COLORADO
Colorado Water Conservation Board
Department of Natural Resources

East Douglas Creek (Upper)
Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence Bear Park Creek at UTM North: 4393993.88 UTM East: 182860.70
LOWER TERMINUS:	Confluence Brush Creek at UTM North: 4395976.77 UTM East: 181933.58
WATER DIVISION:	6
WATER DISTRICT:	43
COUNTY:	Garfield & Rio Blanco
WATERSHED:	Lower White (HUC#:14050007)
CWCB ID:	15/6/A-004
RECOMMENDER	Bureau of Land Management
LENGTH:	1.56 miles
FLOW RECOMMENDATION:	2.1 cfs (5/1 – 7/15) 0.5 cfs (7/16 – 10/15)
EXISTING ISF:	5-85CW259; 1.0 cfs (1/1-12/31)

EAST DOUGLAS CREEK (UPPER)

Introduction

Colorado's General Assembly created the Instream Flow and Natural Lake Level Program in 1973, recognizing "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 (CWCB or Board) with the exclusive authority to appropriate and acquire instream flow (ISF) and natural lake level water rights. Before initiating a water right filing, the Board must determine that: 1) there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted, 2) the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made, and 3) such environment can exist without material injury to water rights.

The Bureau of Land Management (BLM) recommended that the CWCB appropriate an increase to the existing ISF water right on East Douglas Creek. The CWCB currently holds an instream flow water right on East Douglas Creek for 1.0 cfs (1/1-12/31) in Case No. 5-85CW259. The BLM does not consider the current instream flow water right to be fully protective of the natural environment in East Douglas Creek, pursuant to modern analytical procedures used by the CWCB. The current instream flow water right does not meet all three instream flow criteria during the spring and summer, which is a critical growth and spawning period for the fish population. Since the stream supports native cutthroat trout, the BLM considers a fully protective instream flow water right to be essential.

East Douglas Creek is located within parts of Garfield and Rio Blanco Counties about 29 miles south of the town of Rangely (See Vicinity Map). East Douglas Creek originates at an elevation of 7,900 feet. It flows in a northerly direction as it drops to an elevation of 5,980 feet where it joins with West Douglas Creek to form Douglas Creek. The proposed reach extends from the confluence with Bear Park Creek downstream to the confluence with Brush Creek. Sixty-one percent of the land on the 1.56 mile proposed reach is publicly owned and managed by the BLM (See Land Ownership Map). BLM recommended this reach of East Douglas Creek because it has a natural environment that can be preserved to a reasonable degree with an increased ISF water right.

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/2015ProposedISFAppropriations.aspx) form the basis for staff's ISF recommendation to be considered by the Board. This report provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury.

Natural Environment

CWCB staff relies on the recommending entity to provide information about the natural environment. In addition, staff reviews information and conducts site visits for each recommended ISF appropriation.

This information is used to provide the Board with a basis for determining that a natural environment exists.

East Douglas Creek is a cold-water, moderate to high gradient stream. It flows through a canyon with a valley floor approximately one-fourth mile in width. The stream cuts through alluvial deposits in the narrow valley and is not confined by bedrock in most locations. The stream generally has small substrate, consisting of sands, gravels, and cobbles. While riffle habitat is abundant, parts of the stream lack extensive pool habitat because of historic overgrazing and lack of woody vegetation.

Fisheries surveys have revealed a self-sustaining population of native cutthroat trout and speckled dace. The BLM is considering implementation of a project to reclaim a portion of the creek to support genetically pure native cutthroat trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

The riparian community is generally comprised of a mix of blue spruce and Douglas fir, with some open areas comprised of grasses and sedges. The riparian area is in good condition and the cover and shading for the stream is good.

Table 1. List of species identified in upper East Douglas Creek.

Species Name	Scientific Name	Status
native cutthroat trout	*Oncorhynchus clarkii**	State Species of Special Concern BLM Sensitive Species
speckled dace	*Rhinichthys osculus*	none

**Identification of subspecies / lineage of native cutthroat trout in Coloardo is ongoing through genetic testing and research.*

ISF Quantification

CWCB staff relies upon the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Methodology

BLM staff used the R2Cross methodology to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (Espegren, 1996). Riffles are most easily visualized as the stream habitat types that would dry up first should streamflow cease. The field data collected consists of streamflow measurements and surveys of channel geometry at a transect and of the longitudinal slope of the water surface.

The field data is used to model three hydraulic parameters: average depth, average velocity, and percent wetted perimeter. Maintaining these 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). BLM staff interprets the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on meeting 3 of 3 hydraulic criteria. The winter flow recommendation is based on meeting 2 of 3 hydraulic criteria. The model's suggested accuracy range is 40% to 250% of the streamflow measured in the field. Recommendations that fall outside of the accuracy range may not give an accurate estimate of the hydraulic parameters necessary to determine an ISF rate.

The R2Cross methodology provides the biological quantification of the amount of water needed for summer and winter periods based on empirical studies of fish species preferences. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree, or withdraws the recommendation.

Data Analysis

R2Cross data was collected at two transects for this proposed ISF reach (Table 2). Results obtained at more than one transect are averaged to determine the R2Cross flow rate for the reach of stream. The R2Cross model results in a summer flow of 3.1 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a winter flow of 1.1 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model.

Table 2. Summary of R2Cross transect measurements and results for upper East Douglas Creek.

Entity	Date Measured	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	7/29/2009	1.6	0.6 – 4.0	1.11	2.33
BLM	7/29/2009	1.55	0.6 – 3.9	1.11	3.88
			Mean	**1.11**	**3.10**

ISF Recommendation

BLM recommends flow increases of 2.1 cfs (5/1 – 7/15) and 0.5 cfs (7/16 – 10/15), based on R2Cross modeling analyses, biological expertise and staff's water availability analysis.

3.1 cfs is recommended for the snowmelt runoff period from May 1 through July 15. Protecting 3.1 cfs will require an increase of 2.1 cfs to the existing instream flow water right. This recommendation is

driven by the average velocity and wetted perimeter criteria. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff flows are available.

1.5 cubic feet per second is recommended for the late summer and early fall period from July 16 through October 15. Protecting 1.5 cfs during this period will require an increase of 0.5 cfs to the existing instream flow water right. This recommendation is driven by water availability, but this flow rate comes very close to meeting two out of the three instream flow criteria. This flow rate is capable of maintaining pool habitat in the creek and preventing excessively water high temperatures.

The BLM recommends that the existing instream flow water right of 1.0 cfs remain unchanged for the time period between October 16 and April 30. It appears that the existing water right accurately reflects the limited water availability during the winter months.

Water Availability

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for making the determination that water is available.

Methodology

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 analyzing 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 hydrology using the most efficient analysis technique.

The final product of the hydrologic analysis used 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, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data.

Basin Characteristics

The proposed ISF increase on upper East Douglas Creek has a 12.9 square mile drainage basin. The average elevation of the basin is 8,140 ft and the average precipitation is 21.58 inches. There are no surface water diversions with records within the drainage basin tributary to the proposed ISF. Consequently, streamflow represents essentially natural flow conditions.

Available Data

East Douglas Creek is a tributary to Douglas Creek. There is a not a current or historic gage on East Douglas Creek, but there is a historic gage on Douglas Creek. The Douglas Creek gage (USGS 09306380 Douglas Creek at Rangely, CO) is located near the confluence with the White River. This gage has a short and intermittent record from 10/1/1976 to 9/30/1978 and 3/9/1994 to 9/30/1995. The drainage basin tributary to the Douglas Creek gage is 425 square miles, the average elevation of the basin is 6,940 ft, and the average precipitation is 16.3 inches. The proration factor between the proposed lower terminus and the Douglas Creek gage is 4.0%. The proration factor is based on the area-precipitation method which estimates streamflow using the ratio of the precipitation weighted drainage area at the lower terminus location to that of the gage location. Large differences in drainage basin size may produce inaccurate results when scaling streamflow (Archfield and Vogel, 2009). Due to the short period of record and small proration factor, the Douglas Creek gage was not used to estimate streamflow at the lower terminus.

The Corral Gulch gage (USGS 09306242 Corral Gulch near Rangely, CO) is located approximately 21 miles east of the proposed lower terminus. This gage has a long period of record, 1974 to present. The drainage basin tributary to the Corral Gulch gage is 31.7 square miles, the average elevation of the basin is 7,540 ft, and the average precipitation is 19.22 inches. The proration factor between the proposed lower terminus and the Corral Gulch gage is 45.7%. The Corral Gulch drainage is lower in elevation and has less average annual precipitation, which may result in an underestimation of streamflow on upper East Douglas Creek. USGS personnel familiar with Corral Gulch did not think it would be representative of conditions on East Douglas Creek or its tributaries (Mark Henneberg, personal communication). Due to differences in drainage basin characteristics and statements by USGS personnel, the Corral Gulch gage was not used to estimate streamflow at the lower terminus.

CWCB staff made one streamflow measurement on the proposed reach of East Douglas Creek. This measurement is included in this water availability analysis.

Data Analysis

StreamStats provides the best available estimate of streamflow in the upper reach of East Douglas Creek.

Water Availability Summary

StreamStats estimates of mean-monthly streamflow is shown on the hydrograph (Figure 1). The proposed increase to the existing ISF is less than the StreamStats estimate. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on East Douglas Creek is a new junior water right, the ISF can exist without material injury to other water rights. Under the provisions of section 37-92-102(3)(b), C.R.S. (2014), the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

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.

Metadata Descriptions

The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

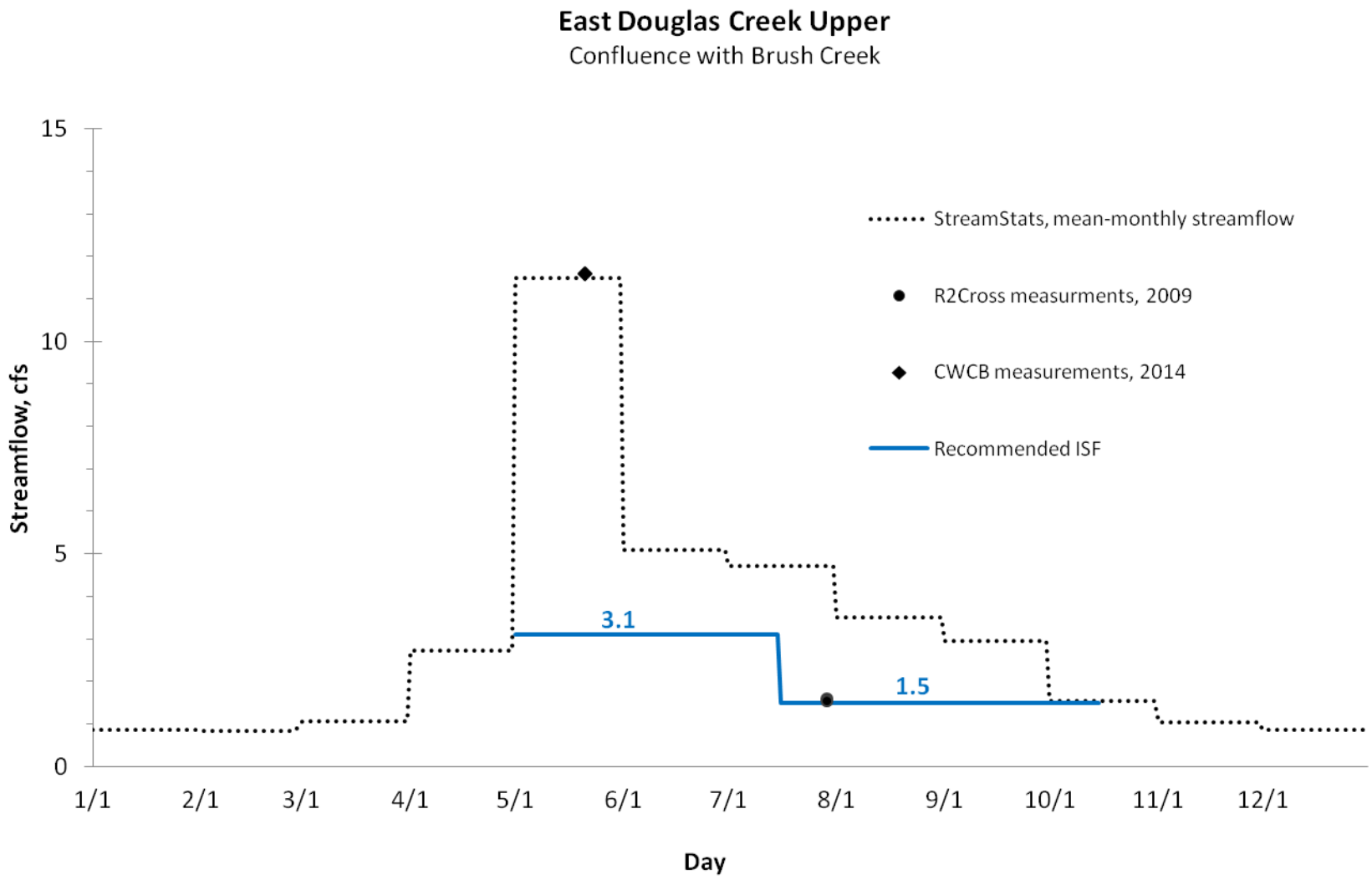
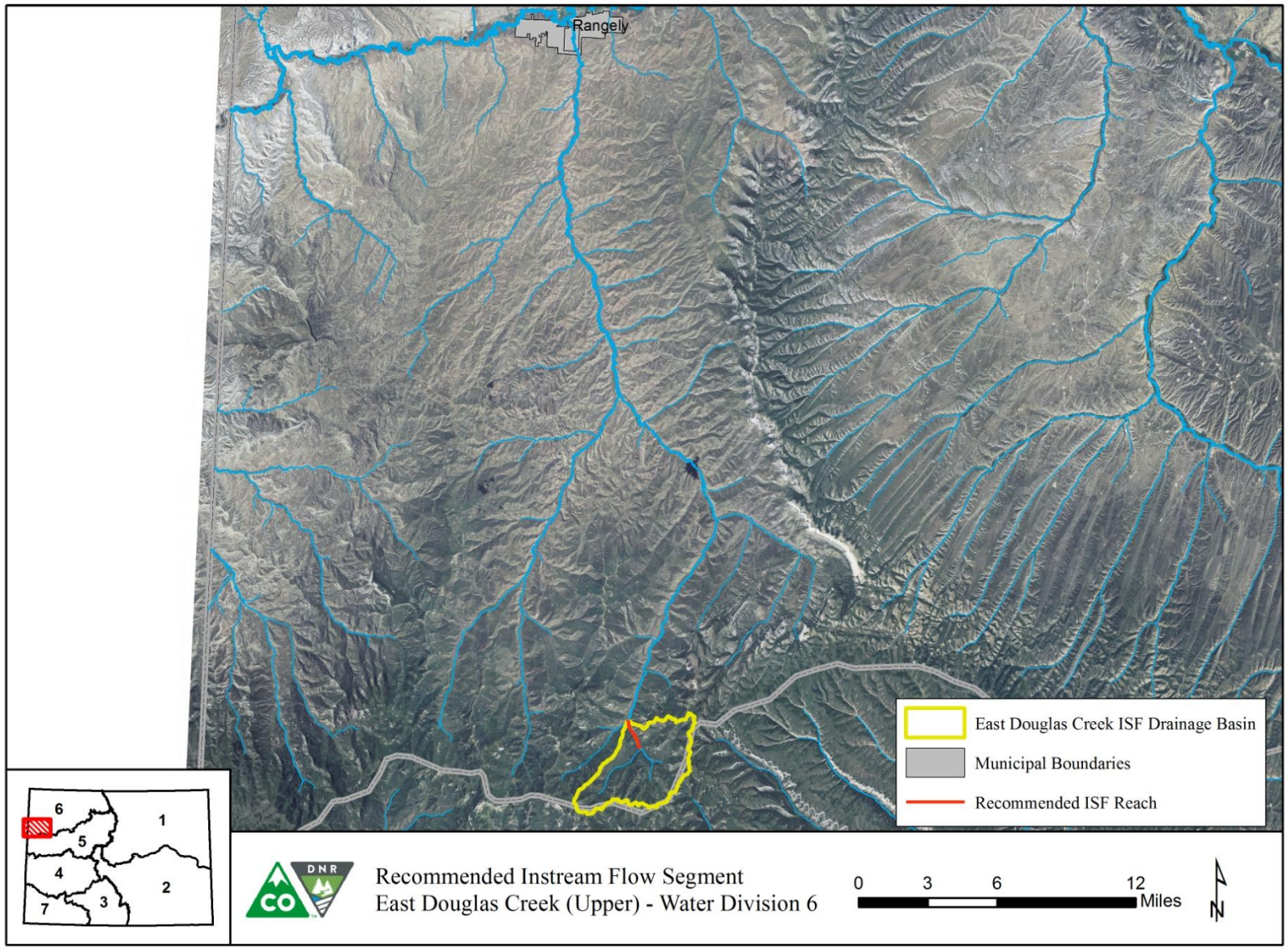
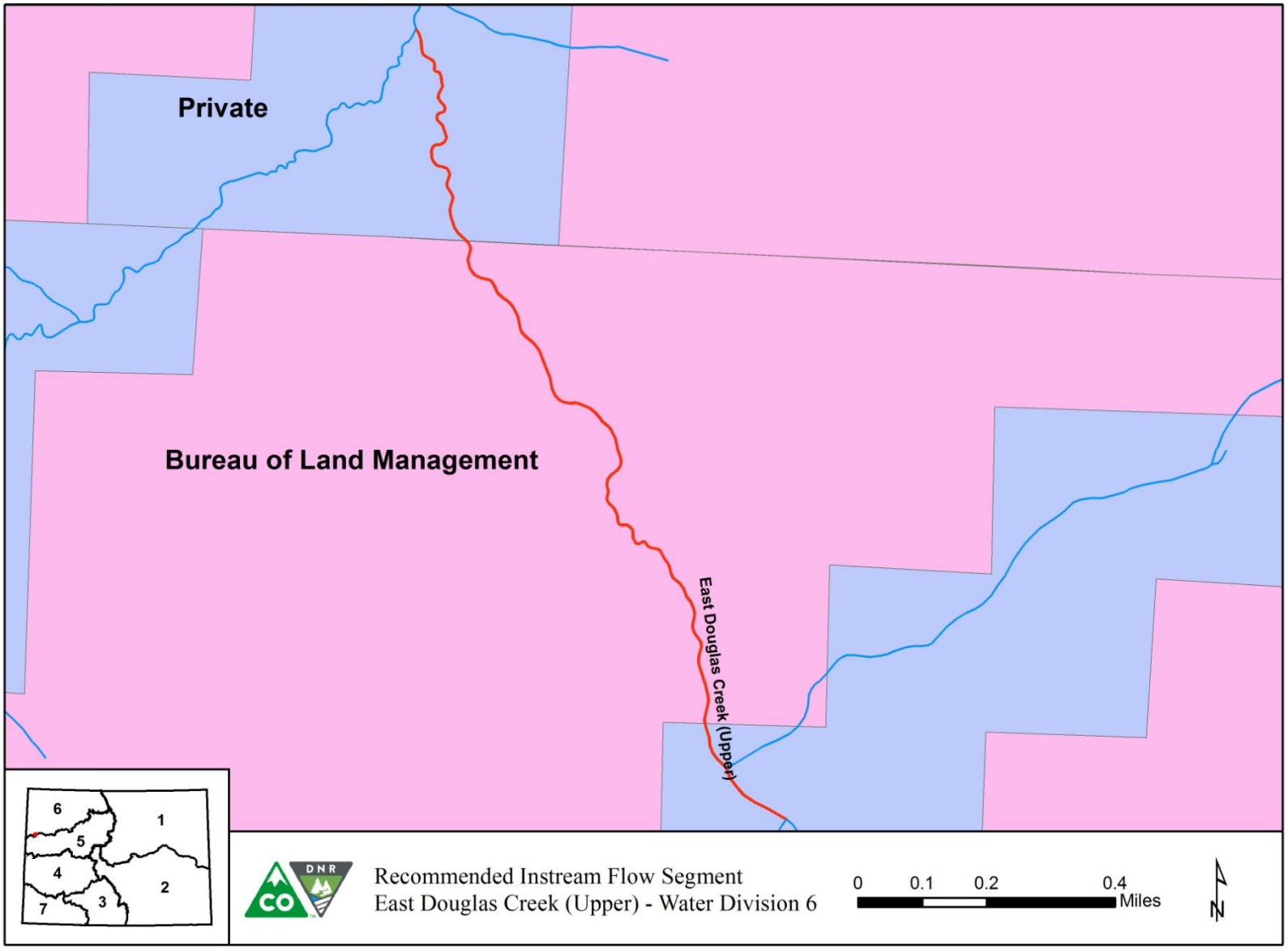


Figure 1. Complete hydrograph showing streamflow data and the proposed ISF rate on upper East Douglas Creek.

Vicinity Map



Land Use Map


Private
Bureau of Land Management
East Douglas Creek (Upper)
6
1
5
4
2
7
3
DNR
CO
Recommended Instream Flow Segment
East Douglas Creek (Upper) - Water Division 6
0
0.1
0.2
0.4
Miles
N

Water Rights Map