COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Dutchman Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Headwaters in the vicinity of UTM North: 4242474.76 UTM East: 369063.00
LOWER TERMINUS:	Confluence with Owens Creek UTM North: 4251307.88 UTM East: 368109.13
WATER DIVISION:	4
WATER DISTRICT:	28
COUNTY:	Saguache
WATERSHED:	Tomichi
CWCB ID:	18/4/A-005
RECOMMENDER:	High Country Conservation Advocates (HCCA), Western Resource Advocates (WRA)
LENGTH:	6.78 miles
FLOW RECOMMENDATION:	0.94 cfs (04/01 - 08/31) 0.84 cfs (09/01 - 03/31)

Dutchman 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.

High Country Conservation Advocates (HCCA) and Western Resource Advocates (WRA) recommended that the CWCB appropriate an ISF water right on a reach of Dutchman Creek. Dutchman Creek originates at the top of the Continental Divide at an elevation of approximately 9,750 feet. It flows in a northwesterly direction for 6.78 miles before it joins Owens Creek at an elevation of approximately 8,440 feet. The proposed reach extends from Dutchman Creek's headwaters downstream to the confluence with Owens Creek, and is located within Saguache County (See Vicinity Map). The U.S. Forest Service owns and manages ninety-nine percent of the land on which the 6.78 mile proposed reach is located, with the remaining one percent privately owned (See Land Ownership Map). The HCCA, and WRA recommended this reach of Dutchman 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.

Dutchman Creek is a cold-water, high gradient stream located in western Saguache County. The stream generally has small-sized substrate consisting of fines, gravels, and small cobbles. There is a mixture of riffles and small pools.

Dutchman Creek supports a healthy aquatic ecosystem. U.S. Forest Service biologist Matt Dare and colleagues conducted stream sampling on Dutchman Creek in 2015. They identified a healthy brook trout population. Several fish (salmonids less than 6 inches) were also observed by Alpine Environmental Consultants during field reconnaissance and sampling in 2016 and 2017.

In addition to supporting a healthy aquatic ecosystem, flows in Dutchman Creek support a robust riparian area. The riparian community is substantial and composed of willow and alder. The riparian zone is in good condition and provides shade and cover for the extant fish community. There are some active and abandoned beaver ponds and extensive wet meadows alongside the creek.

Table 1. List of species identified in Dutchman Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	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
HCCA and WRA 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). HCCA, and WRA staff interpret 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 1 transect for this proposed ISF reach (Table 2). The R2Cross model results in a winter flow of 0.84 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 0.94 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 Dutchman Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
HCCA	07/14/2017 # 1	1.15	0.46 - 2.88	0.84	0.94
			Mean	0.84	0.94

ISF Recommendation
HCCA and WRA recommend the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

0.84 cfs is recommended from September 1 to March 31 to protect biotic resources during winter months. This flow satisfies two of the three hydraulic criteria (50 percent wetted perimeter and average depth) at the assessed cross section.

0.94 cfs is recommended from April 1 to August 31 for the summer flow, which satisfies all three of the hydraulic criteria.

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 Dutchman Creek is 7.61 square miles, with an average elevation of 9,905 feet and average annual precipitation of 21.67 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 Dutchman Creek. The nearest streamflow gage is the Razor Creek above Vouga Reservoir gage (RAZBGVCO). The gage is located approximately 8.9 miles southwest from the proposed lower terminus, with headwaters on the west side of Middle Baldy Peak. The gage record is 06/7/2004 to 8/15/2017; however, the gage operates seasonally from approximately early April to early November (personal communication Jack Brazinsky, Water Commissioner, 9/13/2017). Due to the seasonal nature of the gage and difficulties determining when the gage was operating and when it was not (streamflow is reported when the gage was not operated), this gage was not used to assess water availability on Dutchman Creek.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. There are no active diversion structures on Dutchman Creek, but there are some structures on Owens Creek, which Dutchman Creek joins at the lower terminus. A number of active surface water rights exist on Owens Creek, including the Hellmuth Ditch 1&2 (appropriated 1887, 1.62 cfs). This ditch appears to have two physical diversion points, one of which is located upstream from the confluence with Dutchman Creek and one is located downstream from the confluence. The diversion records for these two locations are combined in Hydrobase (personal communication Jack Brazinsky, Water Commissioner, 9/13/2017). Because the records have been combined, it is not possible to assess how much of the diverted flow comes from Dutchman Creek versus Owens Creek; therefore, the record has limited utility for water availability analyses.

CWCB staff made one streamflow measurements near the proposed reach of Dutchman Creek as summarized in Table 3. This measurement was made just downstream from the confluence with Owens Creek, which was contributing negligible streamflow.

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

Visit Date	Flow (cfs)	Collector
07/17/2017	0.79	CWCB

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

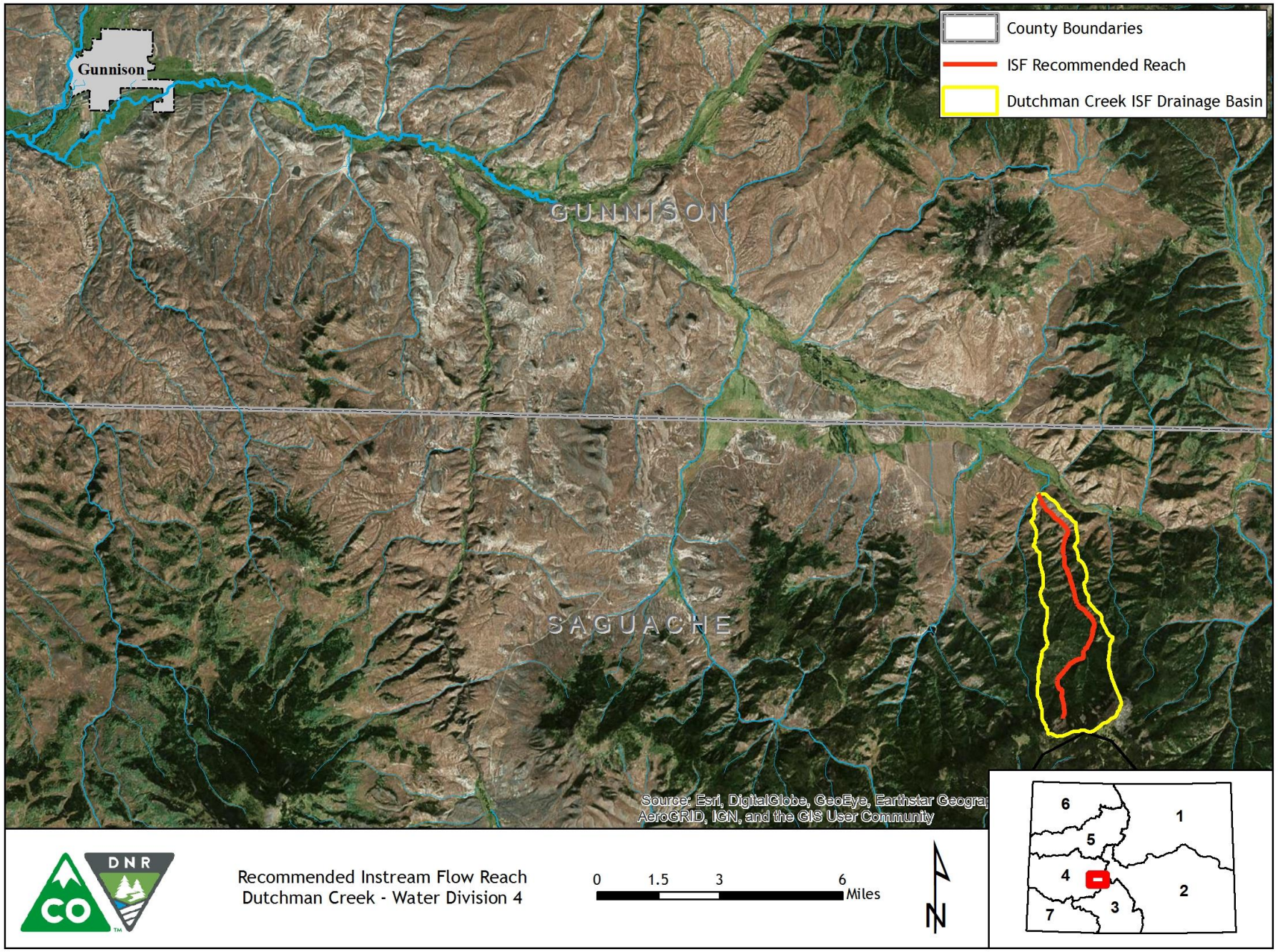
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

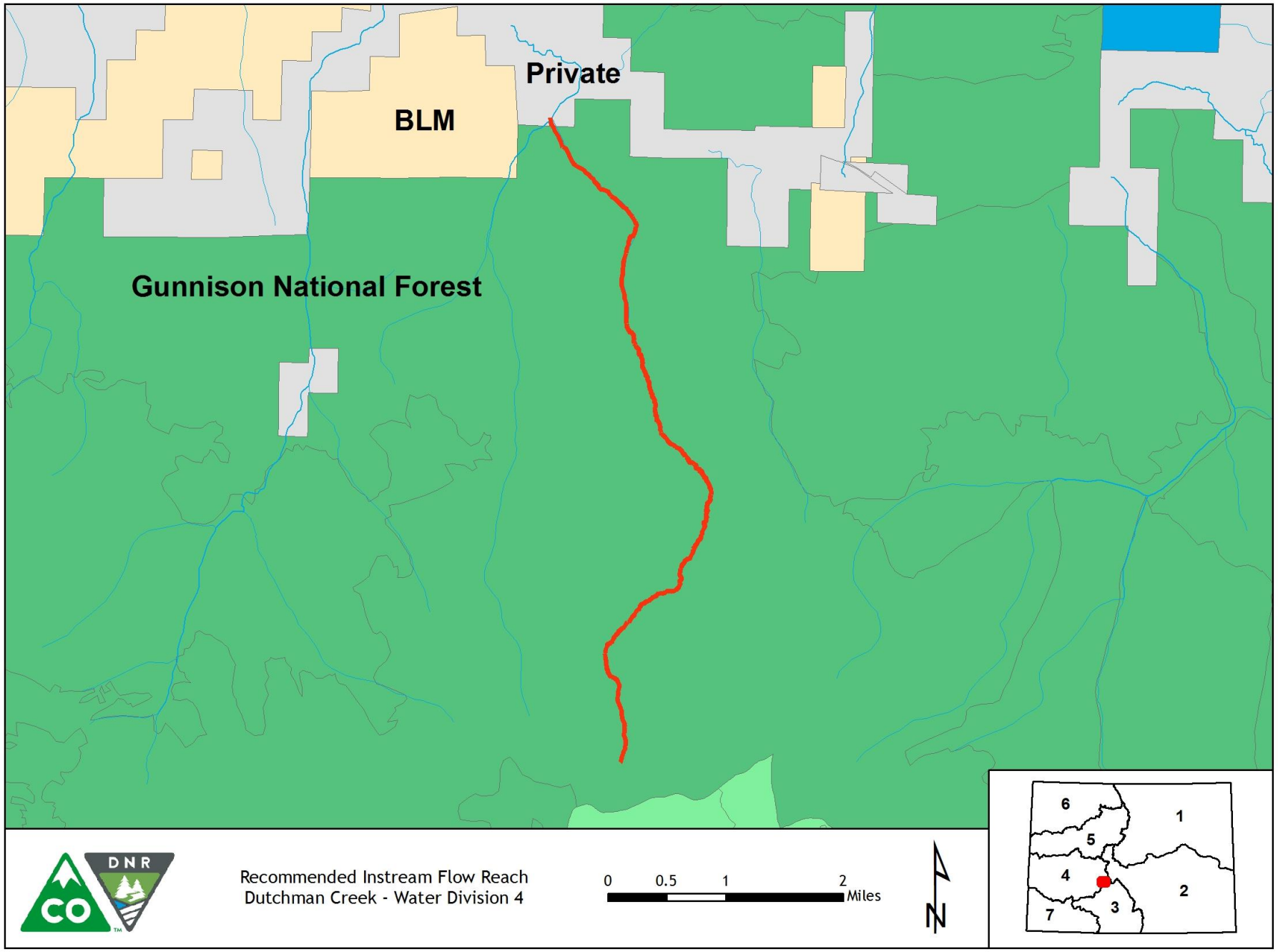
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

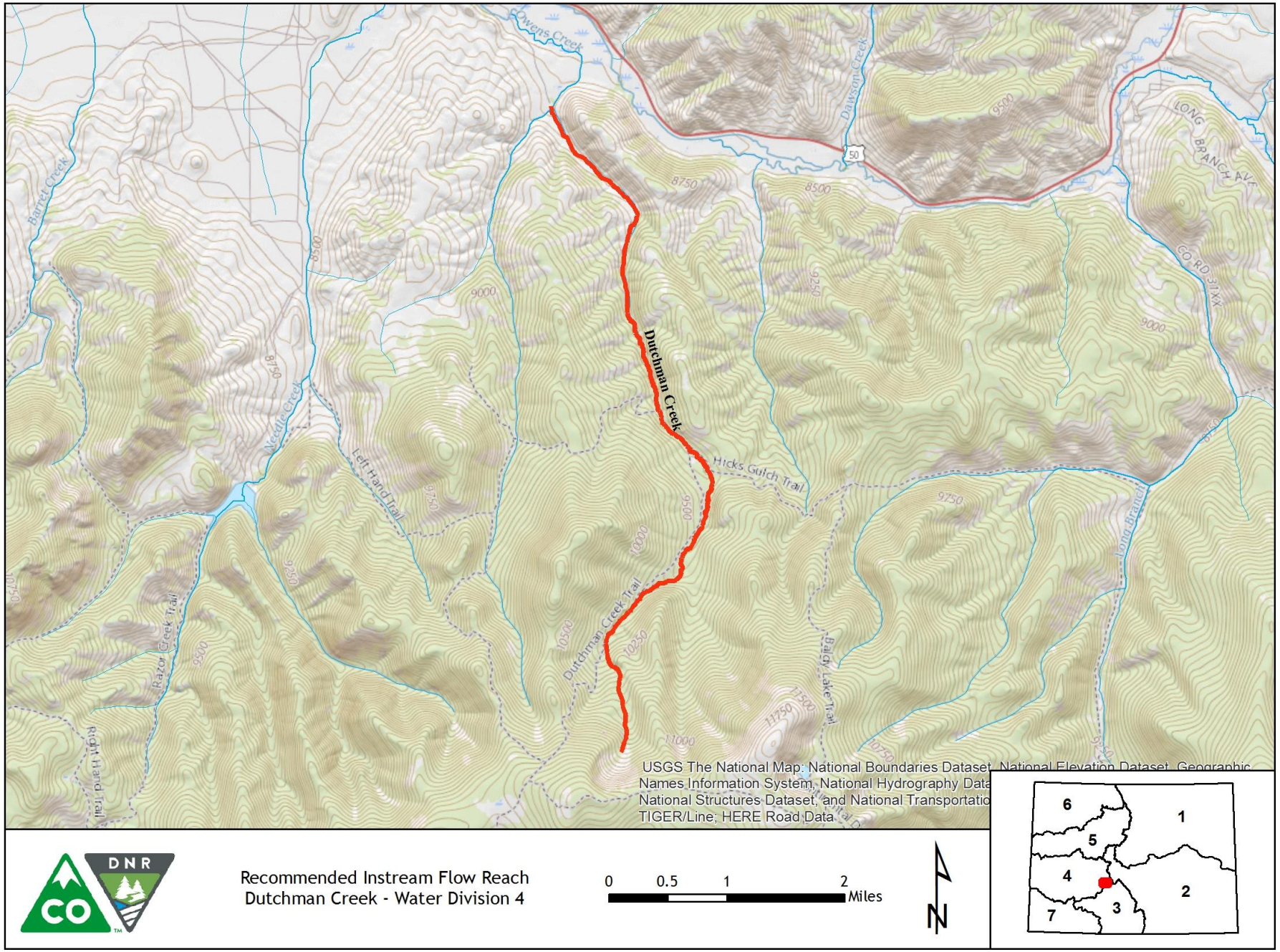
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH