# <u>Stream:</u> Beaver Dam Creek

## Executive Summary

Water Division: 5
Water District: 45
CPW#: 20979
CWCB ID: 12/5/A-002

**Segment:** HEADWATERS TO CONFLUENCE EAST DIVIDE CREEK

**Upper Terminus**: HEADWATERS IN THE VICINITY OF
UTM North: 4359384.32 UTM East: 289024.04

**Lower Terminus**: CONFLUENCE EAST DIVIDE CREEK AT
UTM North: 4360138.20 UTM East: 286958.19

**Watershed:** Colorado headwaters-Plateau (HUC#: 14010005)
**Counties**: Mesa
**Length**: 1.60 miles
**USGS Quad(s)**: Quaker Mesa
**Flow Recommendation:** 0.90 cfs (05/01 – 8/31)
0.35 cfs (09/1 – 10/31)
0.14 cfs (11/1 – 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 Dam Creek to the CWCB for a water right under the Instream Flow Program. Beaver Dam 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 Dam Creek is approximately 1.6 miles long and originates in the White River National Forest at an elevation of 9,120 feet. It flows in an easterly direction as it drops to an elevation of 8,400 feet where it joins East Divide Creek. One Hundred percent of the land on the 1.6 mile segment addressed by this report is publicly owned (see Table 1). Beaver Dam Creek is located within Mesa County and the total drainage area of the creek is approximately 0.81 square miles.

The subject of this report is a segment of Beaver Dam Creek from the headwaters extending downstream to the confluence with East Divide Creek. The proposed segment is located approximately 13 miles southeast of the town of Silt. Staff has received one recommendation for this segment from the CPW, which is discussed below.

## Instream Flow Recommendation

CPW recommended flows of 0.90 cfs (05/01 – 8/31), 0.35 cfs (09/1 – 10/31) and 0.14 cfs (11/1 – 4/30), based on its July 8, 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 Dam Creek.

| Upper Terminus | Lower Terminus | Total Length (miles) | Land Ownership | |
|---|---|---|---|---|
| | | | % Private | % Public |
| Headwaters | Confluence East Divide Creek | 1.60 | 0% | 100% |

All of the public lands in this segment are managed by the USFS.

## Biological Data

Beaver Dam Creek is classified as a small stream (between 10 to 19 feet wide) and fishery surveys indicate the stream environment supports Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*).

## 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 set was 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 rate required.

Table 2. Summary of R2Cross measurements and analysis for Beaver Dam Creek.

| Party | Date | Q (cfs) | Accuracy Range (cfs) | Winter (2/3) (cfs) | Summer (3/3) (cfs) |
|---|---|---|---|---|---|
| CPW | 7/8/2010 | 0.13 | 0.1 – 0.3 | outside of range | outside of range |
| CPW | 7/21/2011 | 0.38 | 0.2 – 0.9 | 0.35 | outside of range |

0.9 cubic feet per second is the highest flow that can accurately be predicted by the R2CROSS data collected to date on Beaver Dams Creek and is recommended for the summer months (as a surrogate for a flow recommendation that meets all three hydraulic criteria). 0.35 cubic feet per second is required to maintain two of the three principal hydraulic criteria; average depth and percent wetted

perimeter. 0.14 cubic feet per second is required to maintain the percent wetted perimeter requirement, and should be sufficient to minimally protect the over wintering fish population

## 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 Information

The proposed instream flow on Beaver Dam Creek represents a headwater stream with a small 0.81 square mile drainage basin. The average elevation of the basin is 8,940 ft and the average precipitation is 31.01 inches. There are no known surface water diversions in the drainage basin tributary to the proposed ISF; therefore, flow conditions in the basin are natural or unaltered.

There is not a gage on Beaver Dam Creek. The nearest gage is downstream on East Divide Creek (East Divide Creek near Silt, CO, USGS 0909700, operated from 1959 to 1965). The East Divide Creek gage has a substantially larger drainage basin area (40.5 square miles). The scaling ratio based on the area-

precipitation method was extremely small (0.022) and well outside of the range (0.5 to 2.5) proposed by Archfield and Vogel (2009) for drainage area scaling. Therefore, StreamStats was the best available information to represent this headwater stream.

**Data Analysis**

The hydrograph (Figure 1) shows the StreamStats results and the proposed instream flow rate. The proposed instream flow rate is at or below the StreamStats mean-monthly streamflow for all months. Based on the available data, staff concludes that water is available for appropriation on Beaver Dam 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:10.10/29/2009WR008481.

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.

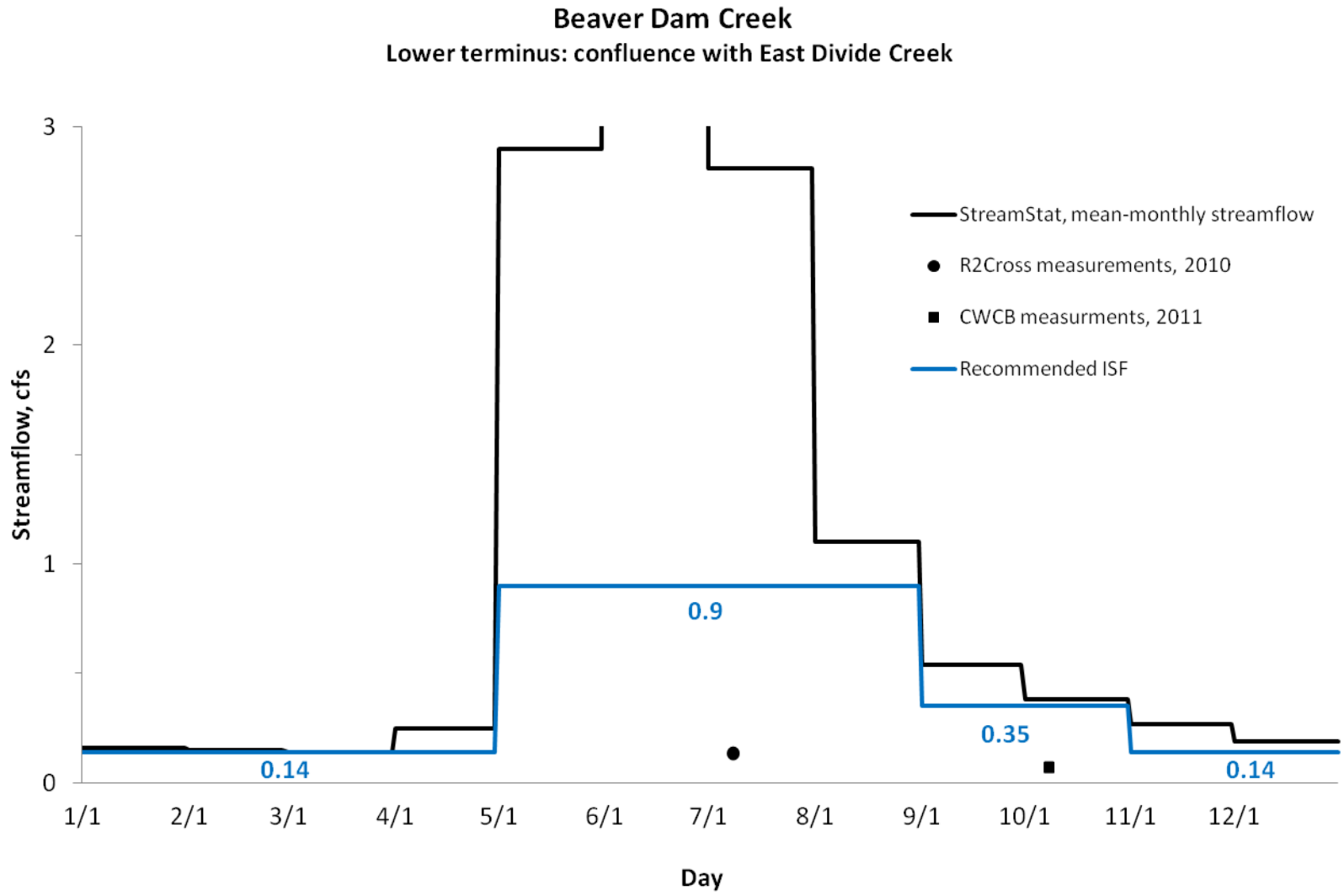



Figure 1. Hydrograph showing streamflow data and the proposed ISF flow rate on Beaver Dam Creek.

## Existing Water Rights

Staff has analyzed the water rights tabulation and determined that there are no decreed absolute surface diversions within this reach of stream. Staff has concluded that a new junior appropriation of water rights on Beaver Dam 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 CONFLUENCE EAST DIVIDE CREEK

**Upper Terminus**: HEADWATERS IN THE VICINITY OF
UTM North: 4359384.32 UTM East: 289024.04
(Latitude 39° 21' 29.41"N) (Longitude 107° 26' 55.29"W)
NE SW Section 16, Township 8 South, Range 90 West 6th PM
1,954' East of the West Section Line; 2,032' North of the South Section Line

**Lower Terminus**: CONFLUENCE EAST DIVIDE CREEK AT
UTM North: 4360138.20 UTM East: 286958.19
(Latitude 39° 21' 52.02"N) (Longitude 107° 28' 22.39"W)
NW NW Section 17, Township 8 South, Range 90 West 6th PM
422' West of the East Section Line; 1,008' South of the North Section Line

**Watershed:** Colorado headwaters-Plateau (HUC#: 14010005)
**Counties**: Mesa
**Length**: 1.60 miles
**USGS Quad(s)**: Quaker Mesa
**Flow Recommendation:** 0.90 cfs (05/01 – 8/31)
0.35 cfs (09/1 – 10/31)
0.14 cfs (11/1 – 4/30)

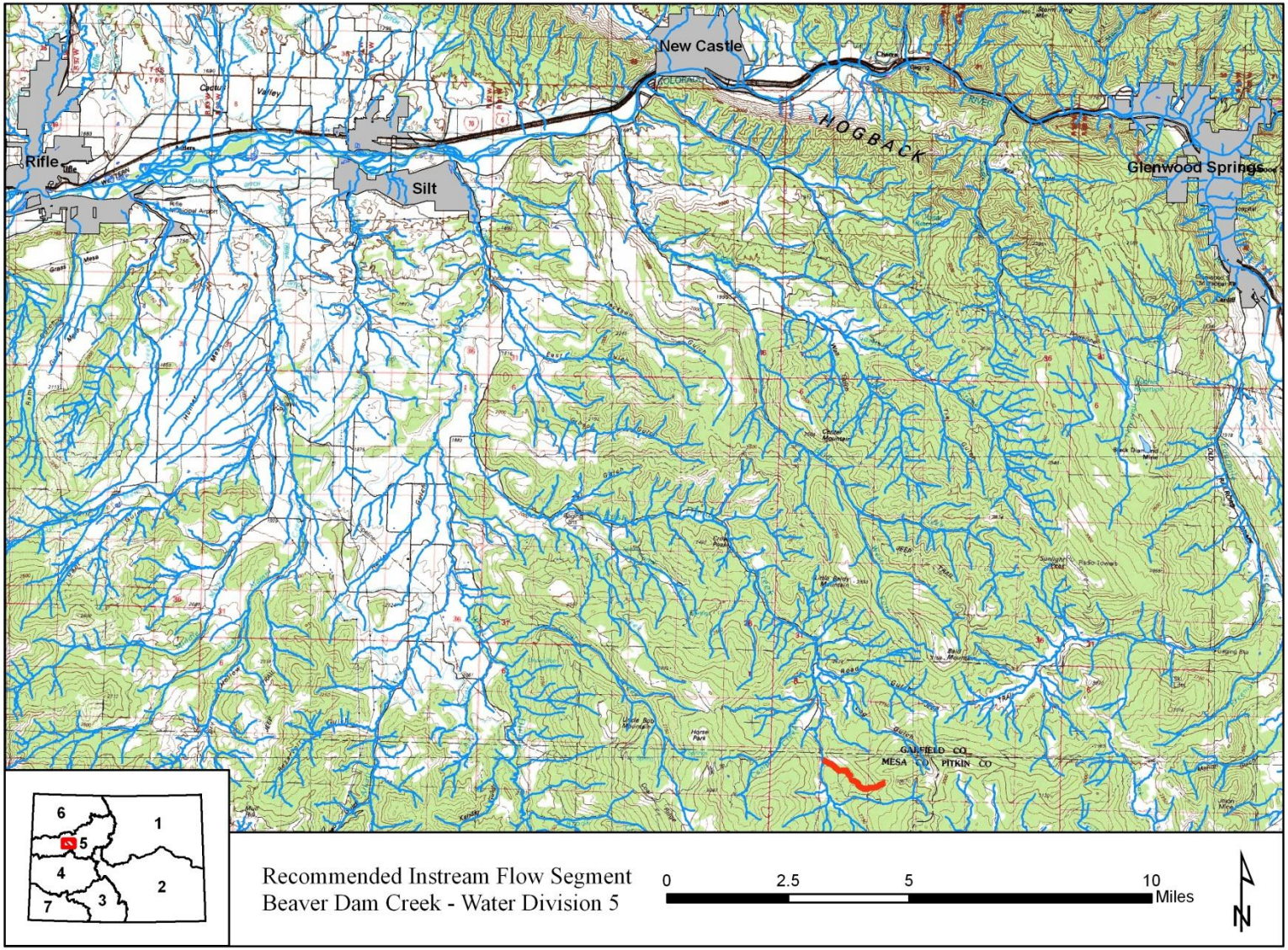
Metadata Descriptions:

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).

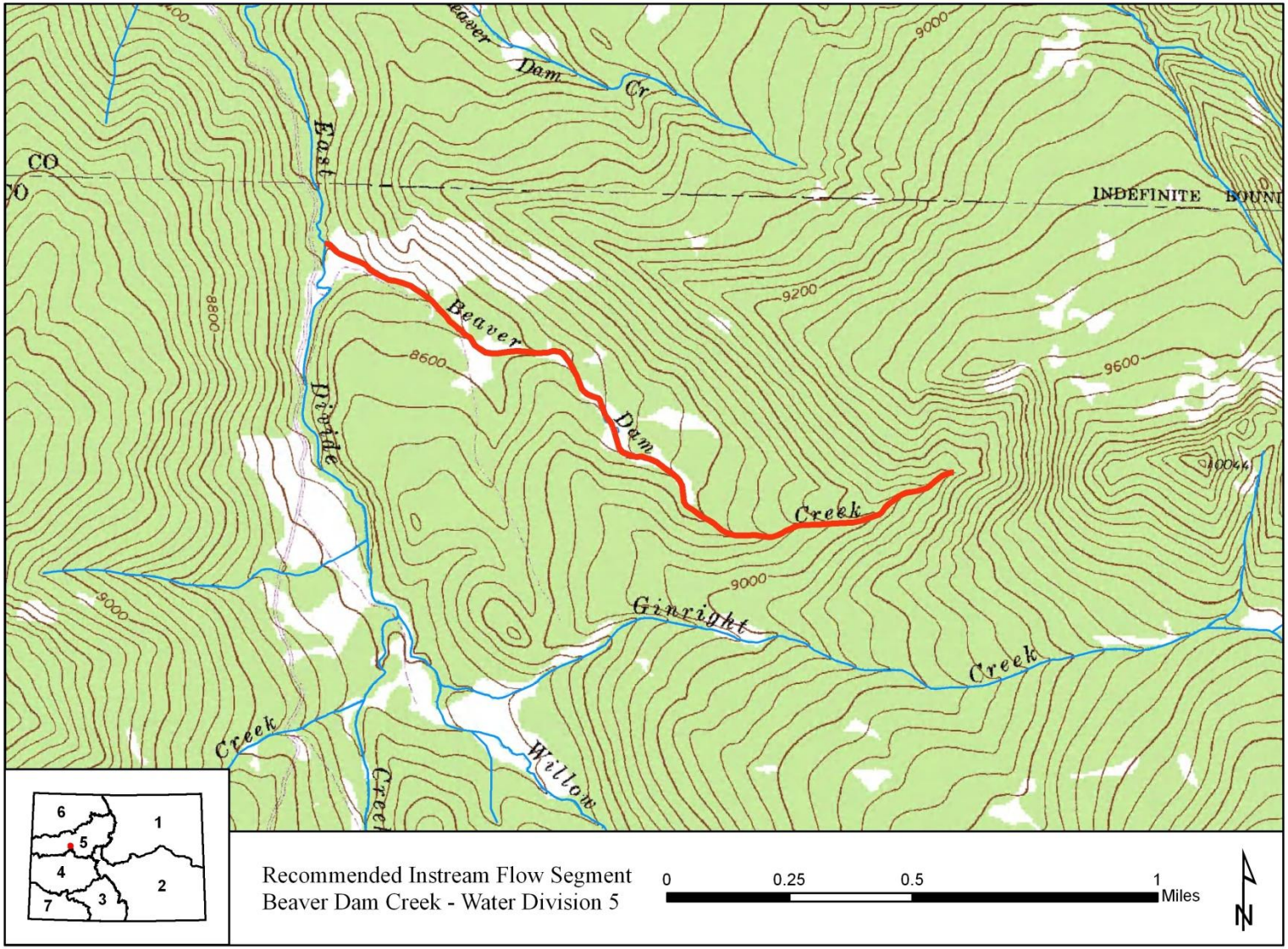
b) The PLSS locations were derived from CWCB GIS using 2005 PLSS data from the U.S. Bureau of Land Management's Geographic Coordinate Database

c) Projected Coordinate System: NAD 1983 UTM Zone 13N

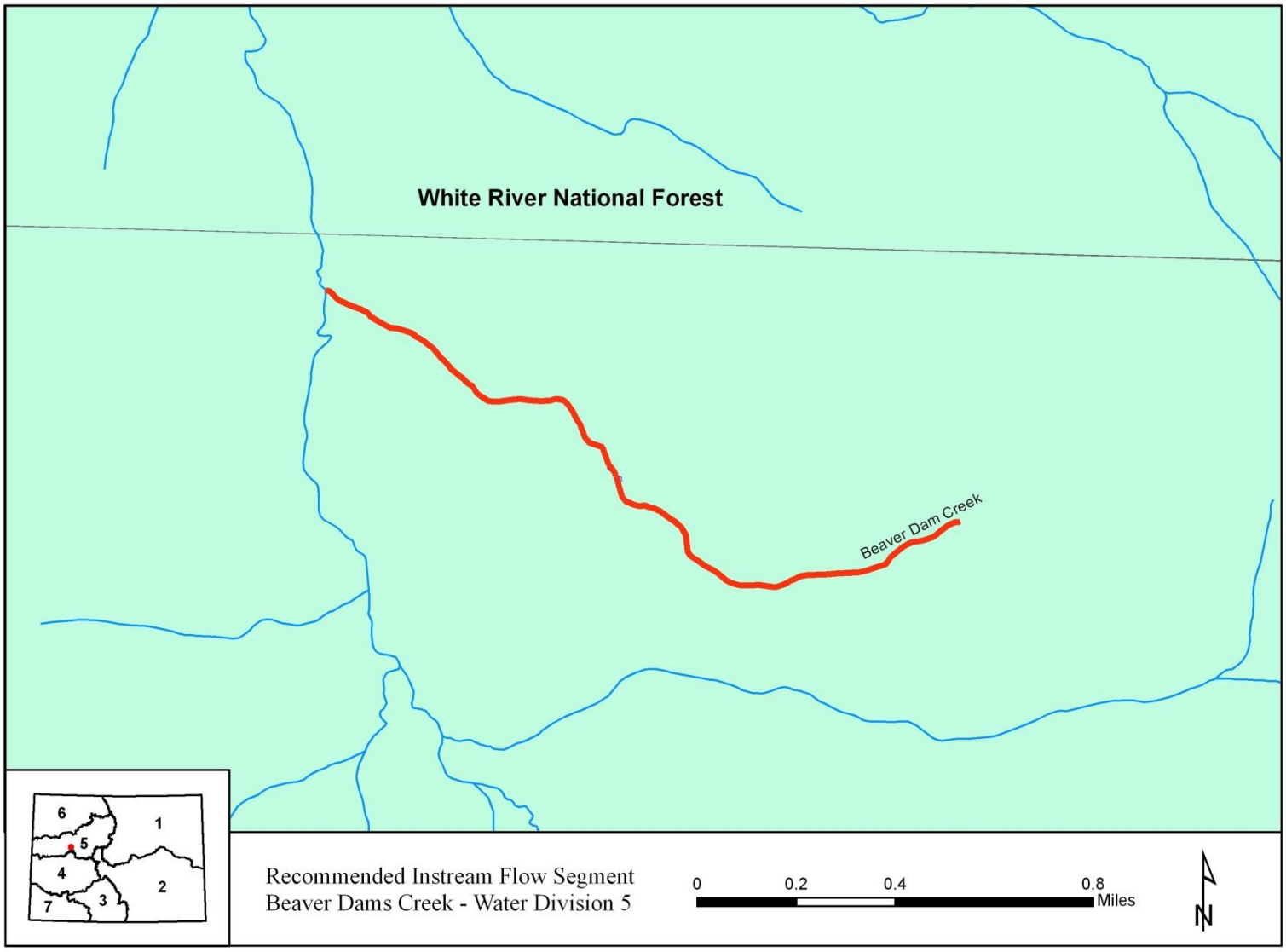
# Vicinity Map



# Water Rights Map



# Land Use Map


White River National Forest
Beaver Dam Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Beaver Dams Creek - Water Division 5
0
0.2
0.4
0.8
Miles
N