COLORADO
Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 718
Denver, CO 80203

Kelso Creek

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION JANUARY 2020

UPPER TERMINUS:	headwaters in the vicinity UTM North: 4271192.67 UTM East: 185287.30
LOWER TERMINUS:	confl Bear Gulch UTM North: 4276621.43 UTM East: 197851.54
WATER DIVISION:	4
WATER DISTRICT:	40
COUNTY:	Mesa
WATERSHED:	Lower Gunnison
CWCB ID:	15/4/A-003
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
LENGTH:	9.89 miles
FLOW RECOMMENDATION:	0.85 cfs (09/01 - 03/31) 2.4 cfs (04/01 - 08/31)

Kelso 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.

CPW recommended that the CWCB appropriate an ISF water right on a reach of Kelso Creek because it has a natural environment that can be preserved to a reasonable degree. Kelso Creek is located within Mesa County (See Vicinity Map), and originates on the east slope of the Uncompahgre Plateau at an elevation of 9,041 feet. Kelso Creek flows northeast to the confluence with Escalante Creek at an elevation of 6,204 feet. The proposed reach extends from the headwaters downstream to the confluence with Bear Gulch. The Grand Mesa National Forest manages 93 percent of the land on the 9.89 mile proposed reach, three percent is managed by CPW, and four percent is privately owned (See Land Ownership Map).

The information contained in this Executive Summary and the associated supporting data and analyses form the basis for staff's ISF recommendation to be considered by the Board. This Executive Summary provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury. Additional supporting information is available at http://cwcb.state.co.us/environment/instream-flow-program/Pages/2020ProposedISFRecommendations.aspx.

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.

Kelso Creek is a relatively low gradient, snow-melt driven stream that supports an important conservation population of Colorado River cutthroat trout. The uplands surrounding Kelso Creek are composed of aspen stands, large open meadows, and interspersed pinyon-juniper woodland. The riparian area supports abundant willows, narrowleaf cottonwoods, and gray alder that stabilize the banks and shade the stream. The stream substrate ranges from sand to cobbles with a mixture of habitat types, including riffles, runs, glides and pools that provide diverse habitat for the fish population. A healthy macroinvertebrate community of mayflies, stoneflies and caddisflies were observed on field visits. The resident trout population in Kelso Creek are a core conservation population of Colorado River cutthroat trout that exhibit greater than 99% genetic purity. This population is self-sustaining and physically isolated from non-native species in Escalante Creek by diversions that serve as migration barriers, which ensures preservation of

their genetic purity in the future. As a result, Kelso Creek is important to CPW for use as a source population for cutthroat trout conservation efforts throughout the Gunnison Basin.

Table 1. List of species identified in Kelso Creek.

Species Name	Scientific Name	Status
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	State - Species of Special Concern Federal – Sensitive Species

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.

Quantification Methodology

CPW 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 data collected consists of a streamflow measurement, survey of channel geometry and features at a single transect, and survey 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). CPW 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 amount of water needed for summer and winter periods. 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 2 transects for this proposed ISF reach by CPW (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 2.35 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model did not

produce in-range results for a winter flow rate. R2Cross field data and model results can be found in the appendix to this report.

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

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/25/2019, 1	14.60	6.54	2.62 - 16.35	Out of range	2.63
06/25/2019, 2	13.97	4.92	1.97 - 12.30	Out of range[1]	2.07
	Mean				2.35

[1]The flow meeting 2 of 3 hydraulic criteria is out of range. The lowest in range streamflow for the modeling results is 1.97 cfs. Please see the ISF Recommendation section below for more information.

ISF Recommendation

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

Based on 2019 field investigations, the initial biological recommendation is 2.4 cfs in the summer, which maintains an average of 1 ft/s velocity, average depth of at least 0.2 feet, and at least 50 percent wetted perimeter in the stream channel. Numerous field trips over a five year period were unable achieve in-range model results that satisfy two of the three hydraulic criteria used to determine winter flow rates. However, the lowest in-range modeled flow (1.97 cfs) is the closest to meeting the two of three criteria. Using this value results in protecting an average depth that is slightly higher than the typical depth criteria for a stream this size (0.24 feet compared to 0.2 feet). It is CPW's opinion that recommending 2.0 cfs (based on rounding 1.97 to the nearest whole number) for the initial biological winter recommendation is reasonable given a number of factors: the value of the Kelso Creek cutthroat trout population; the proven difficulty to achieve in-range model results on Kelso Creek; and importantly, because water availability constraints limit this flow rate to 0.85 cfs during the baseflow period.

The final recommendation is 2.4 cfs in the summer from April 1 to August 31. This flow rate maintains adequate depth, velocity, and wetted perimeter during the critical time period when the eggs are incubating in the gravel.

The final recommended baseflow rate is 0.85 cfs from September 1 through March 31. This flow recommendation is reduced due to water availability constraints, but should provide adequate flows over the baseflow period to maintain habitat and provide connectivity.

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 streamflow 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 Kelso Creek is 16.5 square miles, with an average elevation of 8,438 feet, and an average annual precipitation of 22.3 inches. There are no known surface water diversions within the basin tributary to the proposed ISF. There are no known transbasin imports or exports. Hydrology in this drainage basin represents natural flow conditions. See the Hydrologic Features Map for more information.

Available Data

There is not a current or historic streamflow gage on Kelso Creek. The closest gage identified was the historic Escalante Creek near Delta, CO gage (USGS 09151500). The gage was located downstream approximately 16.3 miles northeast from the proposed lower terminus. The gage has a short period of record from 1977 to 1989. The Escalante Creek gage has a 209 square mile drainage basin. The average elevation of the basin is 7,680 feet and the average precipitation is 18.05 inches. There are over 80 cfs in surface water diversions in the basin tributary to the Escalante gage. The three largest diversions are located on Kelso Creek below the proposed lower terminus.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. There are three diversion structures on Kelso Creek below the proposed lower terminus. However, it is CWCB staff's understanding that below the lower terminus, Kelso Creek goes subsurface and re-emerges at different locations depending on the time of year. Because of the complex hydrology below the proposed lower terminus, Staff elected to not use data

from the diversion structures, which may not provide a reliable estimate of water availability in the upstream reaches.

CWCB staff and other entities made a number of streamflow measurements on the proposed reach of Kelso Creek as summarized in Table 3.

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

Visit Date	Flow (cfs)	Collector
07/31/2019	0.42	CWCB
6/22/2015	2.18	USFS
6/22/2015	1.94	USFS
7/30/2014	0.32	USFS, CPW, CWCB
07/30/2014	0.46	CWCB
9/26/2013	0.41	USFS

Data Analysis
The Escalante Creek gage measures flow from a much larger drainage basin that results in a proration factor of 0.097 based on the area-precipitation method. The area-precipitation method estimates streamflow based on the ratio of the precipitation weighted drainage area at the lower terminus location to that of the gage location. Due to the small proration factor and the large number of water diversions that impact the water measured at the gage, this gage was not used to evaluate water available in the proposed reach.

Due to limited available data and the lack of diversion structures in the basin tributary to the proposed ISF reach, StreamStats was used to assess water availability.

Water Availability Summary
The hydrographs (See Complete and Detailed Hydrographs) show StreamStats results for mean-monthly streamflow. The proposed ISF is below the StreamStats estimates at all times. Staff concludes that the proposed ISF flow rates are available for appropriation.

Material Injury
Because the proposed ISF on Kelso 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. (2019), 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.

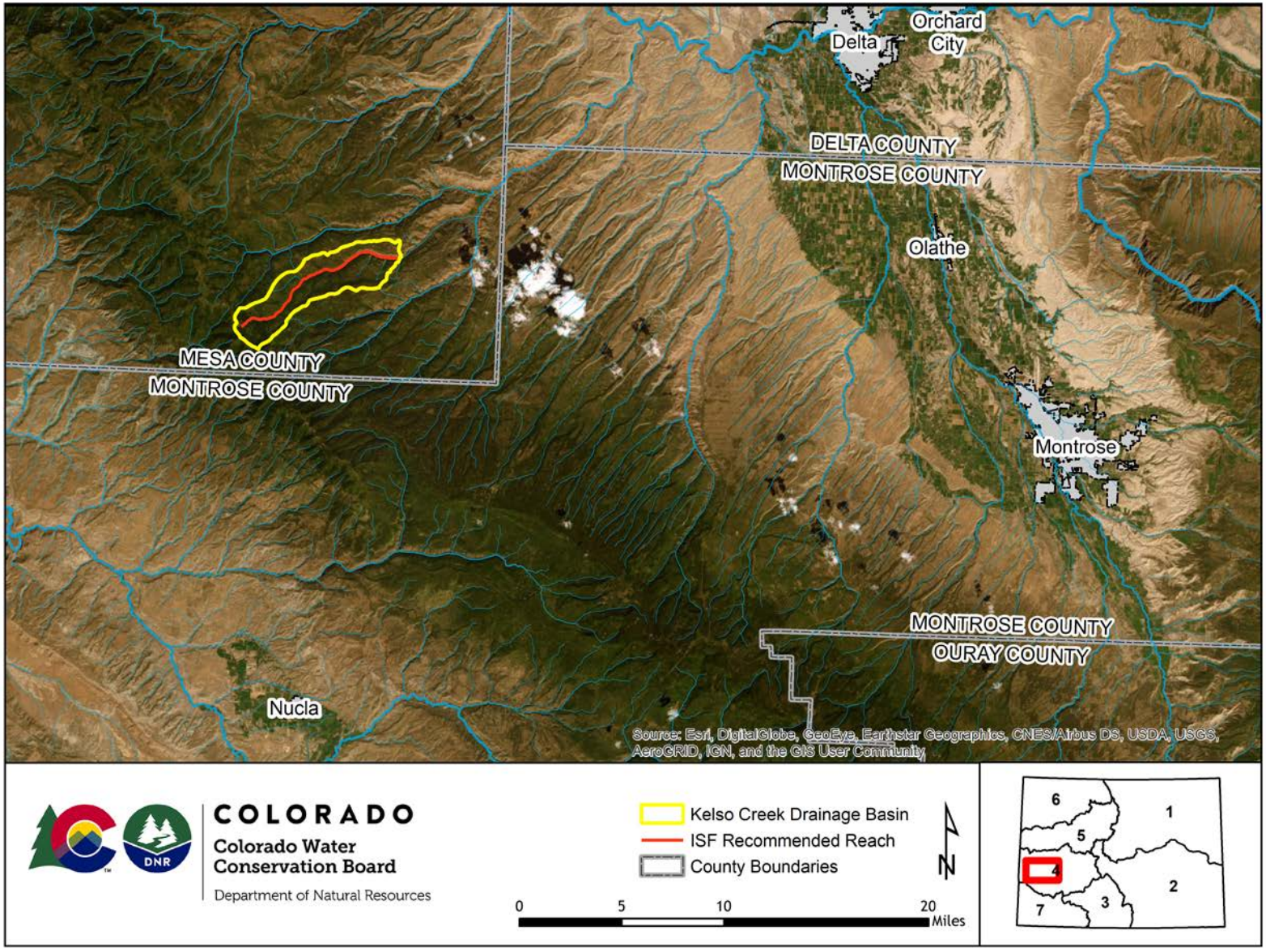
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

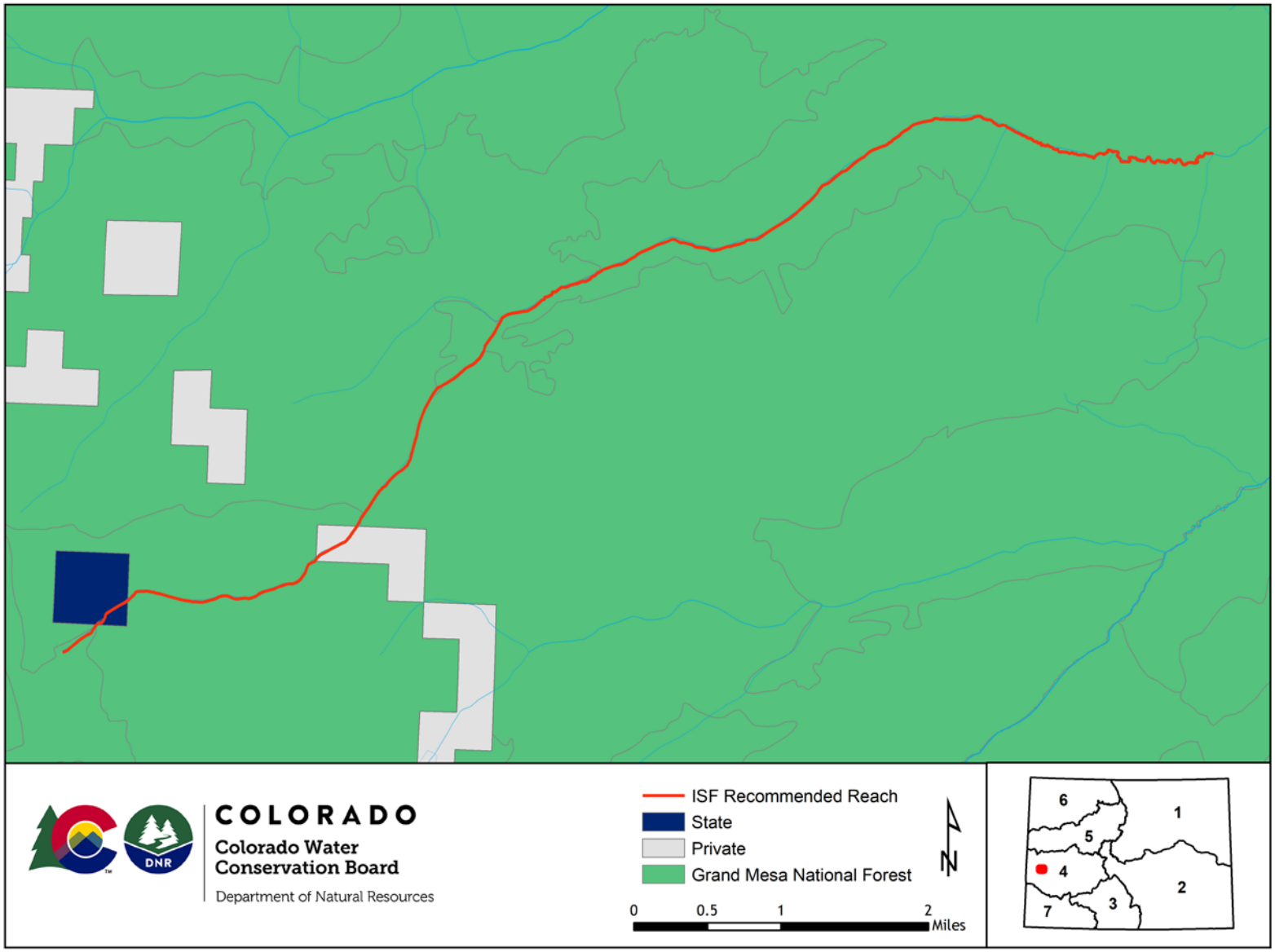
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

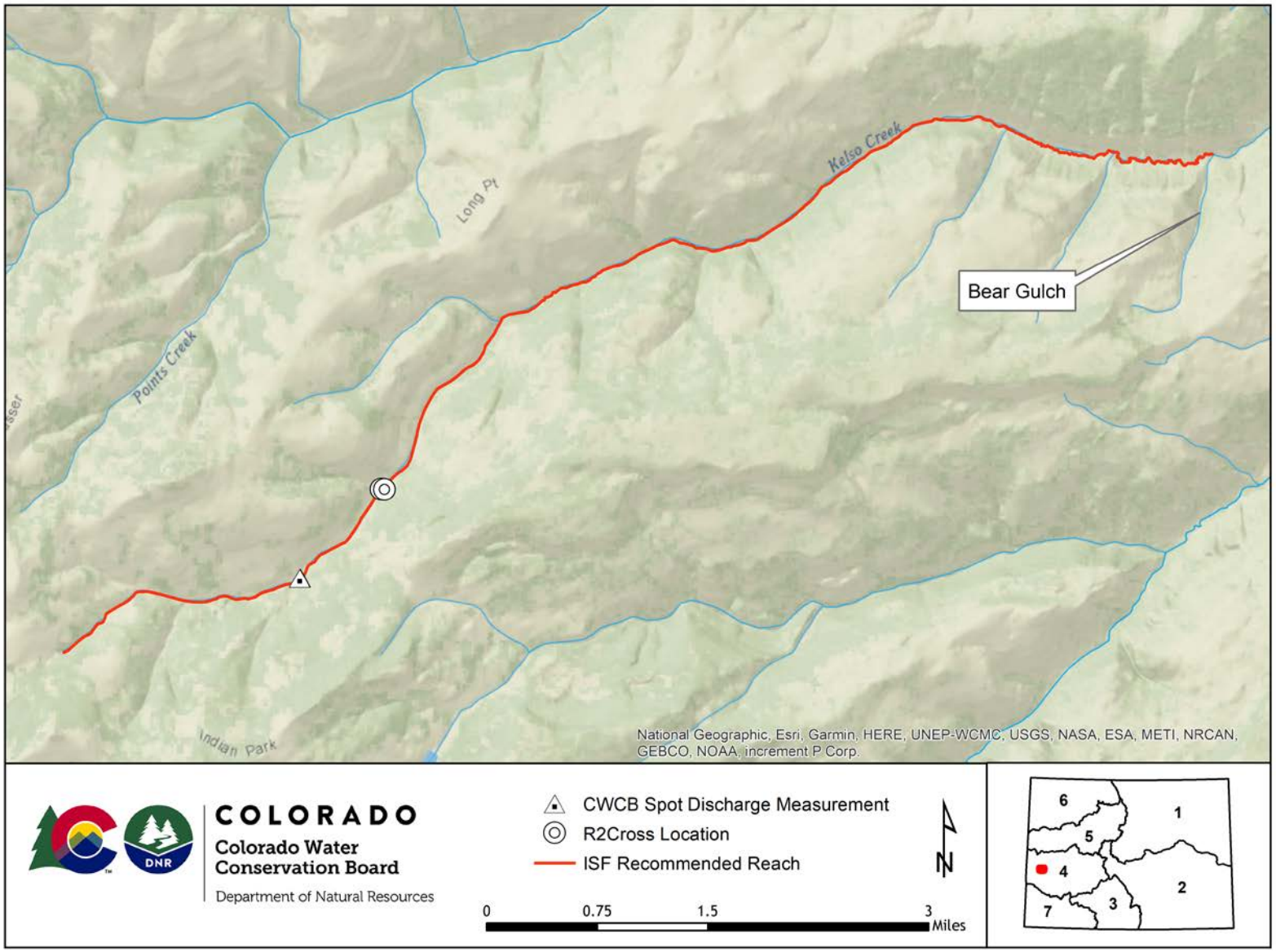
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH