76	5.08	0.23	0.36	1.18	5.27	42.1%	0.22	1.00	0.84
	8.81	4.60	0.20	0.31	0.94	4.76	38.0%	0.20	0.71	0.76
WL	8.86	4.22	0.17	0.26	0.72	4.34	34.7%	0.17	0.48	0.66
	8.91	3.93	0.13	0.21	0.52	4.03	32.2%	0.13	0.28	0.53
	8.96	3.67	0.09	0.16	0.33	3.76	30.0%	0.09	0.13	0.39
	9.01	2.42	0.07	0.11	0.16	2.47	19.8%	0.07	0.05	0.31
	9.06	1.76	0.03	0.06	0.06	1.79	14.3%	0.03	0.01	0.17
	9.11	0.19	0.00	0.01	0.00	0.19	1.5%	0.00	0.00	0.03

3/3 = 1.8

2/3 = 1.7

STREAM NAME: Grizzly Creek - d/s of previous X-Sect
XS LOCATION: 40 48 23.9; 107 13 05.6
XS NUMBER: 81002

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.59

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

Velocity based on test of R/D84>1

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.83	9.94	1.77	2.29	17.57	12.52	100.0%	1.40	147.72	8.41
	7.86	8.88	0.86	1.26	7.65	9.92	79.3%	0.77	34.49	4.51
	7.91	8.41	0.86	1.21	7.21	9.40	75.1%	0.77	32.15	4.46
	7.96	7.93	0.86	1.16	6.81	8.88	70.9%	0.77	30.03	4.41
	8.01	7.80	0.82	1.11	6.41	8.69	69.4%	0.74	27.07	4.22
	8.06	7.75	0.78	1.06	6.03	8.57	68.4%	0.70	24.03	3.99
	8.11	7.69	0.73	1.01	5.64	8.45	67.5%	0.67	21.14	3.75
	8.16	7.64	0.69	0.96	5.26	8.33	66.5%	0.63	18.42	3.50
	8.21	7.59	0.64	0.91	4.88	8.21	65.6%	0.59	15.85	3.25
	8.26	7.53	0.60	0.86	4.50	8.09	64.6%	0.56	21.19	4.71
	8.31	7.48	0.55	0.81	4.12	7.97	63.7%	0.52	16.81	4.08
	8.36	7.29	0.51	0.76	3.75	7.75	61.9%	0.48	13.52	3.60
	8.41	7.11	0.48	0.71	3.39	7.54	60.2%	0.45	10.69	3.15
	8.46	6.92	0.44	0.66	3.04	7.32	58.5%	0.42	8.30	2.73
	8.51	6.74	0.40	0.61	2.70	7.11	56.8%	0.38	6.30	2.33
	8.56	6.58	0.36	0.56	2.37	6.91	55.2%	0.34	4.65	1.96
	8.61	6.36	0.32	0.51	2.04	6.65	53.1%	0.31	3.36	1.64
	8.66	5.95	0.29	0.46	1.74	6.21	49.6%	0.28	2.46	1.42
	8.71	5.53	0.26	0.41	1.45	5.76	46.0%	0.25	1.74	1.20
	8.76	5.08	0.23	0.36	1.18	5.27	42.1%	0.22	1.20	1.01
	8.81	4.60	0.20	0.31	0.94	4.76	38.0%	0.20	0.79	0.84
WL	8.86	4.22	0.17	0.26	0.72	4.34	34.7%	0.17	0.48	0.66
	8.91	3.93	0.13	0.21	0.52	4.03	32.2%	0.13	0.25	0.48
	8.96	3.67	0.09	0.16	0.33	3.76	30.0%	0.09	0.11	0.33
	9.01	2.42	0.07	0.11	0.16	2.47	19.8%	0.07	0.03	0.21
	9.06	1.76	0.03	0.06	0.06	1.79	14.3%	0.03	0.01	0.12
	9.11	0.19	0.00	0.01	0.00	0.19	1.5%	0.00	0.00	0.01

3/3 = 2.6

2/3 -- 2.0

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: GRIZZLY CREEK					CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: D/S OF PREVIOUS XSECT - @ end of Road. 40° 48' 23.9" N 107° 13' 05.6 W					
DATE: 10/2/08	OBSERVERS: UPPENDAHL / ESPEGREN				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: ROUTT	WATERSHED: SLATER		WATER DIVISION: 6		DOW WATER CODE:
MAP(S):	USGS:				
	USFS:				

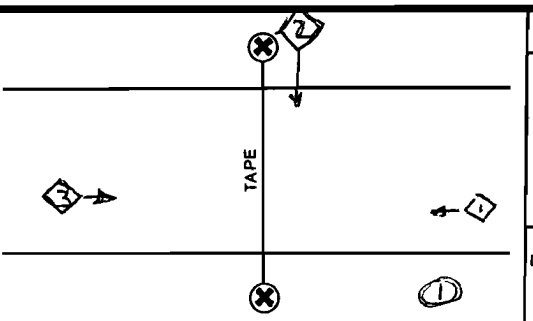
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: MARSH McBIRNEY FLOWMATE 2000			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: SILT TO COBBLE $D_{84} \approx 3/4''$	PHOTOGRAPHS TAKEN: (YES) NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	14°	8.14
③ WS Downstream	6°	9.04
SLOPE	0.90 / 20. = 0.05	

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
SPAWNING BROOK																	
TROUT OBSERVED																	

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

COMMENTS

OBSERVED CADDIS FLY & MAYFLY HATCH

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Grizzly Creek	CROSS-SECTION NO.:	DATE: 10/2/08	SHEET 1 OF 1

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT (RIGHT)	Gage Reading: ____ ft	TIME: 12:55 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
TOP STAKE	0.0		5.88								
GROUND	0.5		6.37								
⊕	1.0		6.83								
	1.2		8.31								
	2.0		8.60								
	3.0		8.73								
W	4.0		8.84	0.0				0.0			
	4.3		8.91	0.05				0.05			
	4.6		9.00	0.10				0.29			
	4.9		9.00	0.10				0.05			
	5.2		9.01	0.10				0.05			
	5.5		9.07	0.20				0.20			
	5.8		9.12	0.25				1.43			
	6.1		9.10	0.25				0.92			
	6.4		9.10	0.275				0.72			
	6.7		9.10	0.20				0.83			
	7.0		9.07	0.30				0.77			
	7.3		8.98	0.20				1.11			
R	7.6		9.00	0.15				0.25			
	7.9		9.10	0.20				0.18			
W	8.3		8.87	0.0				0.0			
	8.5		8.50								
	9.0		7.97								
	10.5		7.81								
⊕	11.0		6.70								
GROUND	11.8		6.23								
TOP	11.8		5.53								
TOTALS:											

End of Measurement	Time: 1:21	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

Grizzly Creek

At End of Road

NW S25 T10N R88W 6PM

Grizzly Creek

At Original XS site

NW S25 T10N R88W 6PM

Grizzly Creek

At Original XS site

NW S25 T10N R88W 6PM

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

LOCATION INFORMATION

STREAM NAME:	Grizzly Creek 071007
XS LOCATION:	d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER:	071007-001
DATE:	10-Jul-07
OBSERVERS:	Uppendahl; H Skinner
1/4 SEC:	NW
SECTION:	25
TWP:	10 N
RANGE:	88 W
PM:	6
COUNTY:	Routt
WATERSHED:	Slater Creek
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:	0.02468085

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

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

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001

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
TS	0.00	4.62			0.00		0.00	0.00	0.0%
BS	0.00	5.10			0.00		0.00	0.00	0.0%
	2.00	5.44			0.00		0.00	0.00	0.0%
	3.00	5.61			0.00		0.00	0.00	0.0%
1 GL	4.00	5.84			0.00		0.00	0.00	0.0%
	5.90	6.51			0.00		0.00	0.00	0.0%
WL	6.40	6.65	0.00	0.00	0.00		0.00	0.00	0.0%
	6.80	6.78	0.10	0.00	0.42	0.10	0.04	0.00	0.0%
	7.20	6.82	0.15	0.00	0.40	0.15	0.06	0.00	0.0%
	7.60	6.83	0.15	0.00	0.40	0.15	0.06	0.00	0.0%
	8.00	6.90	0.15	0.41	0.41	0.15	0.06	0.02	12.6%
	8.40	6.90	0.20	0.47	0.40	0.20	0.08	0.04	19.2%
	8.80	7.06	0.40	0.22	0.43	0.40	0.16	0.04	18.0%
	9.20	7.05	0.35	0.10	0.40	0.35	0.14	0.01	7.2%
	9.60	7.00	0.30	0.38	0.40	0.30	0.12	0.05	23.3%
	10.00	7.00	0.25	0.19	0.40	0.25	0.10	0.02	9.7%
	10.40	6.92	0.25	0.15	0.41	0.25	0.10	0.02	7.7%
	10.80	6.85	0.20	0.06	0.41	0.20	0.08	0.00	2.5%
	11.20	6.80	0.15	0.00	0.40	0.15	0.06	0.00	0.0%
	11.60	6.75	0.10	0.00	0.40	0.10	0.04	0.00	0.0%
	12.00	6.70	0.05	0.00	0.40	0.05	0.02	0.00	0.0%
	12.50	6.70	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
WL	13.00	6.65	0.00	0.00	0.50		0.00	0.00	0.0%
	14.00	6.38			0.00		0.00	0.00	0.0%
1 GL	15.00	6.25			0.00		0.00	0.00	0.0%
	15.50	6.00			0.00		0.00	0.00	0.0%
	16.80	5.60			0.00		0.00	0.00	0.0%
	18.60	5.15			0.00		0.00	0.00	0.0%
BS	20.00	4.45			0.00		0.00	0.00	0.0%
TS	20.00	4.04			0.00		0.00	0.00	0.0%
TOTALS ----------					6.69	0.4 (Max.)	1.15	0.20	100.0%

Manning's n = 0.4224
Hydraulic Radius= 0.171558578

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.15	1.33	16.0%
6.40	1.15	3.20	179.3%
6.42	1.15	3.04	164.8%
6.44	1.15	2.88	150.6%
6.46	1.15	2.72	136.7%
6.48	1.15	2.56	122.9%
6.50	1.15	2.40	109.4%
6.52	1.15	2.25	96.2%
6.54	1.15	2.10	83.1%
6.56	1.15	1.95	70.4%
6.58	1.15	1.81	57.8%
6.60	1.15	1.67	45.6%
6.61	1.15	1.60	39.5%
6.62	1.15	1.53	33.6%
6.63	1.15	1.46	27.7%
6.64	1.15	1.40	21.8%
6.65	1.15	1.33	16.0%
6.66	1.15	1.27	10.3%
6.67	1.15	1.20	4.8%
6.68	1.15	1.14	-0.7%
6.69	1.15	1.08	-6.1%
6.70	1.15	1.02	-11.3%
6.72	1.15	0.91	-20.6%
6.74	1.15	0.81	-29.5%
6.76	1.15	0.71	-38.0%
6.78	1.15	0.62	-46.2%
6.80	1.15	0.53	-53.8%
6.82	1.15	0.45	-60.8%
6.84	1.15	0.38	-66.8%
6.86	1.15	0.32	-72.2%
6.88	1.15	0.26	-77.2%
6.90	1.15	0.21	-81.8%

WATERLINE AT ZERO
AREA ERROR = 6.679

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0, 107 13 11.1
XS NUMBER: 071007-001

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG DEPTH (FT)	MAX DEPTH (FT)	AREA (SQ FT)	WETTED PERIM (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG VELOCITY (FT/SEC)
"GL"	6.25	9.84	0.46	0.81	4.56	10.03	100.0%	0.45	1.49	0.33
	6.28	9.54	0.45	0.78	4.28	9.72	96.9%	0.44	1.37	0.32
	6.33	9.01	0.42	0.73	3.82	9.19	91.6%	0.42	1.18	0.31
	6.38	8.48	0.40	0.68	3.38	8.65	86.2%	0.39	1.00	0.30
	6.43	8.15	0.36	0.63	2.97	8.30	82.7%	0.36	0.83	0.28
	6.48	7.82	0.33	0.58	2.57	7.96	79.3%	0.32	0.67	0.26
	6.53	7.48	0.29	0.53	2.19	7.60	75.8%	0.29	0.53	0.24
	6.58	7.12	0.26	0.48	1.82	7.23	72.0%	0.25	0.40	0.22
	6.63	6.75	0.22	0.43	1.47	6.85	68.3%	0.22	0.29	0.20
"WL"	6.68	6.22	0.18	0.38	1.15	6.31	62.9%	0.18	0.20	0.18
	6.73	5.13	0.17	0.33	0.87	5.20	51.8%	0.17	0.14	0.17
	6.78	4.57	0.14	0.28	0.62	4.64	46.2%	0.13	0.09	0.15
	6.83	3.42	0.12	0.23	0.42	3.48	34.7%	0.12	0.06	0.13
	6.88	2.76	0.10	0.18	0.27	2.81	28.0%	0.09	0.03	0.11
	6.93	1.88	0.08	0.13	0.15	1.92	19.1%	0.08	0.02	0.10
	6.98	1.51	0.04	0.08	0.07	1.53	15.3%	0.04	0.00	0.07
	7.03	0.65	0.02	0.03	0.01	0.66	6.5%	0.02	0.00	0.04

3/3 = ?
2/3 = .25

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.20	cfs
CALCULATED FLOW (Qc)=	0.20	cfs
(Qm-Qc)/Qm * 100 =	-4.0	%
MEASURED WATERLINE (WLm)=	6.65	ft
CALCULATED WATERLINE (WLc)=	6.68	ft
(WLm-WLc)/WLm * 100 =	-0.4	%
MAX MEASURED DEPTH (Dm)=	0.40	ft
MAX CALCULATED DEPTH (Dc)=	0.38	ft
(Dm-Dc)/Dm * 100	4.7	%
MEAN VELOCITY=	0.18	ft/sec
MANNING'S N=	0.422	
SLOPE=	0.02468085	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.5	cfs

RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Data Input & Proofing

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001
DATE: 7/10/2007
OBSERVERS: Uppendahl; H Skinner

1/4 SEC: NW
SECTION: 25
TWP: 10 N
RANGE: 88 W
PM: 6

COUNTY: Routt
WATERSHED: Slater Creek
DIVISION: 6
DOW CODE:
USGS MAP:
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

SLOPE: 0.024680851 ft / ft

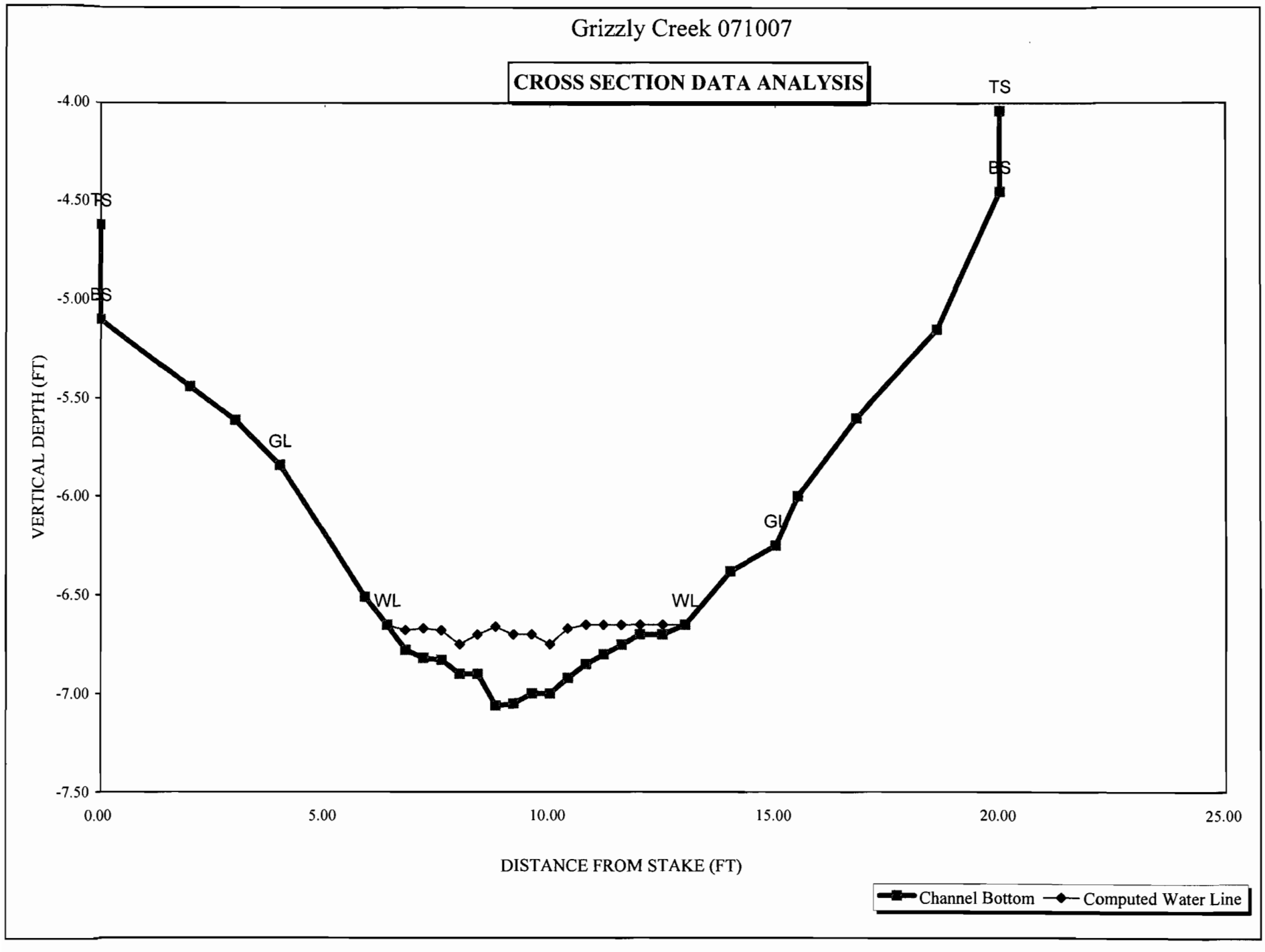
CHECKED BY:.....DATE.....

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

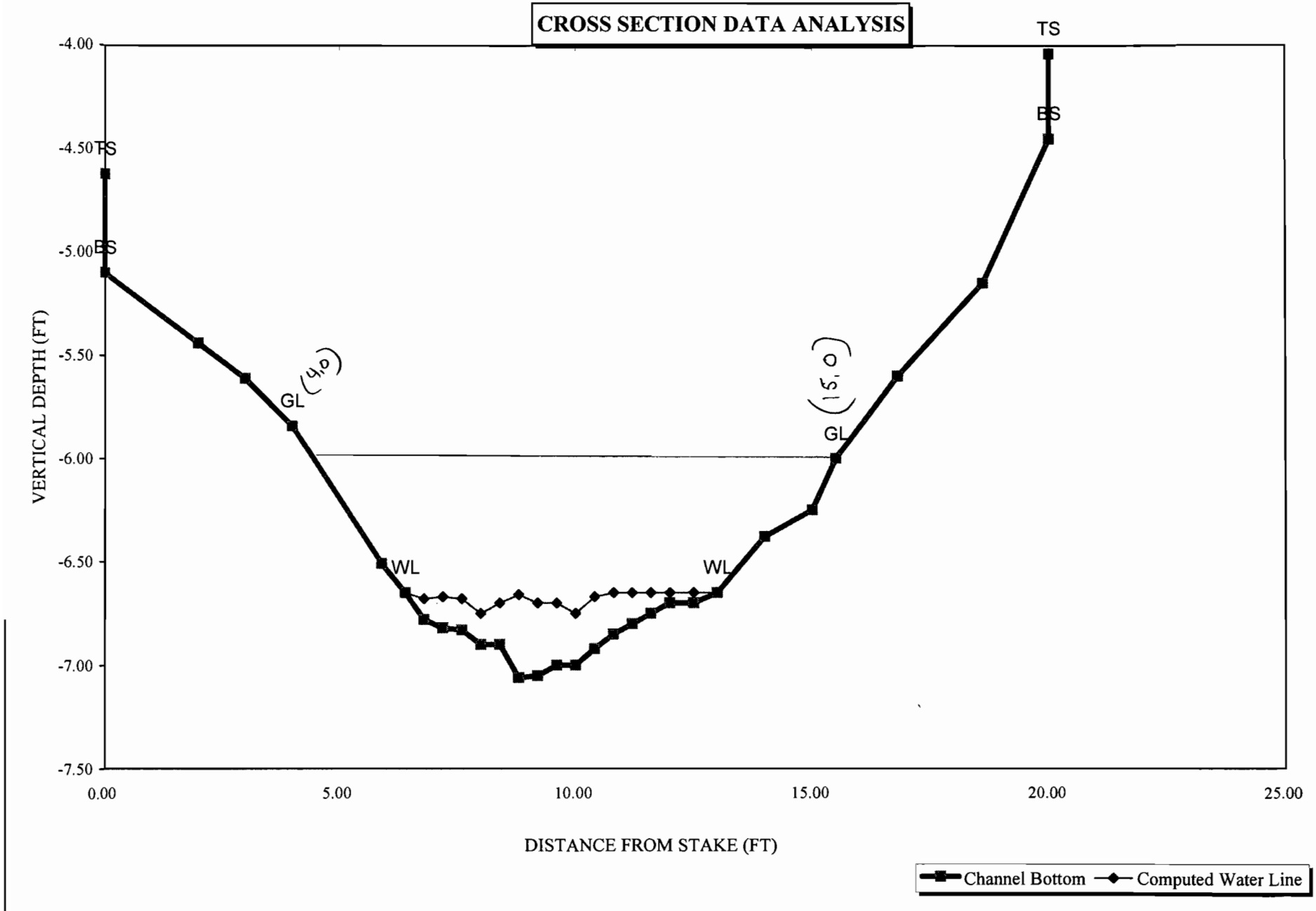
Total Data Points = 30

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	4.62			0.00	0.00	0.00
	BS	0.00	5.10			0.00	0.00	0.00
		2.00	5.44			0.00	0.00	0.00
		3.00	5.61			0.00	0.00	0.00
1	GL	4.00	5.84			0.00	0.00	0.00
		5.90	6.51			0.00	0.00	0.00
	WL	6.40	6.65	0.00	0.00	0.00	0.00	0.00
		6.80	6.78	0.10	0.00	0.04	0.00	6.68
		7.20	6.82	0.15	0.00	0.06	0.00	6.67
		7.60	6.83	0.15	0.00	0.06	0.00	6.68
		8.00	6.90	0.15	0.41	0.06	0.02	6.75
		8.40	6.90	0.20	0.47	0.08	0.04	6.70
		8.80	7.06	0.40	0.22	0.16	0.04	6.66
		9.20	7.05	0.35	0.10	0.14	0.01	6.70
		9.60	7.00	0.30	0.38	0.12	0.05	6.70
		10.00	7.00	0.25	0.19	0.10	0.02	6.75
		10.40	6.92	0.25	0.15	0.10	0.02	6.67
		10.80	6.85	0.20	0.06	0.08	0.00	6.65
		11.20	6.80	0.15	0.00	0.06	0.00	6.65
		11.60	6.75	0.10	0.00	0.04	0.00	6.65
		12.00	6.70	0.05	0.00	0.02	0.00	6.65
		12.50	6.70	0.05	0.00	0.03	0.00	6.65
	WL	13.00	6.65	0.00	0.00	0.00	0.00	0.00
		14.00	6.38			0.00	0.00	0.00
1	GL	15.00	6.25			0.00	0.00	0.00
		15.50	6.00			0.00	0.00	0.00
		16.80	5.60			0.00	0.00	0.00
		18.60	5.15			0.00	0.00	0.00
	BS	20.00	4.45			0.00	0.00	0.00
					Totals	1.15	0.20	

Grizzly Creek 071007



Grizzly Creek 071007



COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Grizzly Creek							CROSS-SECTION NO.: 071007-001
CROSS-SECTION LOCATION: d/s of unnamed tributary							
40 47 51.0		107 13 11.1			8600'		
DATE: 07/10/07	OBSERVERS: Uppendahl + H. Skinner						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 25	TOWNSHIP: 10 N/S	RANGE: 88 E/W	PM: 6		
COUNTY: Routt	WATERSHED: Slater Ck	WATER DIVISION: 6	DOW WATER CODE:				
MAP(S):	USGS:						
	USFS:						

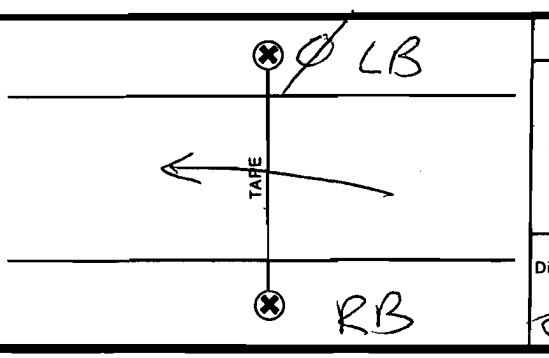
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE:		PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 7	

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	6.65/6.65
② WS Upstream	11.5	6.42
③ WS Downstream	12.0	7.00
SLOPE	.58/23.5 = 0.02468	

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) Fish Seen	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL
~~CRT?~~ BRK			III	II	I		I										

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

COMMENTS WQ SAMPLE = ISF-GC-1

of Fish Seen. ~~CRT?~~ BRK
WQ ISF-GC-1 RW07-7251 NF
Water Temp = 17° C RW07-7249 F

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Grizzly Creek	CROSS-SECTION NO.: 1	DATE: 7/10/07	SHEET 1 OF 1
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT (RIGHT)	Gage Reading: ____ ft	TIME: 10:35

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
TS	0		4.62								
BS	0		5.10								
	2.0		5.44								
	3.0		5.61								
GL	4.0		5.84								
	5.9		6.51								
WL	6.4		6.65	0	0.6			0			
	6.8		6.78	.10	↑			0			
	7.2		6.82	.15				0			
	7.6		6.83	.15				0			
	8.0		6.96	.15				.41			
	8.4		6.90	.20				.47			
	8.8		7.06	.40				.22			
	9.2		7.05	.35				.10			
	9.6		7.00	.30				.38			
	10.0		7.00	.25				.19			
	10.4		6.92	.25				.15			
	10.8		6.85	.20				.06			
	11.2		6.80	.15				0			
	11.6		6.75	.10				0			
	12.0		6.70	.05				0			
	12.5		6.70	.05	↓			0			
WL	13.0		6.65	0	0.6						
	14.0		6.38								
GL	15.0		6.25								
	15.5		6.00								
	16.8		5.60								
	18.6		5.15								
BS	20.0		4.45								
TS	20.0		4.04								
TOTALS:											

End of Measurement	Time: 10:55	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

Grizzly Creek

d/s of unnamed tributary

NW S25 T10N R88W 6PM

Grizzly Creek

d/s of unnamed tributary

NW S25 T10N R88W 6PM

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 1.99

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

Velocity based on test of R/D84>1

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.25	9.84	0.46	0.81	4.56	10.03	100.0%	0.45	2.39	0.52
	6.28	9.54	0.45	0.78	4.28	9.72	96.9%	0.44	2.14	0.50
	6.33	9.01	0.42	0.73	3.82	9.19	91.6%	0.42	1.74	0.46
	6.38	8.48	0.40	0.68	3.38	8.65	86.2%	0.39	1.41	0.42
	6.43	8.15	0.36	0.63	2.97	8.30	82.7%	0.36	1.10	0.37
	6.48	7.82	0.33	0.58	2.57	7.96	79.3%	0.32	0.84	0.33
	6.53	7.48	0.29	0.53	2.19	7.60	75.8%	0.29	0.62	0.28
	6.58	7.12	0.26	0.48	1.82	7.23	72.0%	0.25	0.45	0.25
	6.63	6.75	0.22	0.43	1.47	6.85	68.3%	0.22	0.31	0.21
WL	6.68	6.22	0.18	0.38	1.15	6.31	62.9%	0.18	0.20	0.18
	6.73	5.13	0.17	0.33	0.87	5.20	51.8%	0.17	0.13	0.15
	6.78	4.57	0.14	0.28	0.62	4.64	46.2%	0.13	0.07	0.12
	6.83	3.42	0.12	0.23	0.42	3.48	34.7%	0.12	0.04	0.09
	6.88	2.76	0.10	0.18	0.27	2.81	28.0%	0.09	0.02	0.06
	6.93	1.88	0.08	0.13	0.15	1.92	19.1%	0.08	0.01	0.04
	6.98	1.51	0.04	0.08	0.07	1.53	15.3%	0.04	0.00	0.03
	7.03	0.65	0.02	0.03	0.01	0.66	6.5%	0.02	0.00	0.01

STREAM NAME: Grizzly Creek 071007
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001 Jarrett Variable Manning's n Correction Applied

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.00	11.05	0.65	1.06	7.17	11.34	100.0%	0.63	3.56	0.50
	6.03	10.91	0.63	1.03	6.86	11.19	98.7%	0.61	3.32	0.48
	6.08	10.67	0.59	0.98	6.32	10.93	96.4%	0.58	2.92	0.46
	6.13	10.42	0.56	0.93	5.79	10.67	94.1%	0.54	2.54	0.44
	6.18	10.18	0.52	0.88	5.28	10.41	91.7%	0.51	2.18	0.41
	6.23	9.94	0.48	0.83	4.77	10.15	89.4%	0.47	1.86	0.39
	6.28	9.54	0.45	0.78	4.28	9.72	85.7%	0.44	1.58	0.37
	6.33	9.01	0.42	0.73	3.82	9.19	81.0%	0.42	1.34	0.35
	6.38	8.48	0.40	0.68	3.38	8.65	76.2%	0.39	1.13	0.33
	6.43	8.15	0.36	0.63	2.97	8.30	73.2%	0.36	0.92	0.31
	6.48	7.82	0.33	0.58	2.57	7.96	70.2%	0.32	0.73	0.28
	6.53	7.48	0.29	0.53	2.19	7.60	67.0%	0.29	0.57	0.26
	6.58	7.12	0.26	0.48	1.82	7.23	63.7%	0.25	0.42	0.23
	6.63	6.75	0.22	0.43	1.47	6.85	60.4%	0.22	0.30	0.20
WL	6.68	6.22	0.18	0.38	1.15	6.31	55.6%	0.18	0.20	0.18
	6.73	5.13	0.17	0.33	0.87	5.20	45.8%	0.17	0.14	0.16
	6.78	4.57	0.14	0.28	0.62	4.64	40.9%	0.13	0.09	0.14
	6.83	3.42	0.12	0.23	0.42	3.48	30.7%	0.12	0.05	0.13
	6.88	2.76	0.10	0.18	0.27	2.81	24.7%	0.09	0.03	0.10
	6.93	1.88	0.08	0.13	0.15	1.92	16.9%	0.08	0.01	0.09
	6.98	1.51	0.04	0.08	0.07	1.53	13.5%	0.04	0.00	0.05
	7.03	0.65	0.02	0.03	0.01	0.66	5.8%	0.02	0.00	0.03

3/3 = ?

2/3 = .25

STREAM NAME: Grizzly Creek - Top Stake = 3.00
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-001

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	4.63	9.84	0.46	0.81	4.56	10.03	100.0%	0.45	1.49	0.33	
	4.66	9.54	0.45	0.78	4.28	9.72	96.9%	0.44	1.37	0.32	
	4.71	9.01	0.42	0.73	3.82	9.19	91.6%	0.42	1.18	0.31	
	4.76	8.48	0.40	0.68	3.38	8.65	86.2%	0.39	1.00	0.30	
	4.81	8.15	0.36	0.63	2.97	8.30	82.7%	0.36	0.83	0.28	
	4.86	7.82	0.33	0.58	2.57	7.96	79.3%	0.32	0.67	0.26	
	4.91	7.48	0.29	0.53	2.19	7.60	75.8%	0.29	0.53	0.24	
	4.96	7.12	0.26	0.48	1.82	7.23	72.0%	0.25	0.40	0.22	
	5.01	6.75	0.22	0.43	1.47	6.85	68.3%	0.22	0.29	0.20	
WL	5.06	6.22	0.18	0.38	1.15	6.31	62.9%	0.18	0.20	0.18	Q_m
	5.11	5.13	0.17	0.33	0.87	5.20	51.8%	0.17	0.14	0.17	$Q_m = 0.16$
	5.16	4.57	0.14	0.28	0.62	4.64	46.2%	0.13	0.09	0.15	
	5.21	3.42	0.12	0.23	0.42	3.48	34.7%	0.12	0.06	0.13	
	5.26	2.76	0.10	0.18	0.27	2.81	28.0%	0.09	0.03	0.11	
	5.31	1.88	0.08	0.13	0.15	1.92	19.1%	0.08	0.02	0.10	
	5.36	1.51	0.04	0.08	0.07	1.53	15.3%	0.04	0.00	0.07	
	5.41	0.65	0.02	0.03	0.01	0.66	6.5%	0.02	0.00	0.04	

Data Input & Proofing

STREAM NAME:	Grizzly Creek - Top Stake = 3.00
XS LOCATION:	d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER:	071007-001
DATE:	7/10/2007
OBSERVERS:	Uppendahl; H Skinner
1/4 SEC:	NW
SECTION:	25
TWP:	10 N
RANGE:	88 W
PM:	6
COUNTY:	Routt
WATERSHED:	Slater Creek
DIVISION:	6
DOW CODE:	
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.024680851 ft / ft

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

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

Total Data Points = 30

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	3.00			0.00	0.00	0.00
	BS	0.00	3.48			0.00	0.00	0.00
		2.00	3.82			0.00	0.00	0.00
		3.00	3.99			0.00	0.00	0.00
1	GL	4.00	4.22			0.00	0.00	0.00
		5.90	4.89			0.00	0.00	0.00
	WL	6.40	5.03	0.00	0.00	0.00	0.00	0.00
		6.80	5.16	0.10	0.00	0.04	0.00	5.06
		7.20	5.20	0.15	0.00	0.06	0.00	5.05
		7.60	5.21	0.15	0.00	0.06	0.00	5.06
		8.00	5.28	0.15	0.41	0.06	0.02	5.13
		8.40	5.28	0.20	0.47	0.08	0.04	5.08
		8.80	5.44	0.40	0.22	0.16	0.04	5.04
		9.20	5.43	0.35	0.10	0.14	0.01	5.08
		9.60	5.38	0.30	0.38	0.12	0.05	5.08
		10.00	5.38	0.25	0.19	0.10	0.02	5.13
		10.40	5.30	0.25	0.15	0.10	0.02	5.05
		10.80	5.23	0.20	0.06	0.08	0.00	5.03
		11.20	5.18	0.15	0.00	0.06	0.00	5.03
		11.60	5.13	0.10	0.00	0.04	0.00	5.03
		12.00	5.08	0.05	0.00	0.02	0.00	5.03
		12.50	5.08	0.05	0.00	0.03	0.00	5.03
	WL	13.00	5.03	0.00	0.00	0.00	0.00	0.00
		14.00	4.76			0.00	0.00	0.00
1	GL	15.00	4.63			0.00	0.00	0.00
		15.50	4.38			0.00	0.00	0.00
		16.80	3.98			0.00	0.00	0.00
		18.60	3.53			0.00	0.00	0.00
	BS	20.00	2.83			0.00	0.00	0.00
					Totals	1.15	0.20	

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

LOCATION INFORMATION

STREAM NAME:	Grizzly Creek - 090507
XS LOCATION:	d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER:	071007-002
DATE:	5-Sep-07
OBSERVERS:	Uppendahl & Roach (TU)
1/4 SEC:	NW
SECTION:	25
TWP:	10 N
RANGE:	88 W
PM:	6
COUNTY:	Routt
WATERSHED:	Slater Creek
DIVISION:	6
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.01727273

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

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

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002

DATA POINTS= 26

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	3.00			0.00		0.00	0.00	0.0%
BS	0.01	3.53			0.00		0.00	0.00	0.0%
	2.00	3.80			0.00		0.00	0.00	0.0%
1 GL	4.00	4.25			0.00		0.00	0.00	0.0%
	6.00	4.95			0.00		0.00	0.00	0.0%
WL	6.70	5.10	0.00	0.00	0.00		0.00	0.00	0.0%
	7.10	5.05	0.00	0.00	0.00		0.00	0.00	0.0%
	7.50	5.10	0.00	0.00	0.00		0.00	0.00	0.0%
	7.90	5.20	0.10	0.32	0.41	0.10	0.04	0.01	8.3%
	8.30	5.20	0.10	0.44	0.40	0.10	0.04	0.02	11.4%
	8.70	5.35	0.25	0.21	0.43	0.25	0.10	0.02	13.5%
	9.10	5.40	0.30	0.31	0.40	0.30	0.12	0.04	24.0%
	9.50	5.35	0.25	0.42	0.40	0.25	0.10	0.04	27.1%
	9.90	5.30	0.20	0.18	0.40	0.20	0.08	0.01	9.3%
	10.30	5.30	0.20	0.10	0.40	0.20	0.08	0.01	5.2%
	10.70	5.20	0.10	0.05	0.41	0.10	0.04	0.00	1.3%
	11.10	5.15	0.05	0.00	0.40	0.05	0.03	0.00	0.0%
WL	11.70	5.10	0.00	0.00	0.60		0.00	0.00	0.0%
	13.00	5.05			0.00		0.00	0.00	0.0%
	13.80	4.80			0.00		0.00	0.00	0.0%
1 GL	14.90	4.65			0.00		0.00	0.00	0.0%
	16.00	4.35			0.00		0.00	0.00	0.0%
	18.00	3.70			0.00		0.00	0.00	0.0%
	19.10	2.90			0.00		0.00	0.00	0.0%
BS	20.00	2.80			0.00		0.00	0.00	0.0%
TS	20.01	2.42			0.00		0.00	0.00	0.0%
TOTALS ----------					4.27	0.3 (Max.)	0.63	0.16	100.0%

Manning's n = 0.2188
Hydraulic Radius= 0.146495159

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.63	0.63	0.0%
4.85	0.63	2.35	275.7%
4.87	0.63	2.19	250.6%
4.89	0.63	2.04	225.8%
4.91	0.63	1.88	201.4%
4.93	0.63	1.73	177.4%
4.95	0.63	1.59	153.8%
4.97	0.63	1.44	130.6%
4.99	0.63	1.30	107.9%
5.01	0.63	1.16	85.8%
5.03	0.63	1.03	64.1%
5.05	0.63	0.89	42.9%
5.06	0.63	0.83	32.9%
5.07	0.63	0.77	23.5%
5.08	0.63	0.72	14.9%
5.09	0.63	0.67	7.1%
5.10	0.63	0.63	0.0%
5.11	0.63	0.58	-6.6%
5.12	0.63	0.54	-12.9%
5.13	0.63	0.51	-19.0%
5.14	0.63	0.47	-24.8%
5.15	0.63	0.44	-30.4%
5.17	0.63	0.37	-40.9%
5.19	0.63	0.31	-50.6%
5.21	0.63	0.26	-59.0%
5.23	0.63	0.21	-66.2%
5.25	0.63	0.17	-73.1%
5.27	0.63	0.13	-79.5%
5.29	0.63	0.09	-85.4%
5.31	0.63	0.06	-90.3%
5.33	0.63	0.04	-93.9%
5.35	0.63	0.02	-96.8%

WATERLINE AT ZERO
AREA ERROR = 5.100

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002

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"	4.65	9.76	0.42	0.75	4.10	9.95	99.8%	0.41	2.03	0.49
	4.65	9.76	0.42	0.75	4.10	9.95	100.0%	0.41	2.03	0.49
	4.70	9.25	0.39	0.70	3.63	9.42	94.8%	0.38	1.71	0.47
	4.75	8.74	0.36	0.65	3.18	8.90	89.5%	0.36	1.43	0.45
	4.80	8.23	0.33	0.60	2.75	8.38	84.3%	0.33	1.17	0.42
	4.85	7.93	0.30	0.55	2.35	8.06	81.1%	0.29	0.92	0.39
	4.90	7.62	0.26	0.50	1.96	7.74	77.9%	0.25	0.70	0.36
	4.95	7.32	0.22	0.45	1.59	7.42	74.7%	0.21	0.51	0.32
	5.00	6.93	0.18	0.40	1.23	7.02	70.6%	0.18	0.34	0.28
	5.05	6.53	0.14	0.35	0.89	6.61	66.5%	0.14	0.21	0.23
"WL"	5.10	4.20	0.15	0.30	0.62	4.27	42.9%	0.15	0.16	0.25
	5.15	3.40	0.13	0.25	0.44	3.46	34.8%	0.13	0.10	0.22
	5.20	2.40	0.12	0.20	0.28	2.45	24.6%	0.11	0.06	0.21
	5.25	2.07	0.08	0.15	0.17	2.10	21.1%	0.08	0.03	0.17
	5.30	1.33	0.06	0.10	0.07	1.35	13.6%	0.05	0.01	0.13
	5.35	0.80	0.03	0.05	0.02	0.81	8.1%	0.02	0.00	0.08
	5.40	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

3/3 = ?
2/3 = 0.45

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.16	cfs
CALCULATED FLOW (Qc)=	0.16	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	5.10	ft
CALCULATED WATERLINE (WLc)=	5.10	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.25	ft/sec
MANNING'S N=	0.219	
SLOPE=	0.01727273	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.4	cfs

RECOMMENDED INSTREAM FLOW:

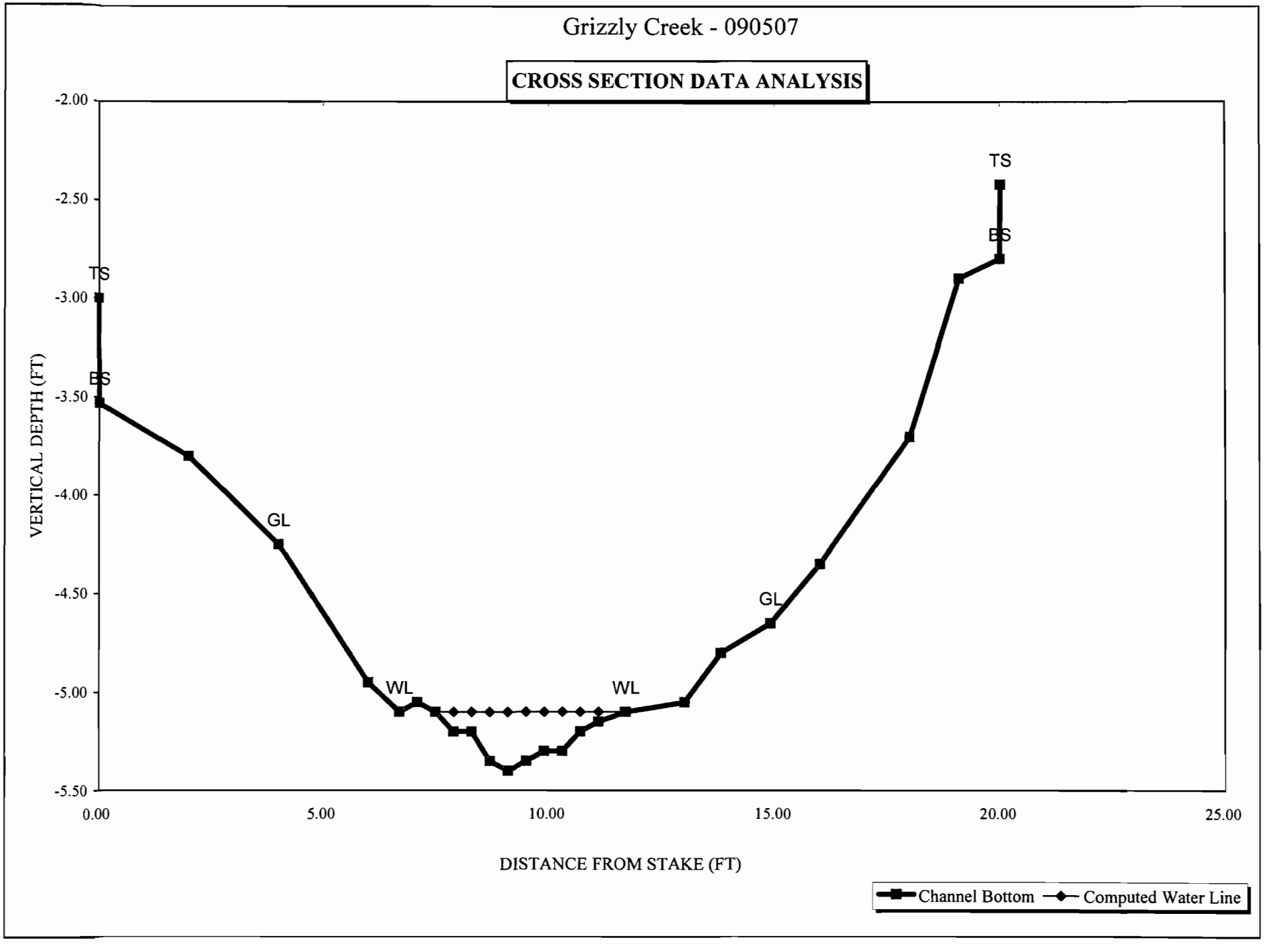
FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

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

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

Grizzly Creek - 090507



Data Input & Proofing

STREAM NAME:	Grizzly Creek - 090507
XS LOCATION:	d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER:	071007-002
DATE:	9/5/2007
OBSERVERS:	Uppendahl & Roach (TU)
1/4 SEC:	NW
SECTION:	25
TWP:	10 N
RANGE:	88 W
PM:	6
COUNTY:	Routt
WATERSHED:	Slater Creek
DIVISION:	6
DOW CODE:	
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.017272727 ft / ft

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

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

Total Data Points = 26

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	3.00			0.00	0.00	0.00
	BS	0.01	3.53			0.00	0.00	0.00
		2.00	3.80			0.00	0.00	0.00
1	GL	4.00	4.25			0.00	0.00	0.00
		6.00	4.95			0.00	0.00	0.00
	WL	6.70	5.10	0.00	0.00	0.00	0.00	0.00
		7.10	5.05	0.00	0.00	0.00	0.00	0.00
		7.50	5.10	0.00	0.00	0.00	0.00	0.00
		7.90	5.20	0.10	0.32	0.04	0.01	5.10
		8.30	5.20	0.10	0.44	0.04	0.02	5.10
		8.70	5.35	0.25	0.21	0.10	0.02	5.10
		9.10	5.40	0.30	0.31	0.12	0.04	5.10
		9.50	5.35	0.25	0.42	0.10	0.04	5.10
		9.90	5.30	0.20	0.18	0.08	0.01	5.10
		10.30	5.30	0.20	0.10	0.08	0.01	5.10
		10.70	5.20	0.10	0.05	0.04	0.00	5.10
		11.10	5.15	0.05	0.00	0.03	0.00	5.10
	WL	11.70	5.10	0.00	0.00	0.00	0.00	0.00
		13.00	5.05			0.00	0.00	0.00
		13.80	4.80			0.00	0.00	0.00
1	GL	14.90	4.65			0.00	0.00	0.00
		16.00	4.35			0.00	0.00	0.00
		18.00	3.70			0.00	0.00	0.00
		19.10	2.90			0.00	0.00	0.00
	BS	20.00	2.80			0.00	0.00	0.00
	TS	20.01	2.42			0.00	0.00	0.00
					Totals	0.63	0.16	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Grizzly Creek						CROSS-SECTION NO.: 2007-02
CROSS-SECTION LOCATION: 1/3 of unnamed tributary						40° 47' 50.6" 107° 13' 10.5"
DATE: 9/5/07	OBSERVERS: Wondahl / Reed					
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 25	TOWNSHIP: 10 (N)/S	RANGE: 88 E(W)	PM: 6	
COUNTY: Routt	WATERSHED: Slater Ck	WATER DIVISION: 6	DOW WATER CODE:			
MAP(S): USGS:						
USFS:						

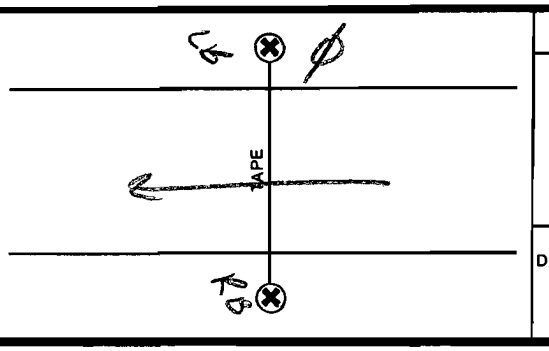
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: Marsh-McBirney Flo-Mate.			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/(NO)	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	5.10/5.10
② WS Upstream	11.0	4.85
③ WS Downstream	22.0	5.42
SLOPE	.57/33.0	

SKETCH



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

13/5.42/4.85/67

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
Fish seen			11														

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Grizzly creek	CROSS-SECTION NO.: 2007-02	DATE: 9/5/07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 14:00

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
TS	0		3.00								
TS	0		3.53								
	2.0		3.80								
GL	4.0		4.25								
	6.0		4.95								
WL	6.7		5.10	0				0			
	7.1		5.05	0				0			
	7.5		5.10	0				0			
	7.9		5.20	.10				.32			
	8.3		5.20	.15				.44			
	8.7		5.35	.25				.21			
	9.1		5.40	.30				.3			
	9.5		5.35	.25				.42			
	9.9		5.30	.20				.18			
	10.3		5.30	.20				.10			
	10.7		5.20	.10				.05			
	11.1		5.15	.05				0			
WL	11.7		5.10	0				0			
	13.0		5.10								
	13.8		4.80								
GL	14.9		4.65								
	16.0		4.35								
	18.0		3.70								
	19.1		2.90								
BS	20.0		2.80								
TS	20.1		2.42								
TOTALS:											0.16

End of Measurement	Time: 15:00	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY: MLH	CALCULATIONS CHECKED BY:

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.77

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

Velocity based on test of R/D84>1

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.65	9.76	0.42	0.75	4.10	9.95	100.0%	0.41	4.48	1.09
	4.65	9.76	0.42	0.75	4.10	9.95	100.0%	0.41	4.48	1.09
	4.70	9.25	0.39	0.70	3.63	9.42	94.8%	0.38	3.57	0.98
	4.75	8.74	0.36	0.65	3.18	8.90	89.5%	0.36	2.79	0.88
	4.80	8.23	0.33	0.60	2.75	8.38	84.3%	0.33	2.14	0.78
	4.85	7.93	0.30	0.55	2.35	8.06	81.1%	0.29	1.54	0.66
	4.90	7.62	0.26	0.50	1.96	7.74	77.9%	0.25	1.07	0.55
	4.95	7.32	0.22	0.45	1.59	7.42	74.7%	0.21	0.71	0.45
	5.00	6.93	0.18	0.40	1.23	7.02	70.6%	0.18	0.44	0.36
	5.05	6.53	0.14	0.35	0.89	6.61	66.5%	0.14	0.25	0.28
WL	5.10	4.20	0.15	0.30	0.62	4.27	42.9%	0.15	0.16	0.25
	5.15	3.40	0.13	0.25	0.44	3.46	34.8%	0.13	0.08	0.19
	5.20	2.40	0.12	0.20	0.28	2.45	24.6%	0.11	0.04	0.15
	5.25	2.07	0.08	0.15	0.17	2.10	21.1%	0.08	0.02	0.10
	5.30	1.33	0.06	0.10	0.07	1.35	13.6%	0.05	0.00	0.05
	5.35	0.80	0.03	0.05	0.02	0.81	8.1%	0.02	0.00	0.02
	5.40	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

3/3 = 3.75

2/3 = 0.6

STREAM NAME: Grizzly Creek - 090507
XS LOCATION: d/s of unnamed tributary. 40 47 51.0; 107 13 11.1
XS NUMBER: 071007-002 Jarrett Variable Manning's n Correction Applied

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	4.65	9.76	0.42	0.75	4.10	9.95	100.0%	0.41	2.39	0.58
	4.65	9.76	0.42	0.75	4.10	9.95	100.0%	0.41	2.39	0.58
	4.70	9.25	0.39	0.70	3.63	9.42	94.8%	0.38	2.00	0.55
	4.75	8.74	0.36	0.65	3.18	8.90	89.5%	0.36	1.64	0.52
	4.80	8.23	0.33	0.60	2.75	8.38	84.3%	0.33	1.33	0.48
	4.85	7.93	0.30	0.55	2.35	8.06	81.1%	0.29	1.03	0.44
	4.90	7.62	0.26	0.50	1.96	7.74	77.9%	0.25	0.76	0.39
	4.95	7.32	0.22	0.45	1.59	7.42	74.7%	0.21	0.54	0.34
	5.00	6.93	0.18	0.40	1.23	7.02	70.6%	0.18	0.35	0.29
	5.05	6.53	0.14	0.35	0.89	6.61	66.5%	0.14	0.21	0.23
WL	5.10	4.20	0.15	0.30	0.62	4.27	42.9%	0.15	0.16	0.25
	5.15	3.40	0.13	0.25	0.44	3.46	34.8%	0.13	0.10	0.22
	5.20	2.40	0.12	0.20	0.28	2.45	24.6%	0.11	0.06	0.20
	5.25	2.07	0.08	0.15	0.17	2.10	21.1%	0.08	0.03	0.15
	5.30	1.33	0.06	0.10	0.07	1.35	13.6%	0.05	0.01	0.11
	5.35	0.80	0.03	0.05	0.02	0.81	8.1%	0.02	0.00	0.06
	5.40	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

3/3 = ?
2/3 = .45

Grizzly Creek

d/s of unnamed tributary

NW S25 T10N R88W 6PM