COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Lost Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence with Hahn Creek UTM North: 4441691.21 UTM East: 290147.03
LOWER TERMINUS:	Confluence with Long Park Creek UTM North: 4436992.17 UTM East: 289667.03
WATER DIVISION:	6
WATER DISTRICT:	43
COUNTY:	Rio Blanco
WATERSHED:	Upper White
CWCB ID:	18/6/A-006
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
LENGTH:	3.64 miles
FLOW RECOMMENDATION:	1.3 cfs (10/01 - 03/31) 2.3 cfs (04/01 - 08/15) 1.8 cfs (08/16 - 09/30)

Lost 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.

Colorado Parks and Wildlife (CPW) recommended that the CWCB appropriate an ISF water right on a reach of Lost Creek. Lost Creek originates in the White River National Forest at an elevation of approximately 9,640 feet. It flows in a southeasterly direction for 8.3 miles and drops to an elevation of approximately 7,560 feet where it joins the North Fork White River. The proposed ISF reach extends from the confluence with Hahn Creek downstream to the confluence with Long Park Creek, and is located within Rio Blanco County (See Vicinity Map). The U.S. Forest Service owns and manages one-hundred percent of the land on which the 3.64 mile proposed reach is located (See Land Ownership Map). CPW recommended this reach of Lost 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.

Lost Creek has a high-value natural environment that supports a self-sustaining population of native Colorado River cutthroat trout. The Colorado River Cutthroat Trout Conservation Plan also recognizes the importance of Lost Creek as one of Colorado's streams that contains a pure conservation population of this species. Lost Creek was last sampled in August 2015, utilizing standard electrofishing techniques. The 2015 data shows multiple age classes (5 or more) of Colorado River cutthroat trout and a wide range of sizes from juvenile fish (3 inch) to 11 inch adults. Lost Creek's natural environment also contains a diverse macroinvertebrate community and some extensive beaver dam complexes in the lower reaches of the stream (downstream of this proposed ISF segment).

Table 1. List of species identified in Lost Creek.

Species Name	Scientific Name	Status
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	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

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 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). 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. However, the R2Cross model also contains the Thorne and Zevenbergen subroutine which uses field measured bed material grain size to estimate velocity. This method is not constrained by the accuracy range of the Manning's n subroutine.

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). 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 1.3 cfs, which meets 2 of 3 criteria, and the R2Cross model results in a summer flow of 2.3 cfs, which meets 3 of 3 criteria.

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

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
None	08/23/2017 # 1	0.75	NA*	1.3	2.3
			Mean	1.3	2.3

**Results calculated using the R2Cross Thorne-Zevenbergen subroutine*

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

2.3 cfs is recommended for the period of April 1 to August 15.

1.8 cfs is recommended for the period of August 16 to September 30. This flow rate is needed for cutthroat trout rearing and growth. This recommendation is limited by water availability.

1.3 cfs is recommended for the period of October 1 to March 31. This flow rate is needed for overwintering adults and juveniles.

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 Lost Creek is 16.9 square miles, with an average elevation of 8,994 feet and average annual precipitation of 30.6 inches (See the Hydrologic Features Map). There are a number of spring water rights in the basin tributary to this reach. These water uses appear to be small and hydrology is essentially natural flow conditions.

Available Data
There is not a current streamflow gage on Lost Creek, but there was a historical gage located downstream from the proposed ISF reach. The Lost Creek near Buford, CO gage (USGS 9302450) was located approximately 0.64 miles downstream from the proposed lower terminus. The gage had a continuous period of record from 10/1/1964 to 9/29/1989. The drainage basin of the Lost Creek gage is 21.6 square miles, with an average elevation of 8,971 feet and average annual precipitation of 30.3 inches. In addition to the spring water rights, the gage is impacted by the Lost Creek Ranger Station pipeline (0.1 cfs; appropriated 1891 and 1931).

CWCB staff made no streamflow measurements on the proposed reach of Lost Creek, but did assist CPW in collecting field data.

Data Analysis
The Lost Creek gage has 25 years of record for each day of the year. This record is relatively long, which should provide good information about the range of hydrologic conditions in the area. The area-precipitation method was used to scale the Lost Creek gage data to the lower terminus on Lost Creek at the confluence with Long Park Creek. The method estimates streamflow based on the ratio of the precipitation weighted drainage area. The scaling factor for Brush Creek basin at the lower terminus is 0.79. Median streamflow and 95% confidence intervals for median streamflow were calculated.

Water Availability Summary
The hydrographs (See Complete and Detailed Hydrographs) show median and 95% confidence interval for median streamflow estimated at the lower terminus of Lost Creek. The proposed ISF is below the median streamflow estimate most of the time and below the 95% confidence interval for median streamflow at all times. Staff concludes that water is available for appropriation on Lost Creek.

Material Injury
Because the proposed ISF on Lost 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.

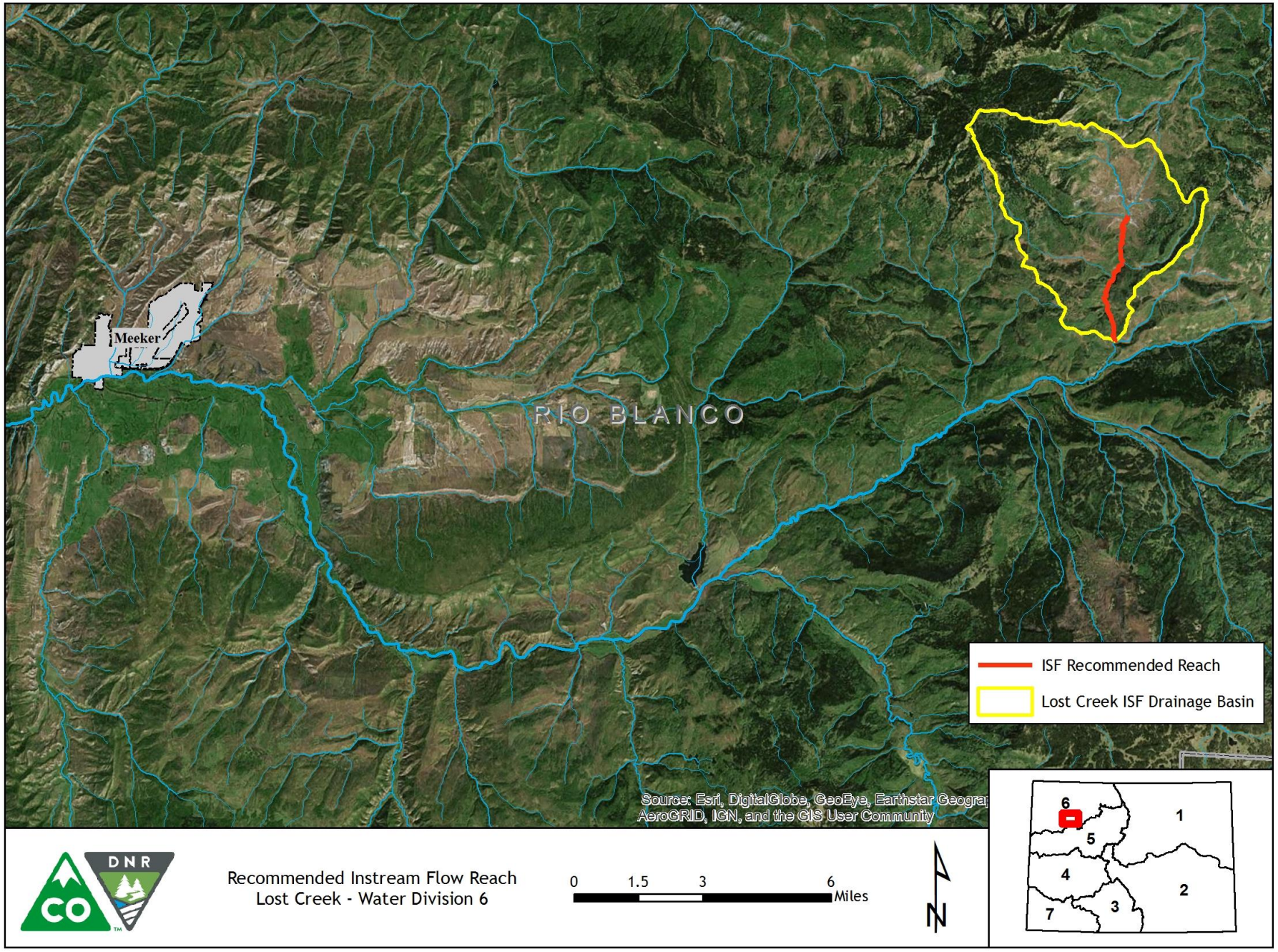
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

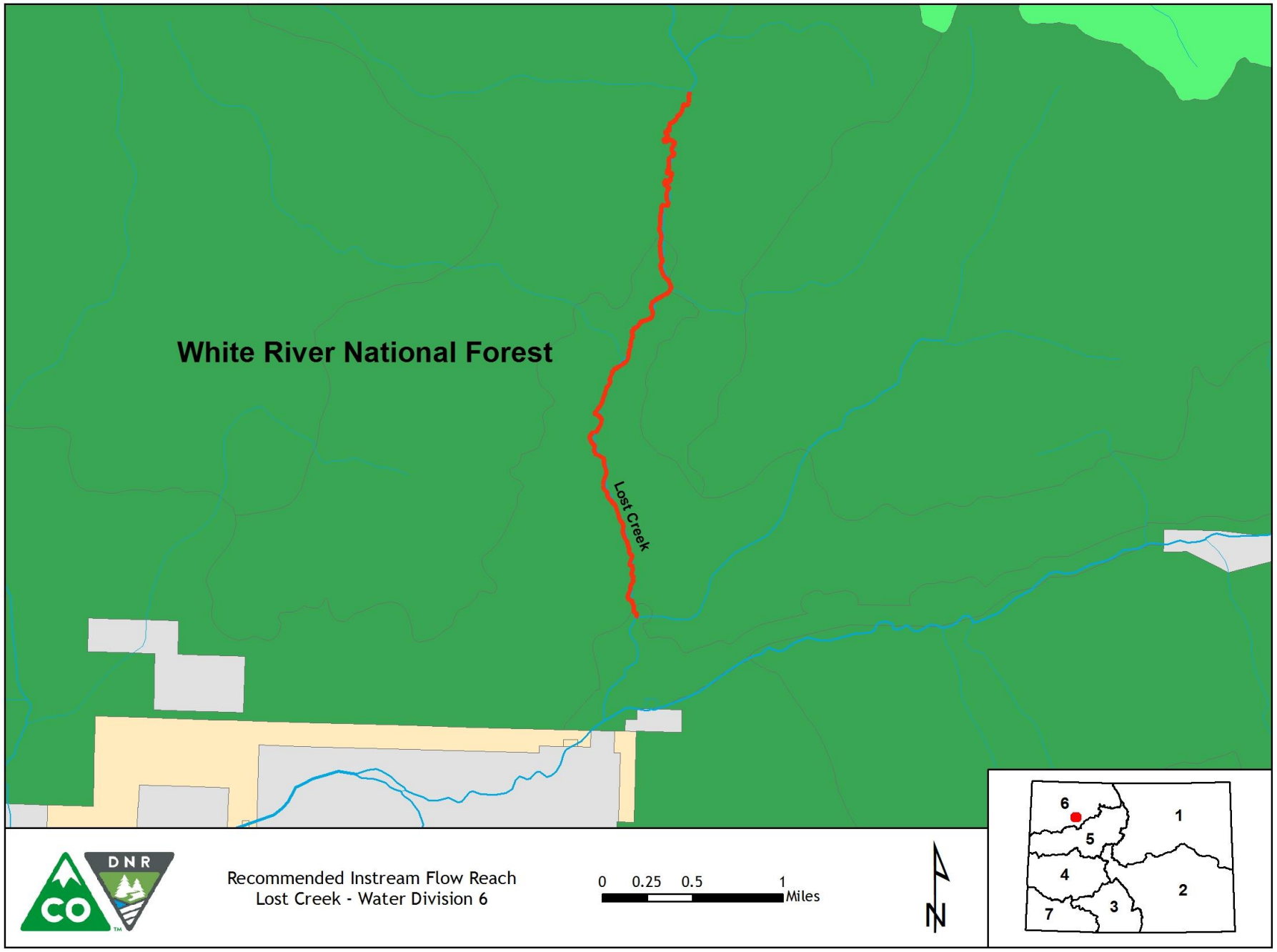
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

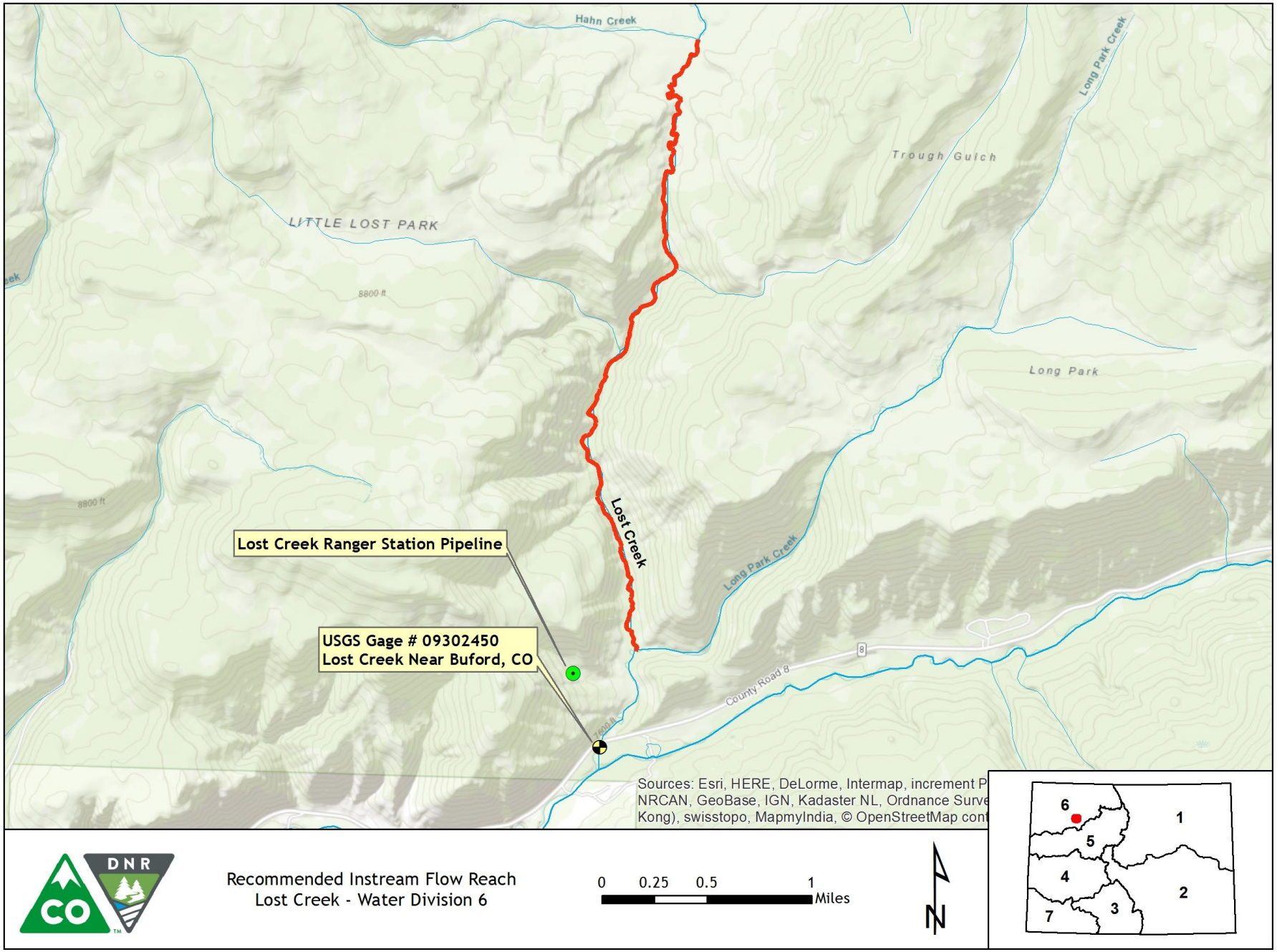
VICINITY MAP



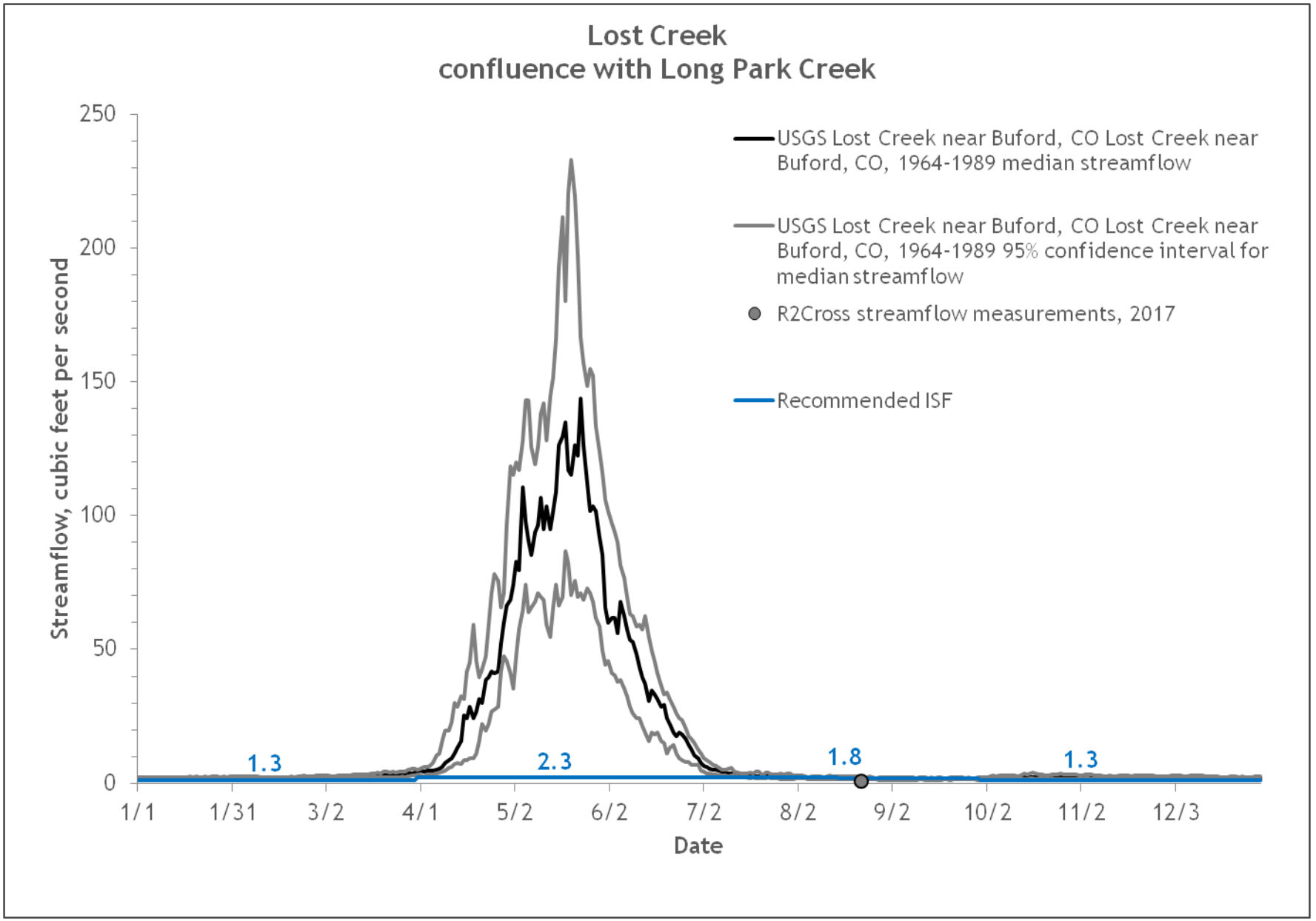
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH