

## **Stream: Beaver Creek**

### **Executive Summary**

Water Division: 5

Water District: 45

CPW#: 19097

CWCB ID: 12/5/A-001

**Segment:** HEADWATERS TO HEADGATE DAME DITCH

**Upper Terminus:** HEADWATERS IN THE VICINITY OF

UTM North: 4362863.76      UTM East: 253143.54

**Lower Terminus:** HEADGATE DAME DITCH AT

UTM North: 4372572.20      UTM East: 256355.77

**Watershed:** Colorado headwaters-Plateau (HUC#: 14010005)

**County:** Garfield

**Length:** 8.11 miles

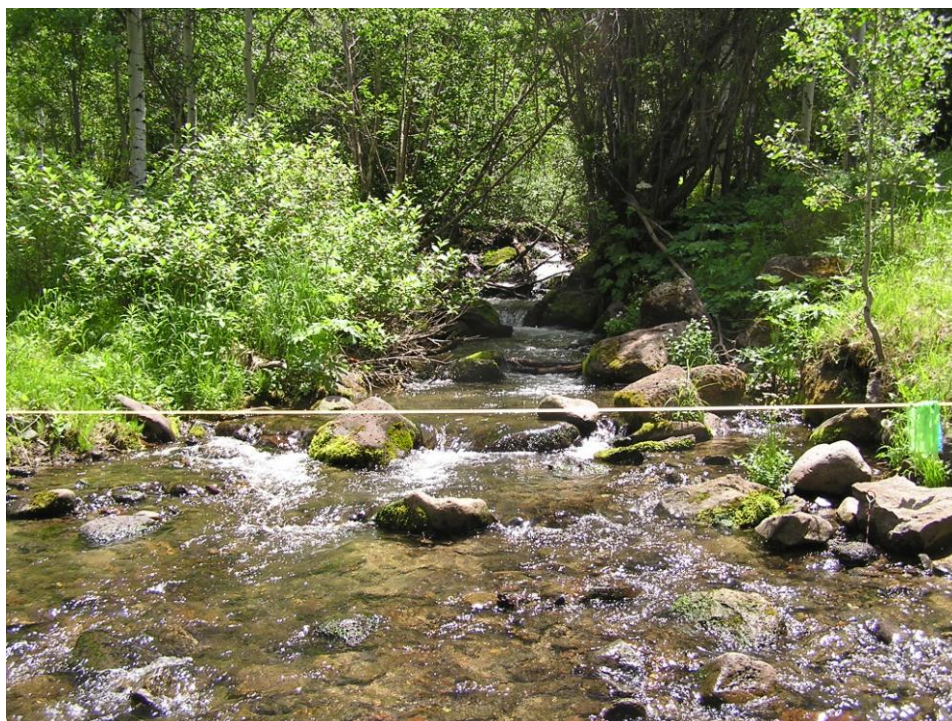
**USGS Quad(s):** North Mamm Peak

**Flow Recommendation:** 4.75 cfs (5/1 – 6/30)

2.85 cfs (7/1 – 7/31)

1.00 cfs (8/1 – 11/30)

0.70 cfs (12/1 – 4/30)



## **Staff Analysis and Recommendation**

### **Summary**

The information contained in this report and the associated supporting data and analyses (located at <http://cwcb.state.co.us/environment/instream-flow-program/Pages/2014ProposedInstreamFlowAppropriations.aspx>) form 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 by ISF 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. Colorado Parks and Wildlife (CPW) recommended this segment of Beaver Creek to the CWCB for a water right under the Instream Flow Program. Beaver Creek is being considered because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

Beaver Creek is approximately 14 miles long and originates on the south flank of North Mamm Peak at an elevation of 10,000 feet. It flows in a northerly direction as it drops to an elevation of 5,500 feet where it joins The Colorado River. Forty-two percent of the land on the 8.11 mile segment addressed by this report is publicly owned (see Table 1). Beaver Creek is located within Garfield County and the total drainage area of the creek is approximately 13.2 square.

The subject of this report is a segment of Beaver Creek beginning at the headwaters and extending downstream to the Dame Ditch. The proposed segment is located approximately 4.2 miles southwest of the town of Rifle. Staff has received one recommendation for this segment from CPW, which is discussed below.

### **Instream Flow Recommendation**

CPW recommended flows of 4.75 cfs (5/1 – 6/30), 2.85 cfs (7/1 – 7/31), 1.00 cfs (8/1 – 11/30) and 0.70 cfs (12/1 – 4/30), based on its July 7, 2010 and August 18, 2010 data collection efforts and staff's water availability analyses.

### **Land Status Review**

Table 1. Summary of land ownership data in the vicinity of the proposed ISF on Beaver Creek

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Headwaters	Dame Ditch Headgate	8.11	58%	42%

All of the public lands in this segment are managed by the US Forest Service.

## Biological Data

Beaver Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment supports Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) and brown trout (*Salmo trutta*).

## Field Survey Data

CPW 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 CPW 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. Colorado Parks and Wildlife has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, two data sets were collected, with the results shown in Table 2 below. Table 2 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 (250% 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. 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 2. Summary of R2Cross measurements and analysis for Beaver Creek.

Party	Date	Q (cfs)	Accuracy Range (cfs)	Winter (2/3) (cfs)	Summer (3/3) (cfs)
CPW	7/7/2010	4.2	1.7 – 10.4	1.9	4.75
CPW	8/18/2010	2.2	0.9 – 5.6	1.4	Out of Range
			Averages	1.65	4.75

The summer flow recommendation which met 3 of 3 hydraulic criteria and was within the accuracy range of the model ranged was 4.75 cfs. The winter flow recommendations which met 2 of 3 hydraulic criteria and that were within the accuracy range of the model ranged from 1.9 cfs to 1.4 cfs. Averaging

the winter flow recommendations that fell within the accuracy range of the model resulted in a winter flow recommendation of 1.65 cfs. The winter recommendation was lowered to 0.7 cfs due to water availability constraints. In addition, the shoulder month recommendations were adjusted to reflect the timing and amount of flow estimated from the water availability analysis.

## **Hydrologic Data and Analysis**

CWCB staff conducts hydrologic analyses for each recommended instream flow (ISF) appropriation to provide the Board with a basis for making the determination that water is available. Each recommended ISF reach has a unique flow regime that depends on variables such as the timing, magnitude, and location of water inputs (such as rain, snow, and snowmelt) and water losses (such as diversions, reservoirs, evaporation and transpiration, groundwater recharge, etc). Although extensive and time consuming investigations of all variables may be possible, staff takes a pragmatic and cost-effective approach to analyze water availability. This approach focuses on streamflows and the influence of flow alterations, such as diversions, to understand how much water is physically available in the recommended reach.

Staff's hydrologic analysis is data-driven, meaning that staff gathers and evaluates the best available data and uses the best available analysis method for that data. Whenever possible, long-term stream gage data (period of record 20 or more years) will be used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and StreamStats will be used when long-term gage data is not available. StreamStats, a statistical hydrologic program, uses regression equations developed by the USGS (Capesius and Stephens, 2009) to estimate mean flows for each month based on drainage basin area and average drainage basin precipitation. Diversion records will also be used to evaluate the effect of surface water diversions when necessary. Interviews with water commissioners, landowners, and ditch or reservoir operators can provide additional information. A range of analytical techniques may be employed to extend gage records, estimate streamflow in ungaged locations, and estimate the effects of diversions. The goal is to obtain the most detailed and reliable estimate of actual hydrology using the most efficient analysis technique.

The final product of the hydrologic analysis to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available; otherwise, mean-monthly streamflow values will be presented.

## **Background**

The proposed instream flow on Beaver Creek has a 7.86 square mile drainage basin. The average elevation of the basin is 9,420 ft and the average precipitation is 29.5 inches. There are two decreed absolute surface diversions within this reach of stream: L and C Ditch (appropriation date 1892, 10 cfs) and Beaver Creek Grass Mesa Ditch (appropriation dates 1892, 10 cfs; 1907, 12.64 cfs; 1907, 2.0 cfs). The Beaver Grass Mesa Ditch has 10 years with recorded use from 1975 to 2012. The L and C ditch is an alternate point of diversion for the Beaver Creek Grass Mesa Ditch; it has 12 years of recorded use

from 1975 to 2012. Both of these ditches can be called out by senior rights lower in the basin during times of shortage. There are also four spring water rights in the basin with a maximum diversion rate of 0.275 cfs. Therefore, streamflow in the proposed ISF reach is likely to be nearly natural flow conditions in most years.

There was a historical gage on Beaver Creek, Beaver Creek near Rifle (USGS 09092500, operated from 1952 to 1982). This gage was located approximately 1,370 ft downstream from the proposed lower terminus. The gage was potentially influenced by the diversions mentioned above plus the Dame Ditch (appropriation dates 1884 and 1887, 2.833 cfs) and Smith and Neve Ditch (appropriation date 1887, 2.48 cfs) which are located at and below the lower terminus respectively. Both of these ditches are senior to the diversions upstream and could pull water through the proposed ISF reach.

### **Data Analysis**

USGS gage 09092500 provides the best available data for Beaver Creek. The final data was scaled to the lower terminus using the area-precipitation method which resulted in a ratio of 0.99, well within the guidelines of 0.5 to 2.5 proposed by Archfield and Vogel (2009). The area-precipitation method estimates streamflow based on the ratio of the precipitation weighted drainage area at the lower terminus location to that of the gage location. The median and 95% confidence intervals for the median were calculated using the gage dataset. Statistically there is 95% confidence that the true value of the median is located within the confidence interval.

The hydrograph (Figure 1) shows that the proposed instream flow rate is below the median daily streamflow 355 days of the year. The proposed ISF is above the median streamflow for ten days; 1 day in February, 3 days in early May, 5 days in July and 1 day in November. Each of those days is below the upper 95% confidence interval for the median. Staff has concluded that water is available for appropriation on Beaver Creek.

### **Citations**

Archfield, S.A., and R.M. Vogel, 2009, Map correlation method: selection of reference streamgage to estimate daily streamflow at ungaged catchments, *Water Resources Research*, vol 46, W10513, doi:10.1029/2009WR008481.

Capesius, J.P. and V.C. Stephens, 2009, Regional regression equations for estimation of natural streamflow statistics in Colorado, *Scientific Investigations Report* 2009-5136.

Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

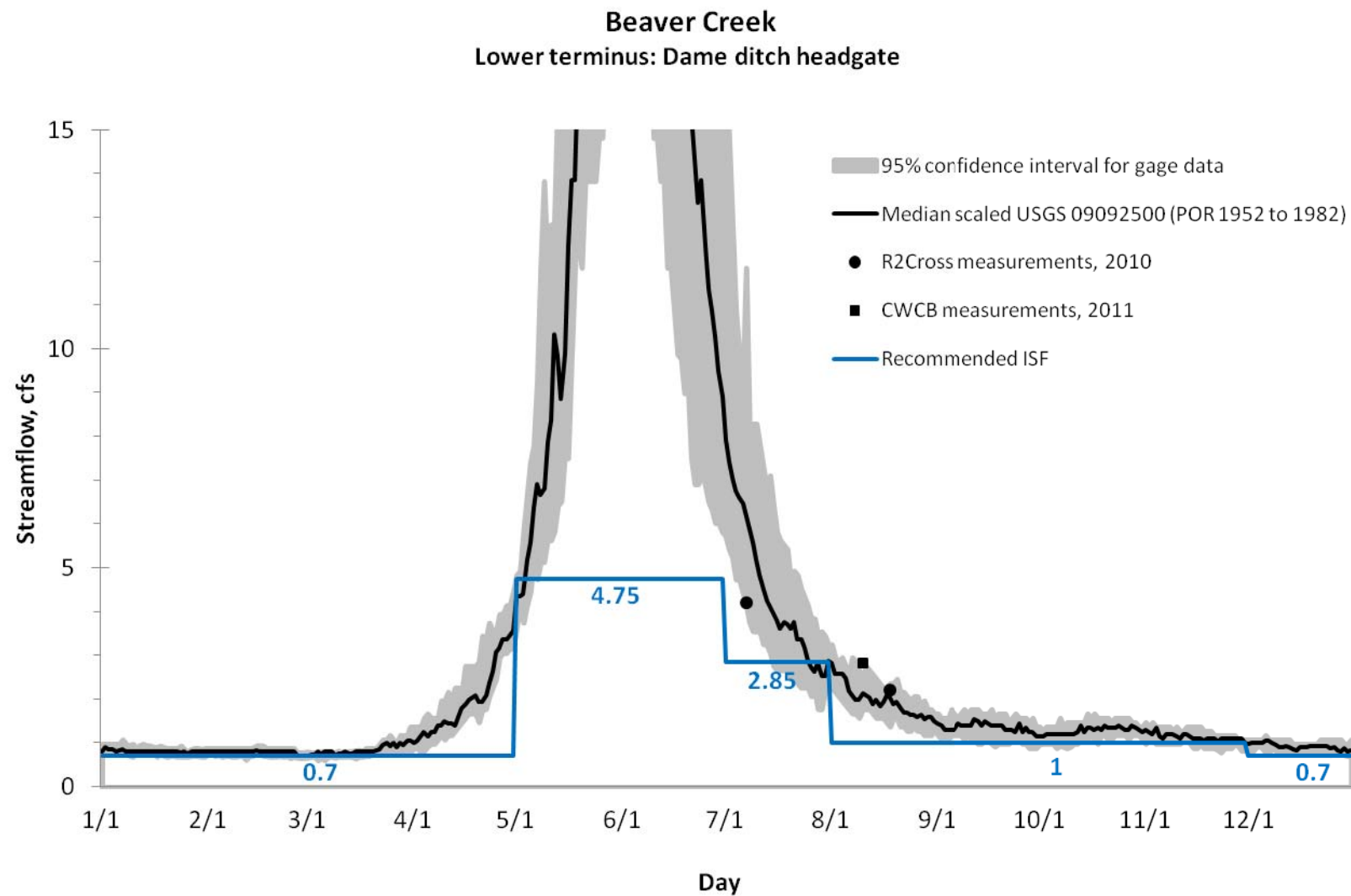


Figure 1. Hydrograph showing streamflow data and the proposed ISF rate on Beaver Creek.

## Existing Water Rights

Staff has analyzed the water rights tabulation and determined that there are two decreed absolute surface diversions within this reach of stream; L and C Ditch for 10 cfs with an 1892 appropriation date and Beaver Creek Grass Mesa Ditch for 24.64 cfs with 1892 and 1907. Staff has concluded that a new junior appropriation of water rights on Beaver Creek can exist 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 that the Board form its intent to appropriate on the following stream reach:

**Segment:** HEADWATERS TO HEADGATE DAME DITCH

**Upper Terminus:** HEADWATERS IN THE VICINITY OF

UTM North: 4362863.76      UTM East: 253143.54

(Latitude 39° 22' 47.93"N)    (Longitude 107° 51' 57.48"W)

SE NE Section 10, Township 8 South, Range 94 West 6<sup>th</sup> PM

800' West of the East Section Line; 2,000' South of the North Section Line

**Lower Terminus:** HEADGATE DAME DITCH

UTM North: 4372572.20      UTM East: 256355.77

(Latitude 39° 28' 5.76"N)    (Longitude 107° 49' 5.76"W)

SW NE Section 1, Township 7 South, Range 94 West 6<sup>th</sup> PM

1,519' West of the East Section Line; 2,430' South of the North Section Line

**Watershed:** Colorado headwaters-Plateau (HUC#: 14010005)

**County:** Garfield

**Length:** 8.11 miles

**USGS Quad(s):** North Mamm Peak

**Flow Recommendation:** 4.75 cfs (5/1 – 6/30)

2.85 cfs (7/1 – 7/31)

1.00 cfs (8/1 – 11/30)

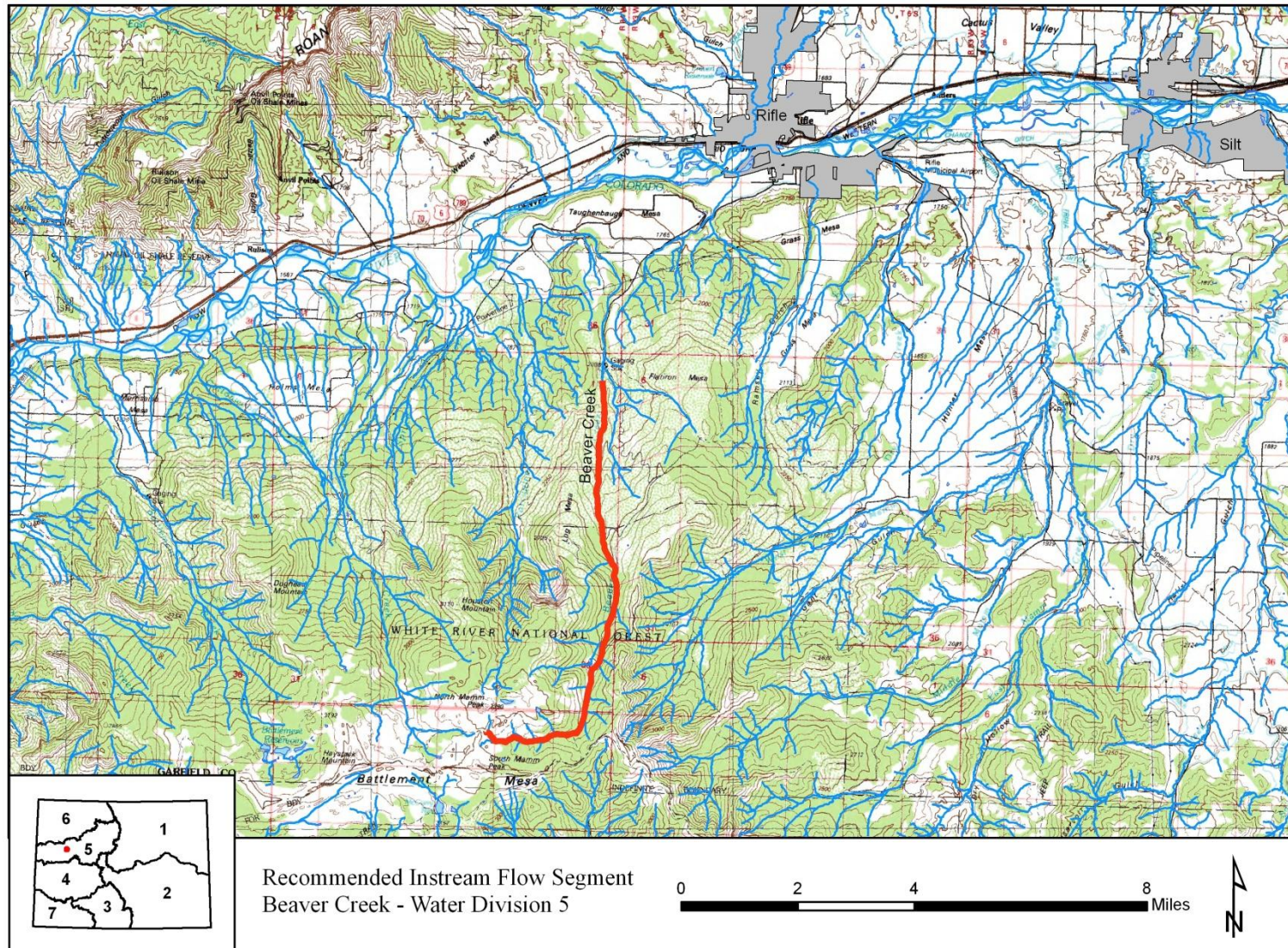
0.70 cfs (12/1 – 4/30)

### Metadata Descriptions:

- a) The UTM, PLSS and Lat/Long locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).
- b) The PLSS locations were derived from CWCB GIS using 2005 PLSS data from the U.S. Bureau of Land Management's Geographic Coordinate Database
- c) Projected Coordinate System: NAD 1983 UTM Zone 13N

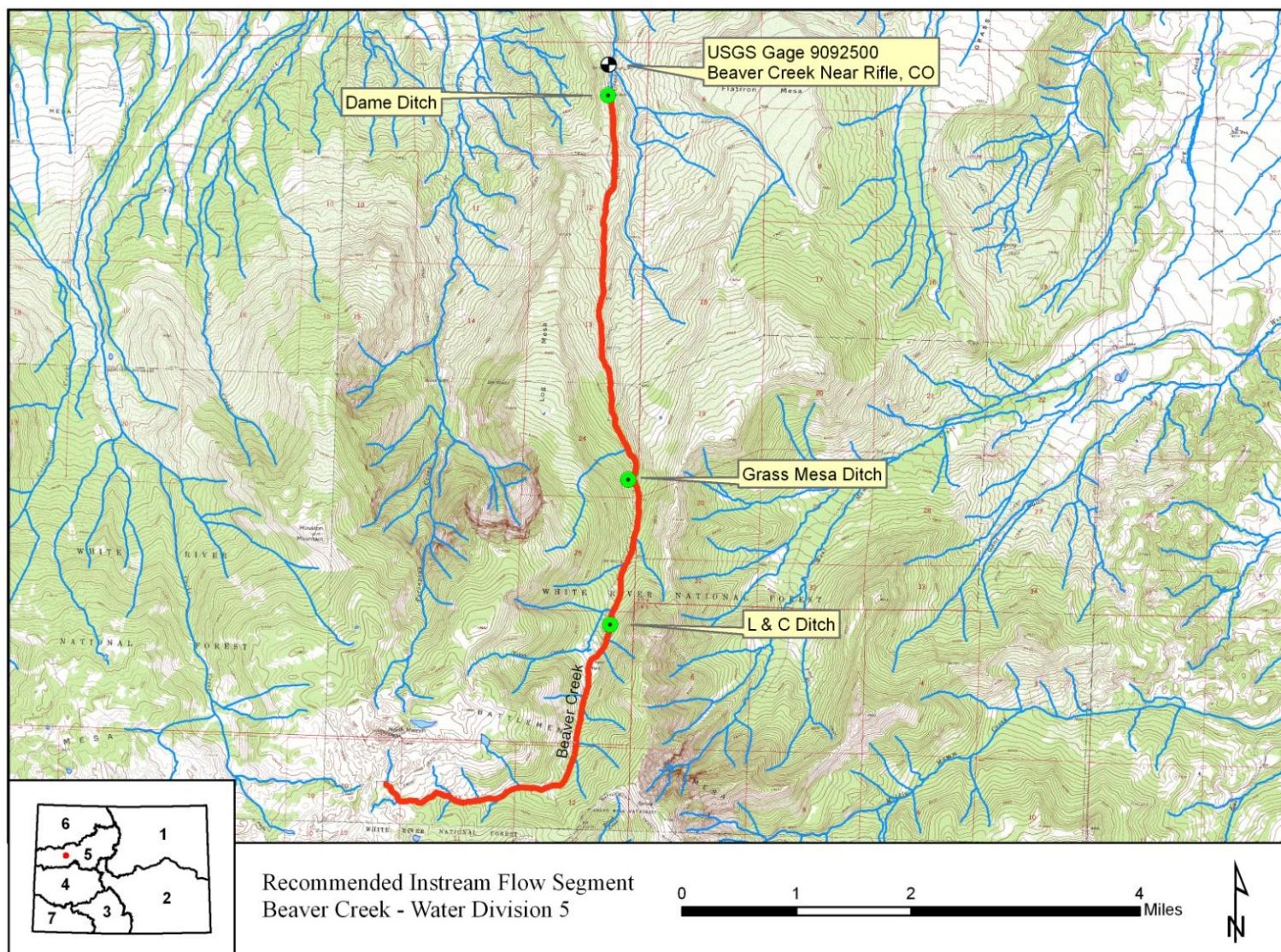


## Vicinity Map





# Water Rights Map





## Land Use Map

