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

Cement Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION JANUARY 2020

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4314893.95 UTM East: 346437.58
LOWER TERMINUS:	confluence with the East River UTM North: 4296619.14 UTM East: 336739.49
WATER DIVISION:	4
WATER DISTRICT:	59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
EXISTING ISF:	80CW0103, 10 cfs (01/01 – 12/31)
CWCB ID:	20/4/A-002
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	17.35 miles
FLOW RECOMMENDATION:	3 cfs (04/15 - 07/10)

Cement 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.

HCCA recommended that the CWCB appropriate an increase to the existing ISF water right on a reach of Cement Creek. Cement Creek is located within Gunnison County (See Vicinity Map), and originates at an elevation of approximately 11,900 feet in the Gunnison National Forest. The creek flows southwest 17.4 miles to the confluence with the East River at an elevation of approximately 8,500 ft. The proposed reach extends from the headwaters of Cement Creek downstream to the confluence with the East River. The U.S. Forest Service manages 81 percent of the land on the 17.35 mile proposed reach and the remaining 19% 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.

Cement Creek is a cold water snowmelt-driven stream. The stream substrate ranges from small gravels to large boulders. The Cement Creek riparian area is diverse, consisting of mixed conifers, alders and willows, high alpine meadows, beaver complexes, and an area of irrigated hay meadow. The riparian zone is in good condition in upper Cement Creek and provides shade and cover for the fish community.

Cement Creek supports a diverse fishery due to a mixture of riffles and small pools that provide high quality habitat for all life stages of fish and other aquatic life. Stream sampling conducted by Colorado Parks and Wildlife (CPW) between 1973 and 2012 documented Colorado River cutthroat trout, brook trout, brown trout, and rainbow trout.

Table 1. List of species identified in Cement Creek.

Species Name	Scientific Name	Status
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	State - Species of Special Concern Federal – Sensitive Species
brook trout	*Salvelinus fontinalis*	None
brown trout	*Salmo trutta*	None
rainbow trout	*Oncorhynchus mykiss*	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.

Quantification Methodology

HCCA 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). HCCA 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

HCCA collected R2Cross data at two transects for this proposed ISF reach (Table 2). The R2Cross model results in a summer flow of 13.11 cfs, which meets 3 of 3 criteria and is within the

accuracy range of the R2Cross model. There is no proposed change to the existing winter ISF rate. R2Cross field data and model results can be found in the appendices.

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

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
9/26/2018, 1	32.25	4.23	1.69 - 10.58	N/A	Out of range
10/05/2018, 2	37.17	13.05	5.22 - 32.63	N/A	13.11
	Mean				13.11

ISF Recommendation

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

Based on analysis of R2cross results, an increase of 3 cfs to the existing ISF of 10 cfs is recommended during the snowmelt runoff period and early summer, from April 15 to July 10. The combined total of 13.0 cfs for the two ISF water rights satisfies all three of the required hydrologic criteria. This recommendation is driven by the average depth criteria.

HCCA supports this increase to the existing summer instream flow rate to protect the groundwater flows necessary to support the Cement Creek fen and riparian area. An increase to the existing instream flow will also maintain the quality of the aquatic habitat during the summer, a critical time for fish growth, survival, and reproduction. The proposed increase will raise the average water depth by 0.04 feet from 0.33 to 0.37 feet. The percent wetted perimeter will also increase. Together, these conditions will increase habitat connectivity including access to pools and other areas that provide critical refuge to fish during the summer months.

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 Cement Creek is 35.7 square miles, with an average elevation of 10,691 feet and average annual precipitation of 31.4 inches (See the Hydrologic Features Map). There is a total of 55 cfs of active decreed surface rights and about 3 acre-feet of decreed storage rights. Due to the number and volume of surface water diversions, streamflow is altered from natural conditions.

Available Data

There is no current gage located on the proposed ISF reach. A historic gage, Cement Creek near Crested Butte, CO (USGS 9112000), was located approximately 2.5 miles upstream from the proposed lower terminus. The historic gage operated from 1910 – 1913 and 1940 – 1951. The drainage basin of the Cement Creek gage was 32.9 square miles, with an average elevation of 10,808 feet and average precipitation of 32.0 inches.

The historic Cement Creek gage has several diversions upstream and downstream from it. In some cases, diversion records can be used to provide an indication of water availability in the reach. Several diversions along Cement Creek have over 40 years of diversion records available; however, others do not keep diversion records. There are a number of intervening water rights located between the measurement location and the proposed lower terminus. Table 3 summarizes surface water diversions 0.5 cfs or greater on Cement Creek. Cement Creek Ditch has the highest amount of water (26 cfs) and is the most senior diversion, but according to the Division Engineer, it does not sweep the creek (email communication from Bob Hurford, Division 4 Engineer, 11/5/19).

Table 3. Active surface water diversions on Cement Creek

Structure Name	WDID	Appropriation Date	Decreed Rate (cfs)	Location in respect to historic gage
Yarnell Ditch	5900712	5/30/1951	6.5	Upstream
Jordan Ditch No. 1-4	5901244-5901247	9/1/1954	3	Upstream
Tim & Helen Morgan Ditch	5900727	6/1/1954	2	Upstream
Reese Ditch No 1 & 2	5901266 5901267	6/1/1973	3.5	Upstream
Cement Creek Ditch	5900537	6/1/1886	26	Downstream
Jones Highline Ditch	5900605	6/14/1903 6/1/1894	1.33 4	Downstream
Adams Cement Creek Ditch	5900502	6/1/1917	1.5	Downstream
Obaid Ditch	5901736	7/1/1925	0.5	Downstream
Cement Cr Ranger Sta	5900536	5/1/1908 5/1/1914 4/3/2002	2.38 2.7 0.25	Downstream
Adams Ranch Ditch & Pond	5900730	6/1/1920	1	Downstream

CWCB staff made three streamflow measurements on the proposed reach of Cement Creek as summarized in Table 4.

Table 4. Summary of streamflow measurement visits and results for Cement Creek.

Visit Date	Flow (cfs)	Collector
05/14/2019	52.80	CWCB
08/02/2019	52.92	CWCB
10/18/2019	17.31	CWCB

Data Analysis

Adjustments were made to the historic gage record to reflect surface water diversions that started after the gage data was collected. Because all structures upstream from the gage have appropriation dates of 1951 or later, Staff made the assumption that diversions were not active during the operation of the Cement Creek gage and therefore, these uses were not accounted for in the gage records. Active structures downstream from the Cement Creek gage are also unaccounted for in the historic record due to their location. Records for Cement Creek diversions start after 1975, so a daily comparison cannot be made to the historic gage. Instead, the median daily diversion rate for each of diversion with records was calculated and subtracted from the median daily gage record. For diversions without records (Jordan Ditch No. 1-4, Reese Ditch No. 1 & 2, and Adams Ranch Ditch & Pond), the full decreed amount, a total of 7.5 cfs,

was subtracted from the median daily gage record during irrigation season (May 15 – Oct 31). Subtracting the full decreed amount is likely to result in underestimating the amount of water available particularly during late summer and early fall.

The historic gage data was not adjusted to account for the additional contributing drainage basin below the gage. This was not done due to the small difference in drainage basin size and precipitation that result in a proration factor of 1.06%. Additionally, no adjustments were made for return flows. All diversions, except for the Cement Creek Ditch, irrigate lands next to the creek and return flows from these diversions likely accrue to the creek above the lower terminus. Due to these factors, this analysis will likely result in an underestimation of the amount of water available in the proposed reach.

Water Availability Summary

The hydrograph (See Complete Hydrograph) shows the adjusted Cement Creek gage record. The methods used to estimate the effects from diversion structures not measured in the historical gage data results in some negative streamflow estimates in September. This demonstrates that this analysis method is likely underestimating the amount of water available. Nevertheless, this conservative estimate does show that water is available for an increase April 15 to July 10. Staff concludes that water is available for this appropriation on Cement Creek.

Material Injury

Because the proposed ISF on Cement 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.

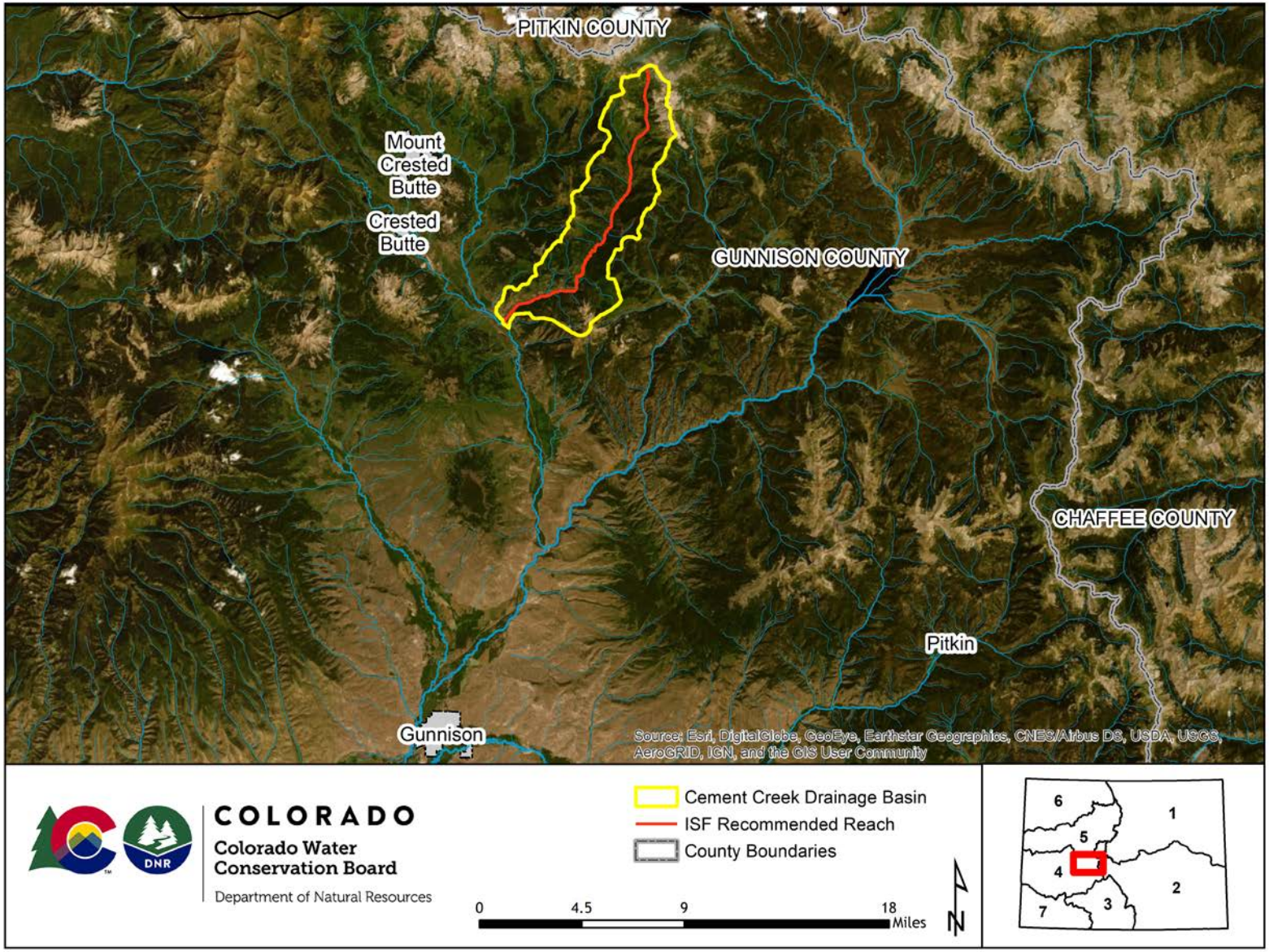
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

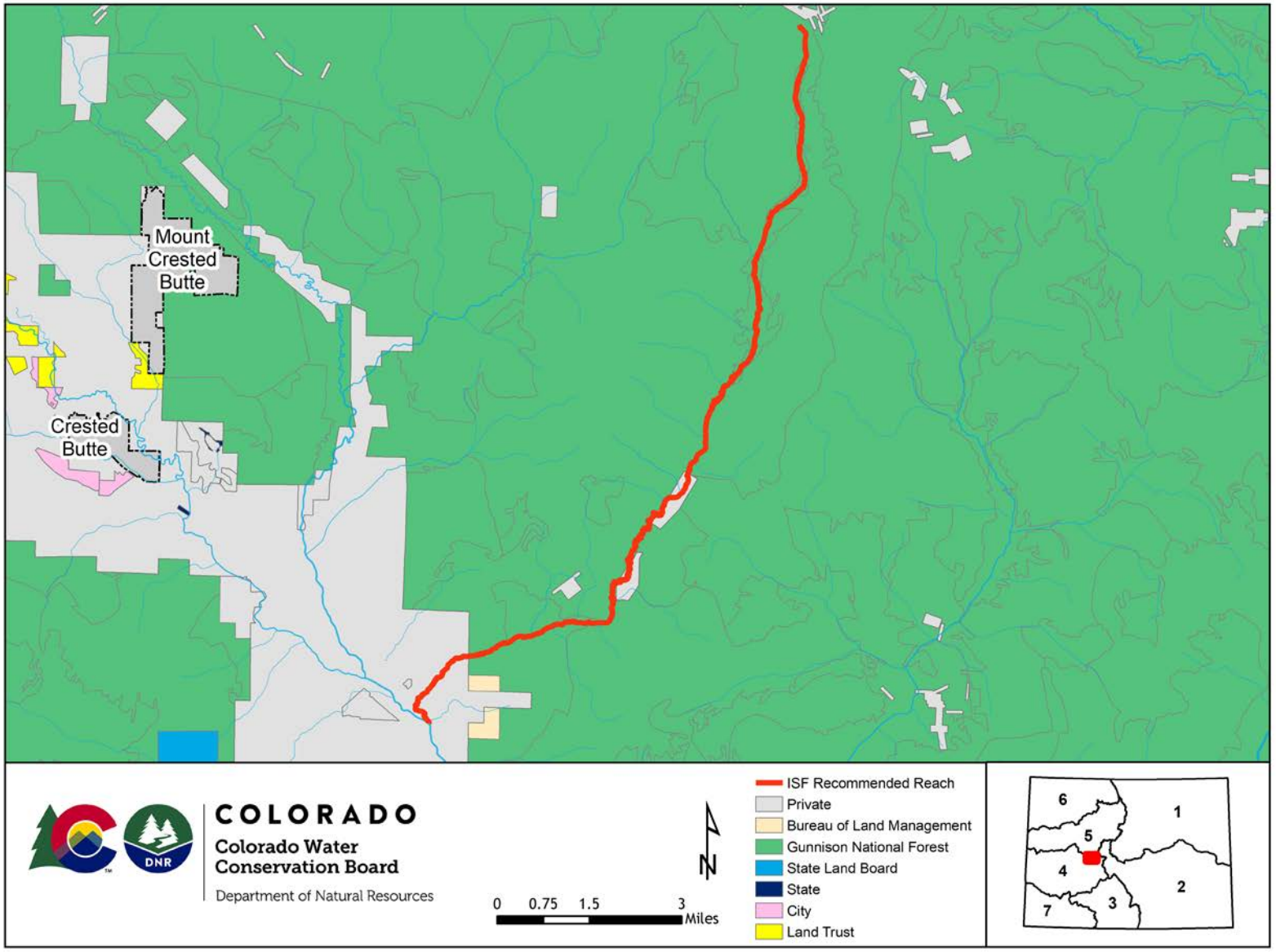
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

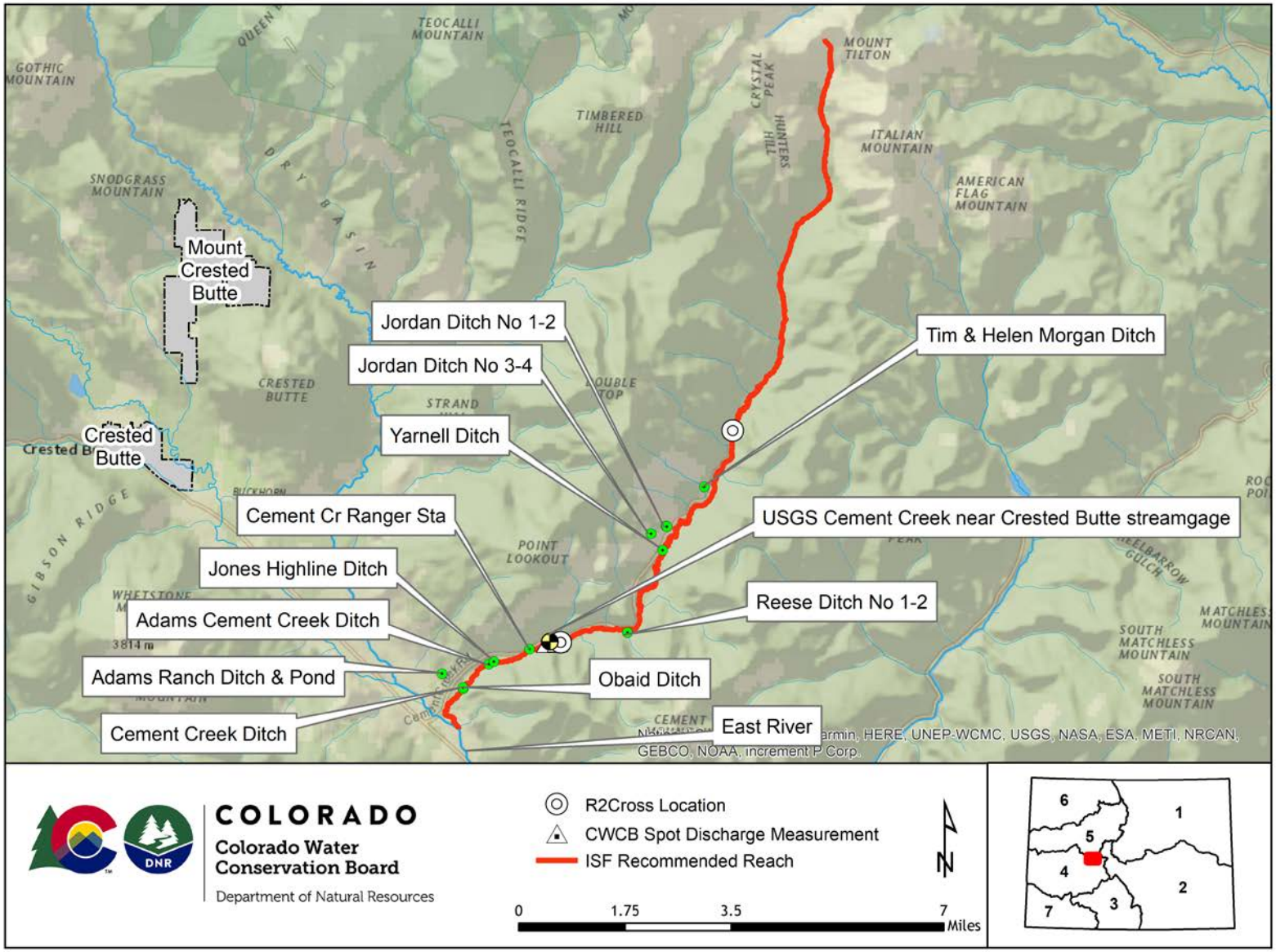
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH