COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Stout Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	BLM/USFS Property Boundary UTM North: 4248489.60 UTM East: 425206.65
LOWER TERMINUS:	confluence with an unnamed tributary at UTM North: 4248935.65 UTM East: 426072.66
WATER DIVISION:	2
WATER DISTRICT:	12
COUNTY:	Fremont
WATERSHED:	Arkansas Headwaters
CWCB ID:	19/2/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	0.62 miles
FLOW RECOMMENDATION:	3.5 cfs (05/01 - 06/30) 1.5 cfs (07/01 - 08/31) 0.6 cfs (09/01 - 04/30)

Stout 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 BLM recommended that the CWCB appropriate an ISF water right on a reach of Stout Creek because it has a natural environment that can be preserved to a reasonable degree with an ISF water right. Stout Creek is located within Fremont County and originates from Stout Creek Lake at an elevation of approximately 11,770 ft on the east slope of the Sangre de Cristo Mountains. Stout Creek flows northwest for approximately 7.35 miles to the confluence with the Arkansas River at an elevation of approximately 5,640 ft (See Vicinity Map). The proposed reach extends from the BLM/USFS property boundary downstream to the confluence with an unnamed tributary. The Bureau of Land Management and U.S. Forest Service manage 42 percent of the land on the 0.62 mile proposed reach (See Land Ownership Map).

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/2019ProposedISFRecommendations.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.

Stout Creek is a cold water, high gradient stream. The reach that is the subject of this recommendation flows through alluvial fans on the eastern slopes of the Sangre de Cristo Range. This portion of Stout Creek has large substrate with boulders up to four feet in diameter. The large substrate and steep gradient provide fish habitat consisting primarily of pools separated by large drops, with few riffles. Water quality is excellent for supporting salmonid fish species. Fish surveys indicate that Stout Creek supports self-sustaining populations of brook trout and brown trout. Spot surveys indicated abundant populations of stonefly and caddisfly. The creek also supports a vigorous riparian community comprised of white fir, maple, and aspen. The riparian community provides ample cover and shading for the creek, and contributes to bank stability.

Table 1. List of species identified in Stout Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
brown trout	*Salmo trutta*	None

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 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 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 winter flow of 1.54 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 3.46 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 Stout Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	07/10/2017 #1	3.48	1.39 - 8.70	1.54	3.43
BLM	07/10/2017 #2	3.48	1.39 - 8.70	Out of range	3.48
			Mean	1.54	3.46

ISF Recommendation

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

3.5 cubic feet per second is recommended during the snowmelt runoff period from May 1 to June 30. This recommendation is driven by the average velocity criteria. Given the small amount of riffle habitat in this reach, it is important to provide velocities that are suitable for spawning trout.

1.5 cubic feet per second is recommended during summer from July 1 to August 31. This recommendation is driven by the wetted perimeter criteria. This flow rate will maintain sufficient physical habitat in the creek for the fish population to complete important parts of their life cycle before cold temperatures reduce fish activity for the winter.

0.6 cubic feet per second is recommended from September 1 to April 30. This recommendation is driven by limited water availability. This flow rate should prevent complete icing of the numerous pools in this reach, allowing the fish population to overwinter.

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 Stout Creek is 2.77 square miles, with an average elevation of 11,030 ft and average annual precipitation of 19.83 inches (See the Hydrologic Features Map). No active surface water diversions were identified in the proposed ISF reach; therefore, hydrology in this drainage basin represents natural flow conditions.

Available Data
There is not a current or historic streamflow gage on Stout Creek or any nearby creek that would be suitable for estimating flow on Stout Creek. There is one diversion structure in the vicinity of the lower terminus, the Woods Pasture Ditch (WDID 1200586, 1.26 cfs, appropriation 1882). Further investigations by Water Commissioner Dan Henrichs revealed that this structure is likely located on the unnamed tributary to Stout Creek, rather than on the proposed ISF reach on Stout Creek (personal communication, Dan Henrichs 11/14/2018).

CWCB staff made one streamflow measurement on the subject reach of Stout Creek as summarized in Table 3.

Table 3. Summary of Streamflow Measurement Visits and Results for Stout Creek.

Visit Date	Flow (cfs)	Collector
10/03/2018	0.03	CWCB

Data Analysis
StreamStats provides the best available estimate of streamflow on Stout Creek.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Stout 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. (2018), 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.

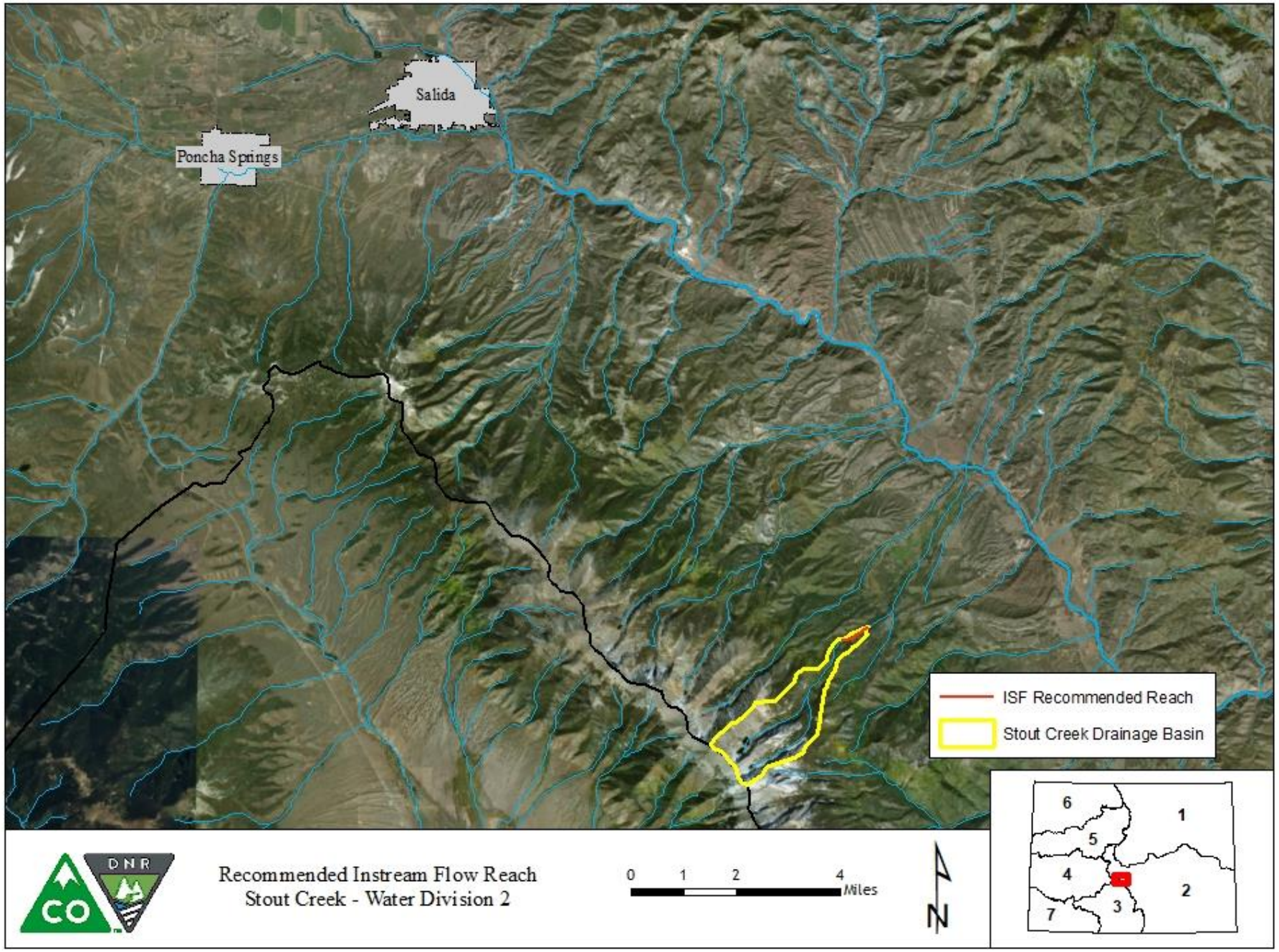
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

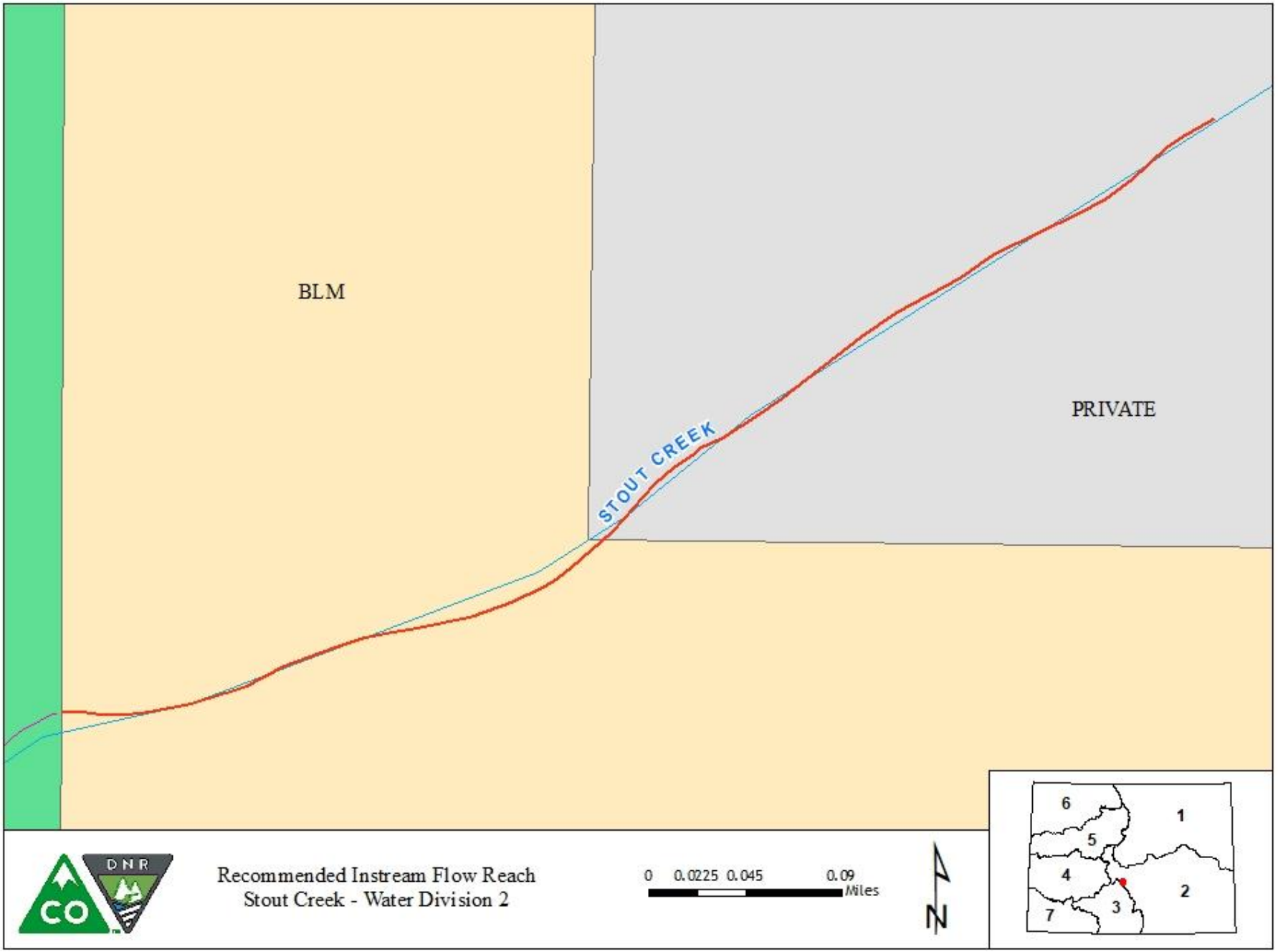
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

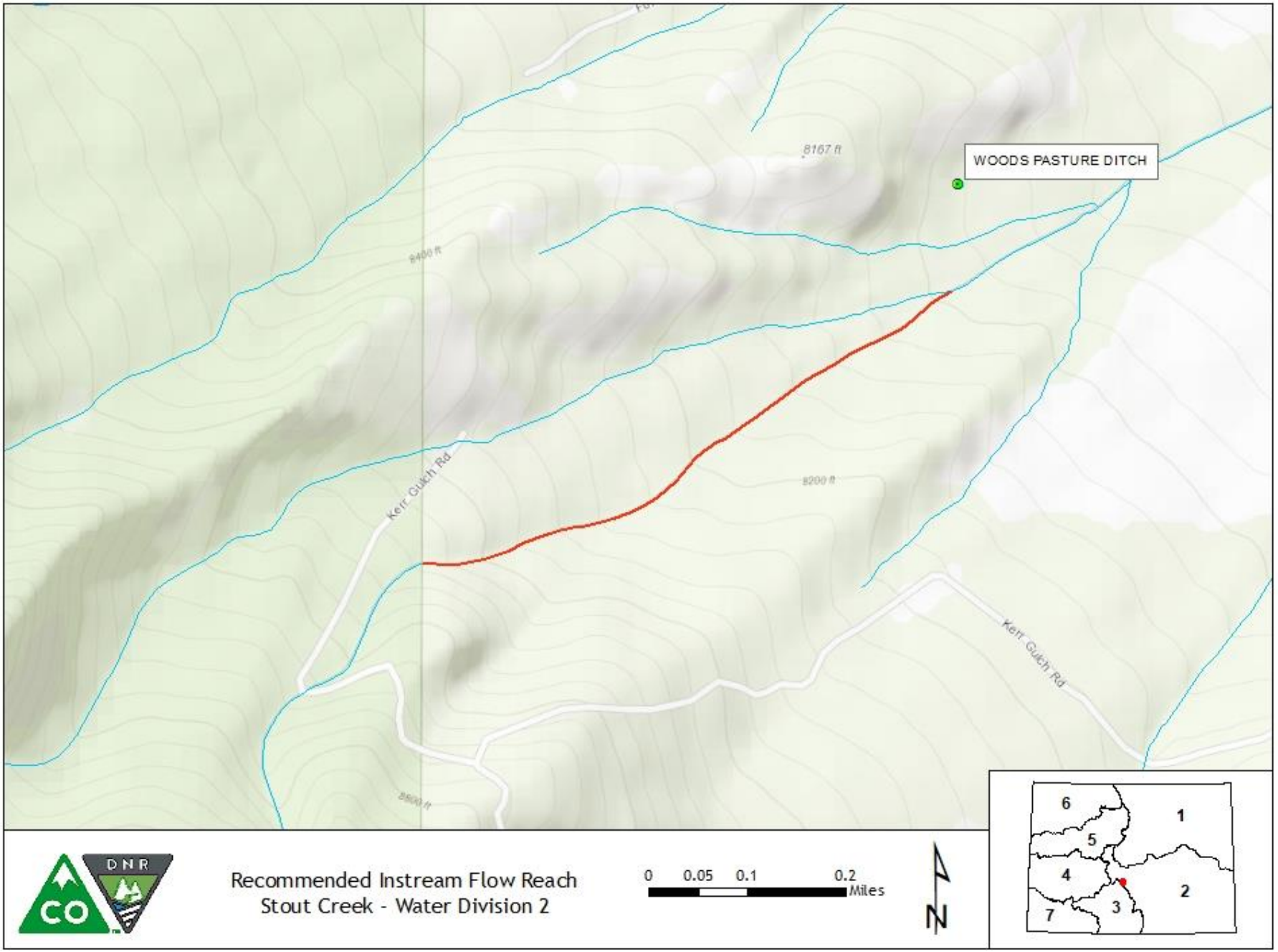
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH