Elk Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 25-26, 2021

UPPER TERMINUS:	headwaters UTM North: 4306042.49 UTM East: 320535.44
LOWER TERMINUS:	confluence Coal Creek UTM North: 4302804.98 UTM East: 321286.22
WATER DIVISION:	4
WATER DISTRICT:	59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
CWCB ID:	21/4/A-006
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	2.66 miles
FLOW RECOMMENDATION:	0.2 cfs (08/16 - 04/30) 1.5 cfs (05/01 - 07/10) 0.65 cfs (07/11 – 08/15)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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) recommended that the CWCB appropriate an ISF water right on a reach of Elk Creek because it has a natural environment that can be preserved to a reasonable degree. The proposed reach extends from Elk Creek's headwaters downstream to the confluence with Coal Creek. Elk Creek is located within Gunnison County (See Vicinity Map), and originates about 4.5 miles west of the Town of Crested Butte in the Gunnison National Forest at an elevation of approximately 11,500 feet. It flows in a southeasterly direction for 2.66 miles until the confluence with Coal Creek at an elevation of 9,500 feet. Ninety percent of the land on the 2.66 mile proposed reach is owned and managed by the U.S. Forest Service, and 10% 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 located at: https://cwcb.colorado.gov/2021-isf-recommendations.

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.

Elk Creek is a cold-water, high gradient stream. The stream channel is a mixture of cascades and small pools with cobble-sized substrate, some large boulders, and ample woody debris. Elk Creek has been impacted by historic mining operations. The Environmental Protection Agency (EPA) recently completed reclamation at the Standard Mine Superfund Site to improve the water quality of Elk Creek.

The riparian zone is in good condition with a robust pine-spruce forest, providing ample shade for the aquatic ecosystem. EPA and Colorado Parks and Wildlife (CPW) identified brook trout and rainbow trout in lower Elk Creek. These populations are believe to be self-sustaining because Elk Creek is not stocked. Numerous macroinvertebrates have been observed, along with a tiger salamander.

Table 1. List of species identified in Elk Creek.

Species Name	Scientific Name	Protection Status
tiger salamander	*Ambystoma tigrinum*	None
rainbow trout	*Oncorhynchus mykiss*	None
brook trout	*Salvelinus fontinalis*	None
mayfly	*Ephemeroptera*	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 a stream habitat type that are most easily visualized as sections of the stream 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 macroinvertebrates (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). 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 0.75 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 1.51 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. 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 Elk Creek.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
10/03/2019, 1	8.80	0.12	0.05 - 0.30	0.20	Out of range
06/24/2020, 2	7.70	2.31	0.92 - 5.78	1.30	1.51
			Mean	0.75	1.51

ISF Recommendation

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

0.2 cfs is recommended from August 16 to April 30. This recommendation is limited by water availability, but will protect the natural environment during the base flow period.

1.5 cfs is recommended from May 1 to July 10 to protect the natural environment during summer months.

0.65 cfs is recommended from July 11 to August 15. This recommendation is limited by water availability, but will protect late summer flows.

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 Elk Creek is 1.68 square miles, with an average elevation of 10,955 feet and average annual precipitation of 33.75 inches (See the Hydrologic Features Map). There are no known surface water diversions in the basin tributary to the proposed reach or within the proposed reach. Due to the lack of surface water diversions, hydrology in this drainage basin represents natural flow conditions.

Available Data and Analysis

Gage Analysis

The EPA contracts with the USGS to operate the Elk Creek at Coal Creek above Crested Butte, CO gage (USGS 09110990) seasonally from April 1st to November 15th each year. This gage is located approximately 400 feet upstream from the proposed lower terminus. The period of record for this gage is October 17, 2017 to present. Median hydrology was not calculated due to the short period of record. Additionally, there are no surface water diversions on Elk Creek so no adjustments were made to the gage.

Because the gage is operated seasonally, staff evaluated methods to estimate missing winter data. Staff examined the nearby Slate River above Baxter Gulch at HWY 135 near Crested Butte, CO gage (USGS 385106106571000). The Slate River gage is located 5.75 miles east of the Elk Creek gage and has a period of record from 2006 to present. The drainage basin of the Slate River gage is 69 square miles, with an average elevation of 10,334 feet and average precipitation of 33.65 inches. The correlation between the Elk Creek gage and the Slate River gage produced a high r^2 value of 0.95. Staff used this correlation to fill data gaps in the winter months of the Elk Creek gage.

Climate Data

Due to the short period of record at the Elk Creek gage, staff evaluated the nearby streamgage, East River below Cement Creek near Crested Butte, CO (USGS 09112200) to assess how 2017 through 2020 compared hydrologically to a longer record. The gage recorded data during most years between 1963 and 2020 for a total of 38 years of records. The East River gage is located approximately 11 miles southeast of the Elk Creek gage. This gage is affected by diversions, but is a reasonable representation of hydrology because it is not affected by large reservoir releases. Based on this analysis, 2017 was near the 75th percentile for total annual streamflow and the fall of 2017 (when the Elk Cr gage was installed) was near median flows. 2018 was the third driest year on record. 2019 was near the 75th percentile for total annual streamflow. In analyzing median daily flow at the gage, the majority of this total annual flow was a result of

a high snowpack that peaked later than most years, but due to a dry summer, 2019 flows quickly dropped to median in early September. 2020 was in the 10th percentile for annual flows, with flows much below median for the majority of the spring and summer.

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

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

Visit Date	Flow (cfs)	Collector
09/30/2020	0.16	CWCB

Water Availability Summary

The Complete Hydrograph shows the measured and estimated streamflows for the Elk Creek gage from 2017 to 2020, streamflow measurements, and the proposed ISF. The measured streamflow is generally above the proposed ISF, with the exception of portions of the known hydrologically dry year of 2018. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on Elk 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. (2020), 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.

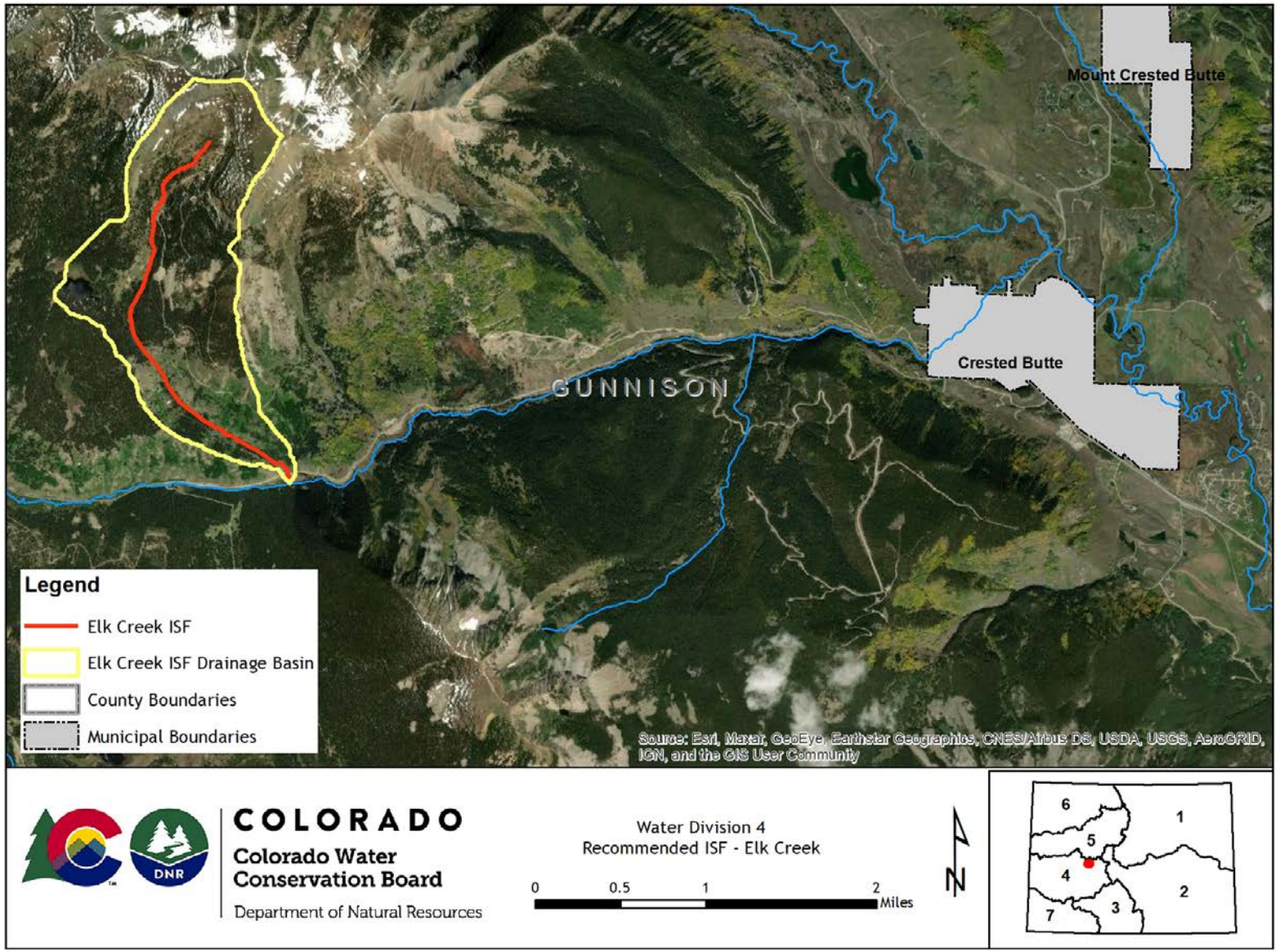
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

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

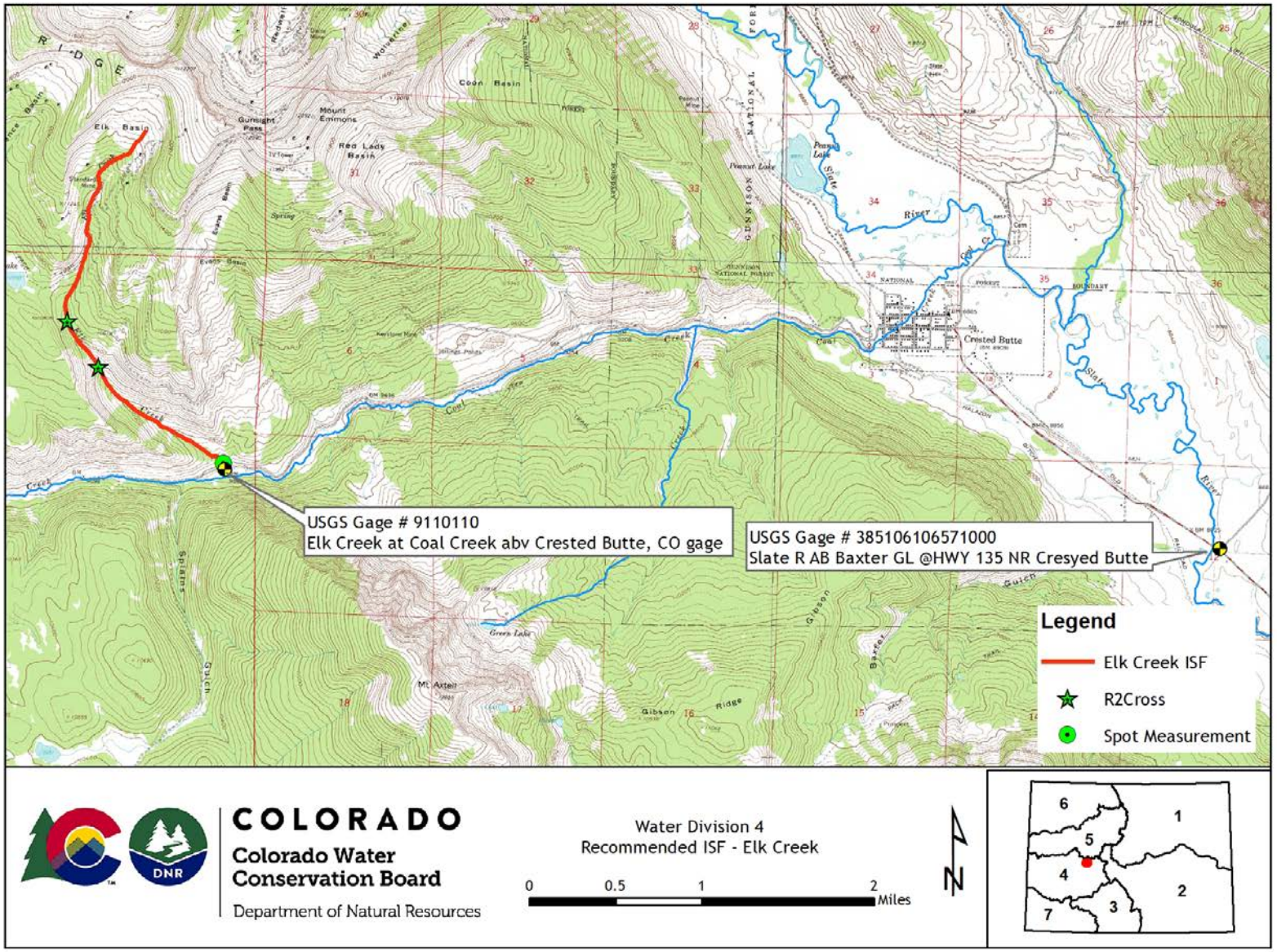
Projected Coordinate System: NAD 1983 UTM Zone 13N.

VICINITY MAP

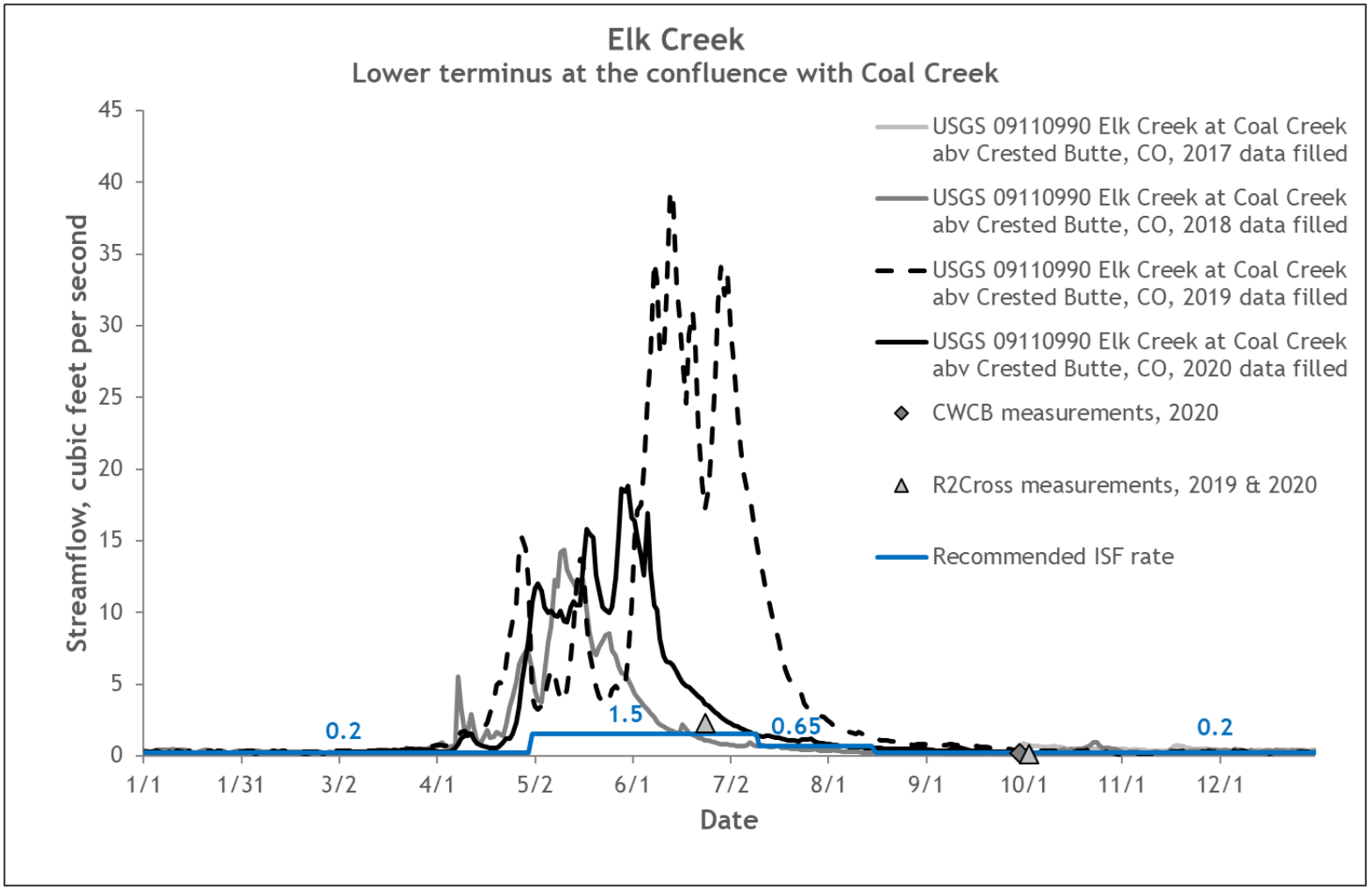


LAND OWNERSHIP MAP

HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH