COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Douglas Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence of East & West Douglas Creeks UTM North: 4418708.38 UTM East: 181274.73
LOWER TERMINUS:	Confluence with White River UTM North: 4444930.57 UTM East: 177669.10
WATER DIVISION:	6
WATER DISTRICT:	43
COUNTY:	Rio Blanco
WATERSHED:	Lower White
CWCB ID:	18/6/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	26.29 miles
FLOW RECOMMENDATION:	2.7 cfs (03/16 - 06/15) 1.7 cfs (06/16 - 06/30)

Douglas Creek

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 (NLL). 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 ISF water right on a reach of Douglas Creek. Douglas Creek originates at the confluence of East and West Douglas Creeks at an elevation of approximately 5,980 feet. It flows in a northerly direction for 26.69 miles until it joins the White River at an elevation of approximately 5,280 feet. The proposed reach extends from the confluence of East and West Douglas Creeks downstream to the confluence with the White River. The entire proposed reach is located within Rio Blanco County (See Vicinity Map). The BLM owns and manages eighty-nine percent of the land on which the 26.29 mile proposed reach is located, with the remaining eleven percent privately owned (See Land Ownership Map). The BLM recommended this reach of Douglas Creek because it has a natural environment that can be preserved to a reasonable degree with an 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/2018ProposedISFRecommendations.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.

Douglas Creek is a moderate gradient stream in a canyon with variable widths. In some locations, there is sufficient width in the canyon bottom for the stream to meander over time. In other locations, stream movement is confined by bedrock. As such, the stream has a stable channel but has a variable substrate size, ranging from gravels to six-inch cobbles. The stream has abundant run and pool habitat, but very limited riffle habitat. Water quality, water temperatures, and food sources are suitable for native species, but very low flows during certain portions of the year limit fish abundance and do not allow for a wide distribution of age classes.

Fishery surveys indicate that the creek supports self-sustaining populations of speckled dace. In addition, the creek environment supports occurrences of northern leopard frog, a BLM sensitive species.

The creek supports a riparian community comprised of willows, sedges, and rushes, but the tamarisk population is extensive. The riparian community has been impacted by historic grazing practices but is recovering.

Table 1. List of species identified in Douglas Creek.

Species Name	Scientific Name	Status
speckled dace	*Rhinichthys osculus*	None
northern leopard frog	*Rana pipiens*	Federal - Sensitive Species State - Species of Greatest Conservation Need

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, surveys of channel geometry at a transect, and 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 macro-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 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 4 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 winter flow of 1.79 cfs, which meets 2 of 3 criteria and is within the

accuracy range of the R2Cross model. The R2Cross model results in a summer flow of 2.69 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model.

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

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	04/23/2015 # 1	4.84	1.94 - 12.10	2.15	2.80
BLM	04/23/2015 # 2	4.00	1.60 - 10.00	Out of range	2.16
BLM	06/28/2016 # 1	3.41	1.36 - 8.53	1.43	2.25
BLM	06/28/2016 # 2	3.87	1.55 - 9.68	Out of range	3.55
			Mean	1.79	2.69

ISF Recommendation

The BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

2.70 cubic feet per second is recommended from March 16 to June 15. In most of the cross sections collected, the recommended flow rates are driven by the average depth and average velocity criteria. Protecting average velocity for spawning habitat is important because many portions of this reach that are suitable for spawning are low gradient. Because some portions of this reach have high width-to-depth ratio, it is also important to maintain sufficient depth for fish passage. BLM believes that maintaining 2.70 cfs will maintain acceptable physical habitat characteristics over a wide variety of riffle widths.

1.70 cubic feet per second is recommended from June 16 to June 30. This recommendation is driven by limited water availability. The BLM believes that this flow rate will support passage by fish that are exiting the creek to the White River before the creek typically dries up during July.

No recommendation is made for the period between July 1 and March 15. Very limited runoff, combined with irrigation diversion in upstream locations, results in a dry stream channel in average to low water years.

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 of 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. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The drainage basin of the proposed ISF on Douglas Creek is 426.00 square miles, with an average elevation of 6,940 feet and average annual precipitation of 16.30 inches (See the Hydrologic Features Map). The Douglas Creek basin supports agriculture, among other uses. There are less than 50 cfs in decreed absolute surface water diversions and 162 AF in storage in the basin. There are no known diversions within the recommended reach. Hydrology is altered to some degree by water use within the basin.

Available Data

There is not a current streamflow gage on the proposed reach of Douglas Creek. Douglas Creek had a historical gage located near the confluence with the White River approximately 0.6 miles upstream from the proposed lower terminus. The Douglas Creek near Rangley, CO gage (USGS 09306380) had two short periods of record, 10/1/1976 to 9/29/1978 and 3/9/1994 to 9/30/1995. The drainage basin of the gage is 425 square miles, with an average elevation of 6,940 feet and average annual precipitation of 16.3 inches. This gage is affected by diversion practices. There are no known intervening diversions between the gage location and the proposed lower terminus.

CWCB staff made no streamflow measurements on the proposed reach of Douglas Creek. Staff conducted a site visit on 7/7/2015 when flows were too high to measure safely.

Data Analysis

The USGS Douglas Creek gage record is very short, with typically just three or four measurements for any given day of the year. Other gages in the region were evaluated for potential regression extension of the record but none were found suitable.

The White River near Watson, UT gage (USGS 09306500) was used to evaluate streamflow conditions on a regional scale to better understand the data from the Douglas Creek gage. The White River gage is located approximately 23 miles downstream from the proposed lower terminus and has a long period of record, 1923 to present (with a 6-year gap between 1979 and 1985). Based on review of annual streamflow from the White River gage, the available data from the Douglas Creek occurred during 3 years classified as Very Dry (<25th percentile), one year classified as Wet Typical (50th to 75th percentile), and one year classified as Very Wet (>75th percentile). This data suggests that median streamflow calculated from the available record will underestimate typical conditions. Nevertheless, median was calculated based on the USGS approved data available through HydroBase on 5/1/2017. Insufficient data was available to calculate confidence intervals for median streamflow.

Water Availability Summary
The hydrographs (See Complete Hydrograph and Detailed Hydrograph) show median streamflow based on the Douglas Creek gage record. The proposed ISF rate is below the median streamflow at all times. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on 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. (2017), the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

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

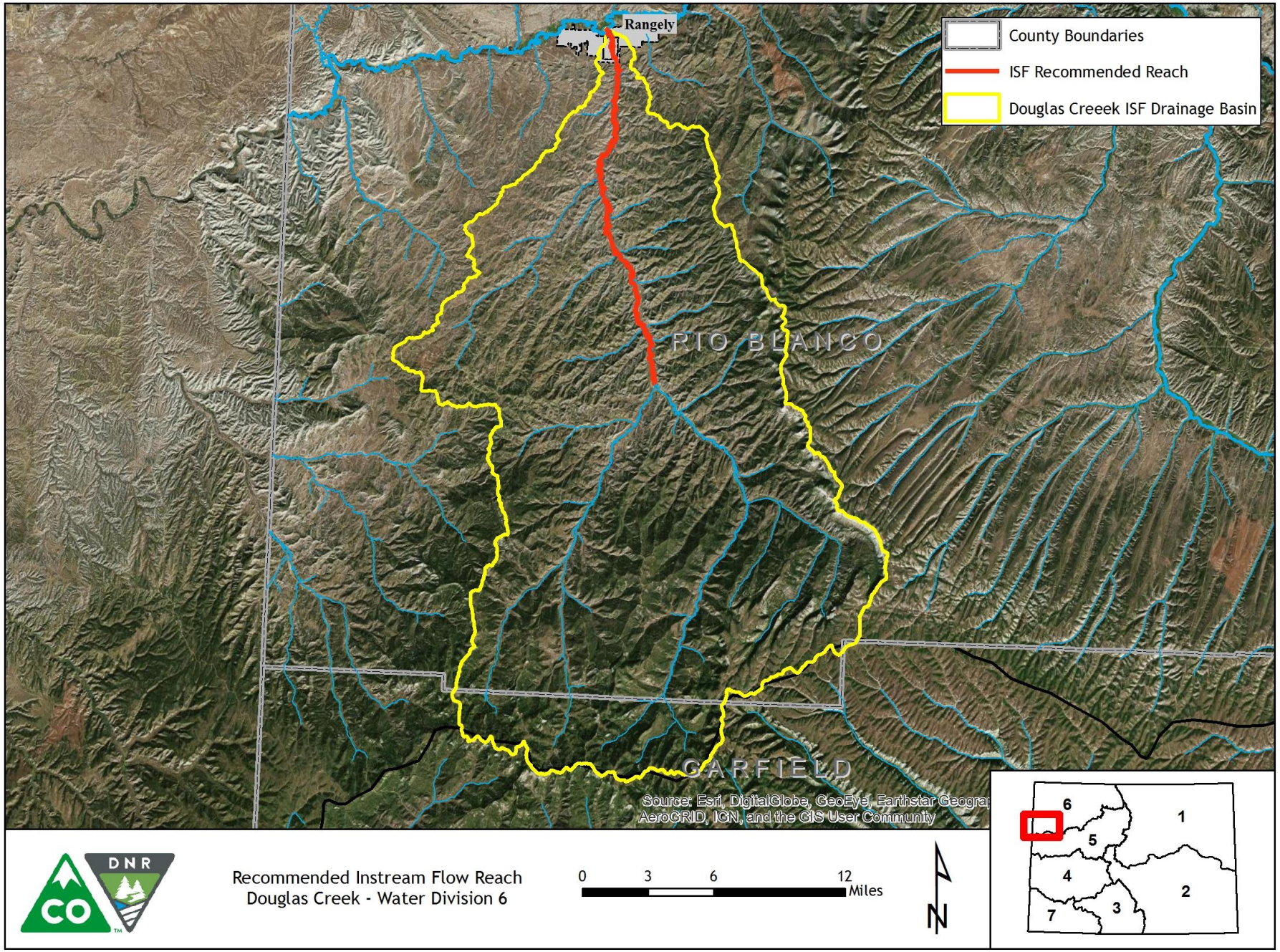
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

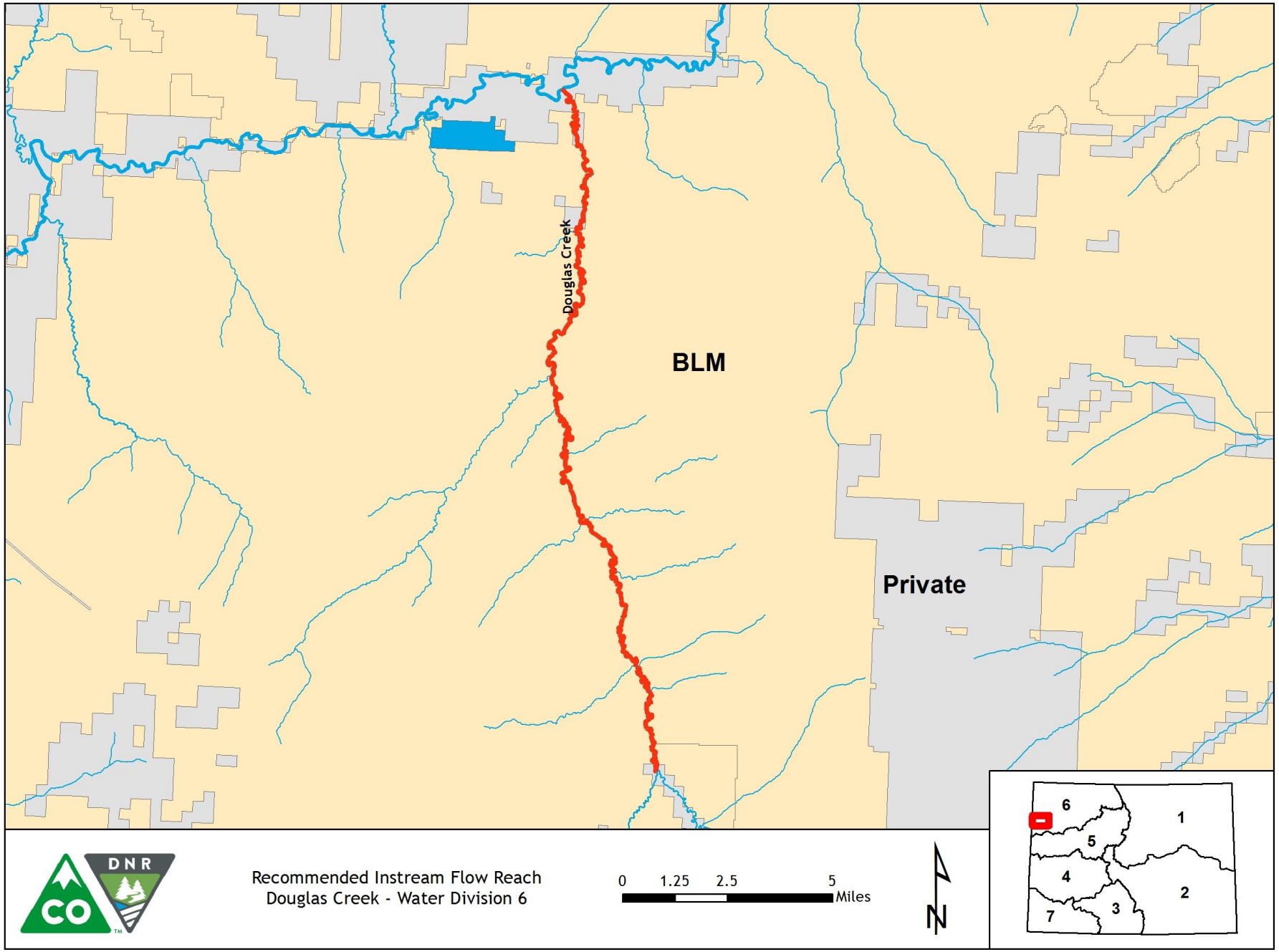
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

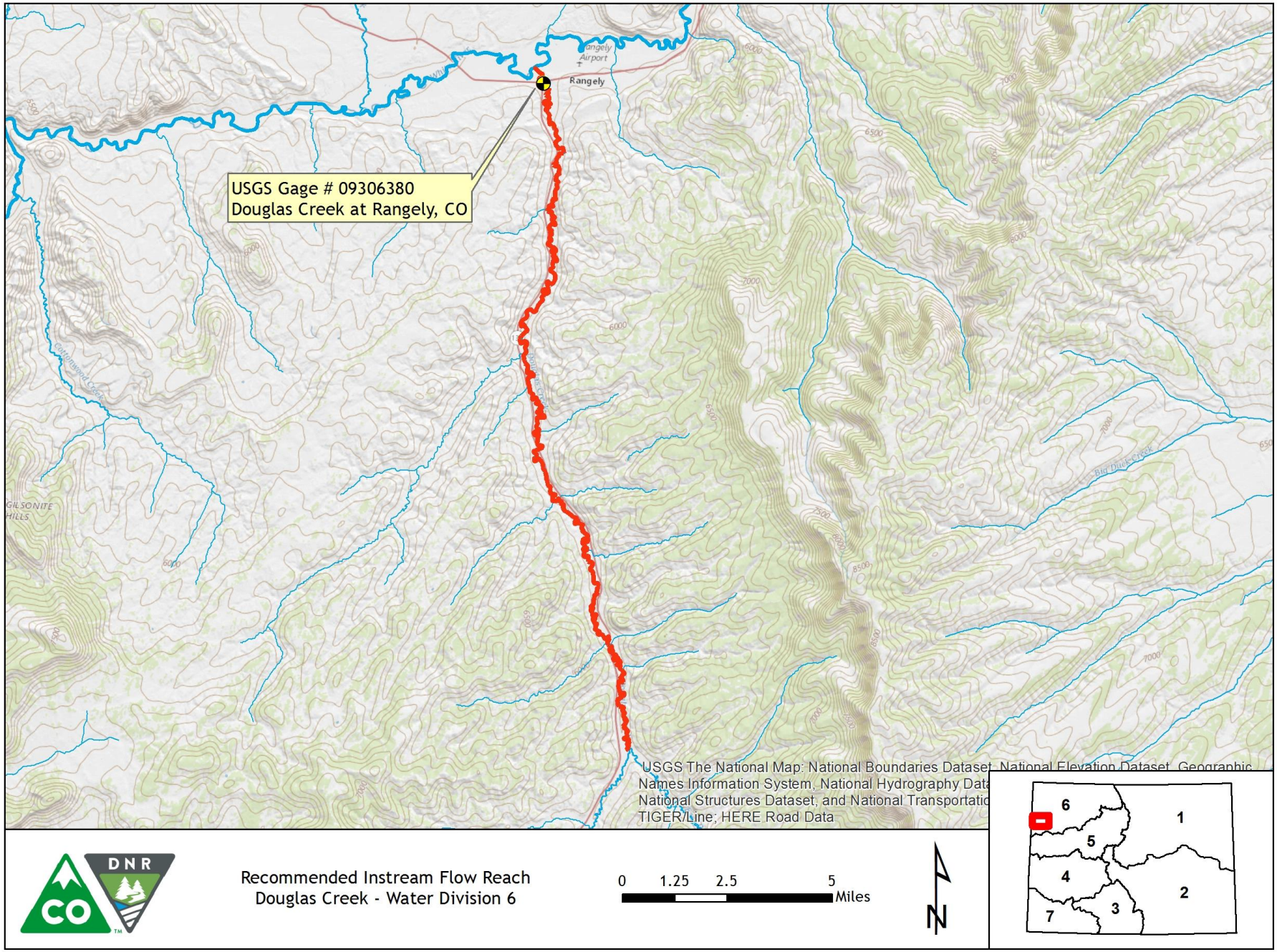
VICINITY MAP



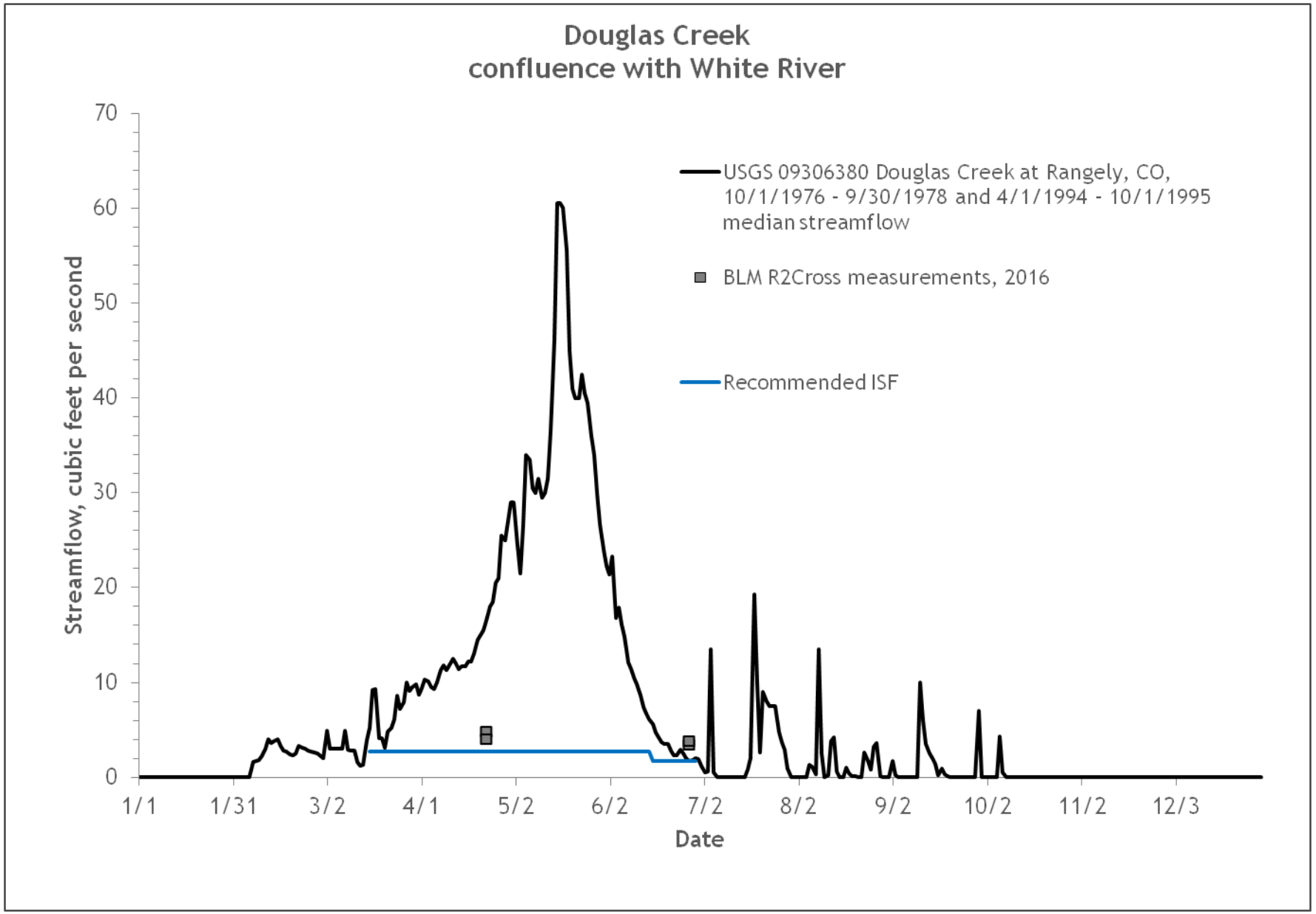
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH