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

Iowa Gulch

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION JANUARY 2020

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4343774.07 UTM East: 398270.52
LOWER TERMINUS:	Iowa Gulch intake UTM North: 4342373.29 UTM East: 394280.86
WATER DIVISION:	2
WATER DISTRICT:	11
COUNTY:	Lake
WATERSHED:	Arkansas Headwaters
CWCB ID:	20/2/A-002
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	3.61 miles
FLOW RECOMMENDATION:	1.7 cfs (05/01 - 09/15) 1 cfs (09/16 - 04/30)

Iowa Gulch

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.

The BLM recommended that the CWCB appropriate an ISF water right on a reach of Iowa Gulch because it has a natural environment that can be preserved to a reasonable degree. Iowa Gulch is located within Lake County (See Vicinity Map), and originates at an elevation of approximately 13,150 feet in the Mosquito Range, flowing west 10.4 miles to the confluence with the Arkansas River at an elevation of 9,350 feet. The proposed reach extends from the headwaters downstream to the Iowa Gulch intake. The BLM manages 68 percent of the land on the 3.61 mile proposed reach and the remaining 32 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.

Iowa Gulch is a steep, cold water, high elevation stream flowing through broad, subalpine meadows. The stream substrate is primarily boulders and cobbles forming large pools separated by riffles. The stream has good floodplain connectivity with the surrounding willow communities, and several sections have numerous side channels that support healthy wetland communities throughout the valley floor. Located near the Leadville Mining District, Iowa Gulch is impacted by historic mining activities that have leached metals into the stream and eliminated fish populations within the recommended segment. However, recent reclamation activities have mitigated impacts to the watershed from abandoned mines and improved water quality to a point that BLM biologists believe it could now support a fish population. Macroinvertebrate samples collected in support of this recommendation were used to evaluate biological condition using the Colorado Benthic Macroinvertebrate Multimetric Index (MMI). The

Iowa Gulch MMI score was 59.9, which is above the attainment threshold of 48 for Biotype 2 (mountains), indicating that the stream can support aquatic life and is not in an impaired condition as compared to reference streams of a similar biotype.

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

BLM 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). BLM 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 the BLM (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 1.31 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 1.69 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 Iowa Gulch.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
09/18/2018, 1	11.41	1.58	0.63 - 3.95	1.57	1.58
09/18/2018, 2	9.22	1.65	0.66 - 4.13	1.05	1.80
	Mean			1.31	1.69

ISF Recommendation

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

1.7 cubic feet per second is recommended from May 1 to September 15. This recommendation is driven by the average depth criteria. Given the small amount of riffle habitat in this reach, it is important to provide depths that are suitable for aquatic macroinvertebrate production, and ultimately for spawning trout when they are reintroduced to the stream.

1.0 cubic feet per second is recommended from September 16 to April 30. This recommendation is driven by limited water availability. This flow rate should prevent complete icing of the numerous pools in this reach, allowing insects and reintroduced fish populations to overwinter.

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 Iowa Gulch is 4.98 square miles, with an average elevation of 12,258 feet and average annual precipitation of 32.36 inches (See the Hydrologic Features Map). There are no surface water diversions in the drainage basin tributary to 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 Iowa Gulch. CWCB staff installed a temporary streamgage on Iowa Gulch 1.7 miles upstream from the lower terminus. Private property downstream and wetlands in the valley limited suitable gaging locations and prevented staff from installing the gage near the proposed lower terminus. This location has a 2.2 square mile drainage basin, 12,661 feet average basin elevation, and 36.04 inches of average basin annual precipitation. The CWCB streamgage was installed on 7/8/2019 and is still operating. The pressure transducer recorded water depth every 15 minutes, which was converted to streamflow using a rating curve developed by staff. The 15 minute interval data collected by CWCB staff was used to calculate daily average streamflow values. There are no diversions above the proposed lower terminus that may affect the CWCB streamgage measurements.

CWCB staff made three streamflow measurements on the proposed reach of Iowa Gulch as summarized in Table 3.

Table 3. Summary of streamflow measurement visits and results for Iowa Gulch.

Visit Date	Flow (cfs)	Collector
07/18/2019	13.28	CWCB
08/13/2019	5.06	CWCB
10/09/2019	0.79	CWCB

Data Analysis

Staff used the daily streamflow data from the CWCB streamgage on Iowa Gulch and did not scale the data to the proposed lower terminus, which is located downstream from the measurement location. This likely underestimates the amount of flow in the stream due to the difference in drainage basin size. Median streamflow and 95% confidence interval for median streamflow were not calculated due to the short period of record.

Because of the short period of record of the CWCB streamgage, staff examined precipitation and streamflow in the basin to assess how 2019 gage data compare to typical conditions. Leadville Lake County AP NOAA climate station (USW0093009) is located 5 miles west of the proposed lower terminus and has recorded daily precipitation from 1948 to present. Staff examined the average monthly precipitation and compared it to the 2019 monthly precipitation totals. The station reported having above average precipitation in March, April, and May, but significantly below average precipitation in July, August, and September.

To further examine hydrology this year, staff computed the median daily streamflow at the EF Arkansas R at US Highway 24 (USGS 7079300) gage and compared it to 2019 flows. The EF Arkansas gage is located approximately 5 miles northwest of the proposed lower terminus. The gage has a drainage basin of 49.8 square miles, an average elevation of 11,477 feet, and 25.52 inches of average basin annual precipitation. The gage is somewhat affected by diversions, but provides a good representation of hydrology because it is not affected by reservoir releases. In 2019, flows at the gage in mid-May were significantly below the median due to a late runoff period. In June through mid-August, flows were significantly above the median, at times more than 250 cfs above the median. In late summer of 2019, flows returned to near median due to the dry summer months.

The analysis of hydrologic indicators showed that although 2019 saw very high and delayed runoff flows, conditions on the stream returned to normal in the fall due to a dry summer. Therefore, this likely means that streamflow recorded by the CWCB streamgage is higher than average in the July, but returns to approximately normal conditions in August (See Figure 1).

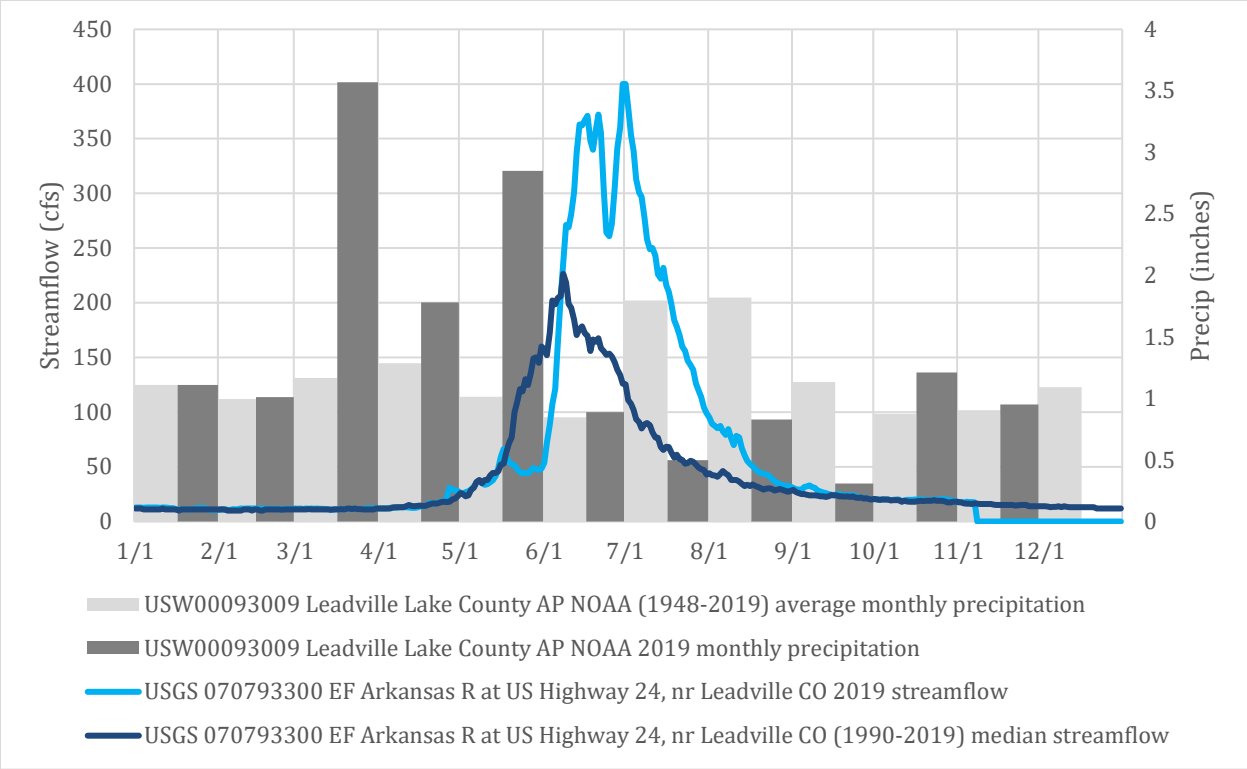


Figure 1. Comparison of average monthly and 2019 precipitation at nearby climate station and median and 2019 streamflow at a nearby streamgage. Streamflow data available through 11/7/2019 and precipitation data only available through 12/13/2019 at time of download.

StreamStats estimates median monthly flow and is not affected by single year conditions, which could be much higher or lower than typical years depending on a number of factors. Although the CWCB streamgage provides an indication that the appropriation was available this year, StreamStats gives an indication of whether the recommendation is available over a longer period. Additionally, it provides information about flow conditions in the spring and winter when no CWCB streamgage data is available.

Water Availability Summary

The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow and the streamflow recorded at the CWCB streamgage. Due to the lack of diversions in the basin, StreamStats provides a good indication of mean monthly flows at the lower terminus. The CWCB streamgage is likely an underestimation of the streamflow at the lower terminus due to the gage's location and a significantly smaller drainage basin. From staff's analysis of precipitation and nearby streamgages, while streamflow recorded at the CWCB streamgage was also likely far above average during the summer months, it provides a good estimate of seasonality and flow amounts typical of a normal autumn.

Due to the location of the CWCB streamgage, the short period of record, and the unusual conditions during the period of record, a combination of StreamStats and the CWCB streamgage record was used in this analysis. StreamStats indicates that runoff begins in May. This was used

to define the beginning of the summer recommendation. Both StreamStats and the CWCB streamgage indicate that the summer flow rate is available until mid-September. StreamStats shows that the winter flow rate is available. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on Iowa Gulch 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.

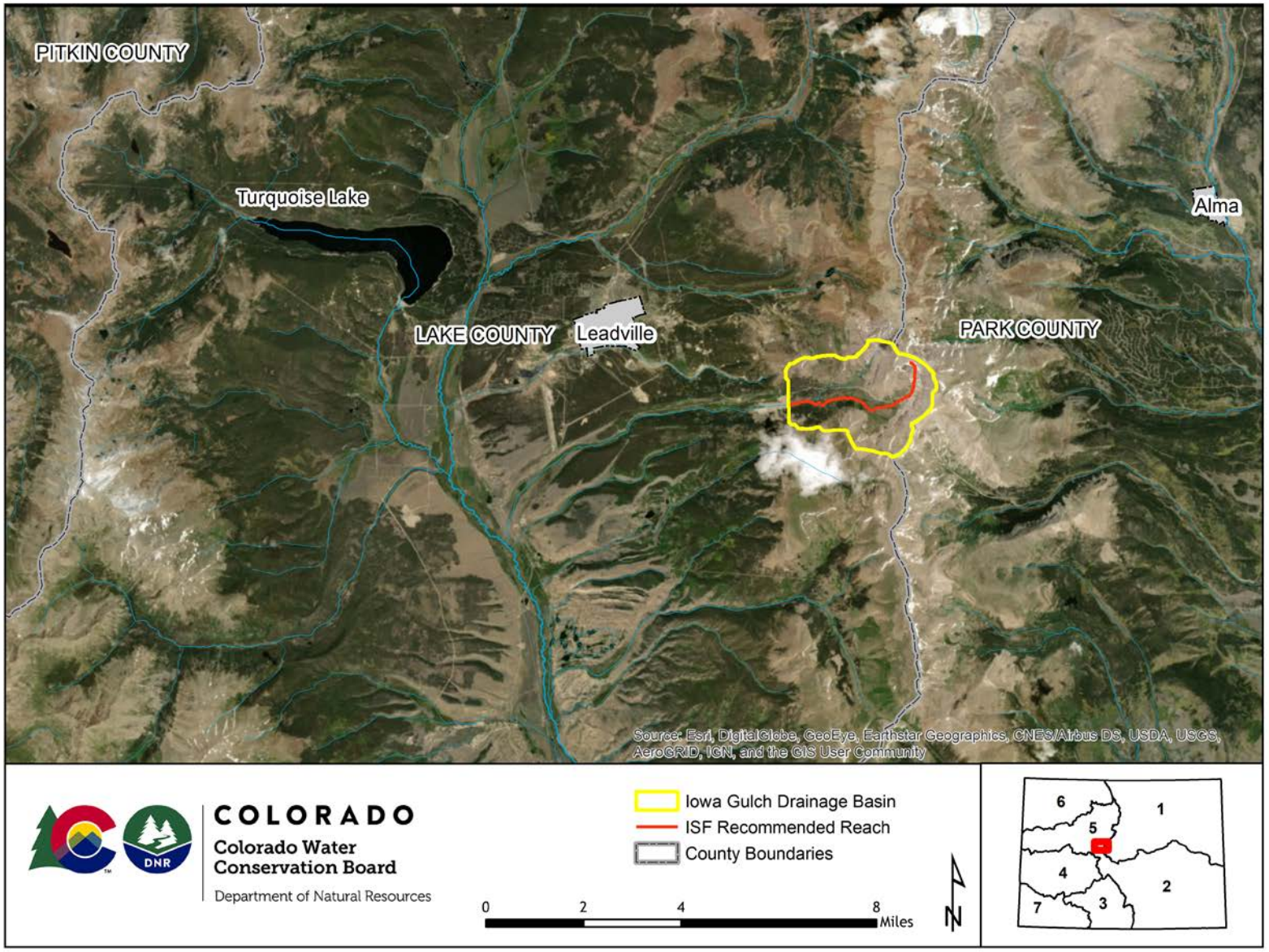
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

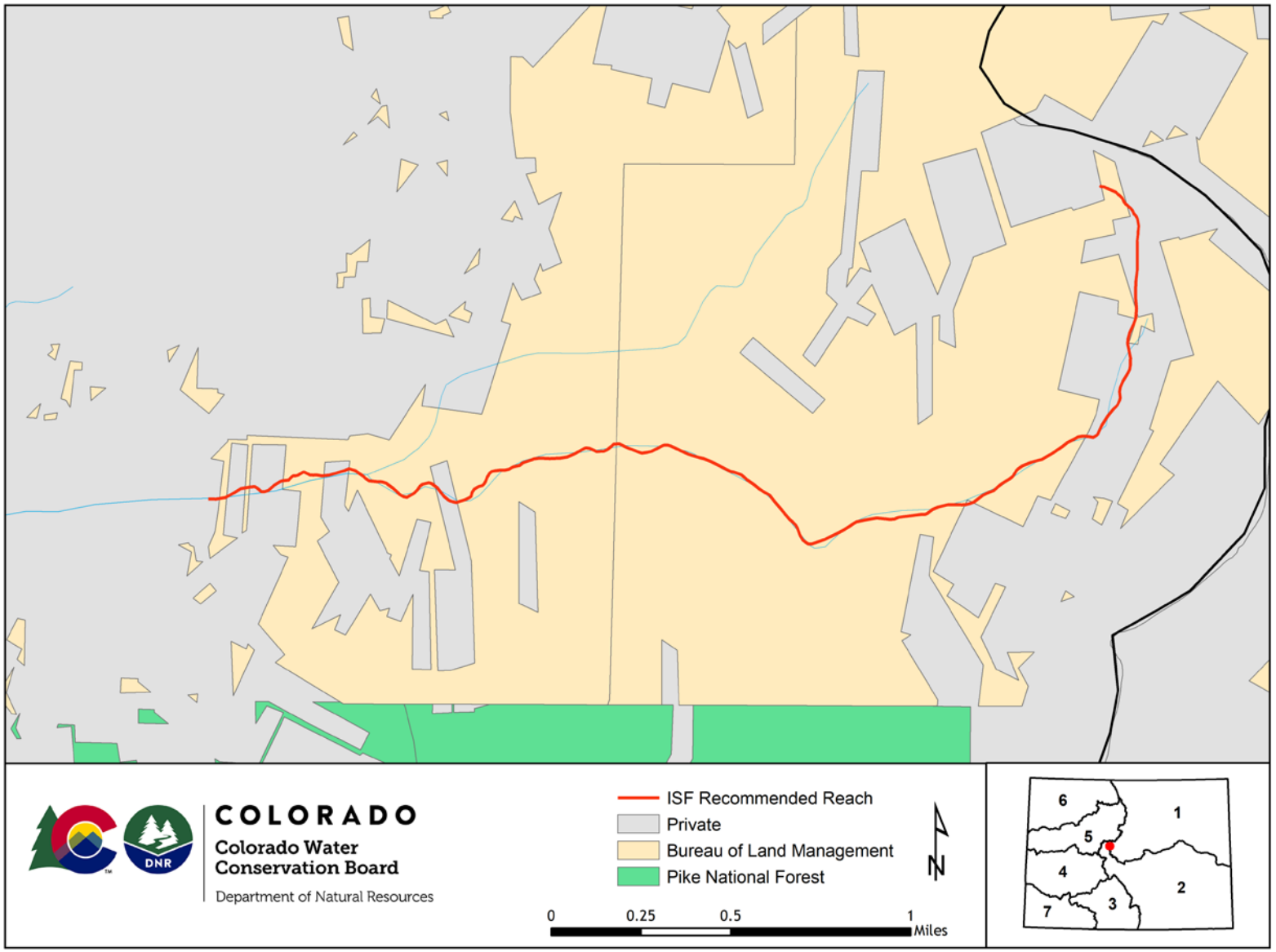
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

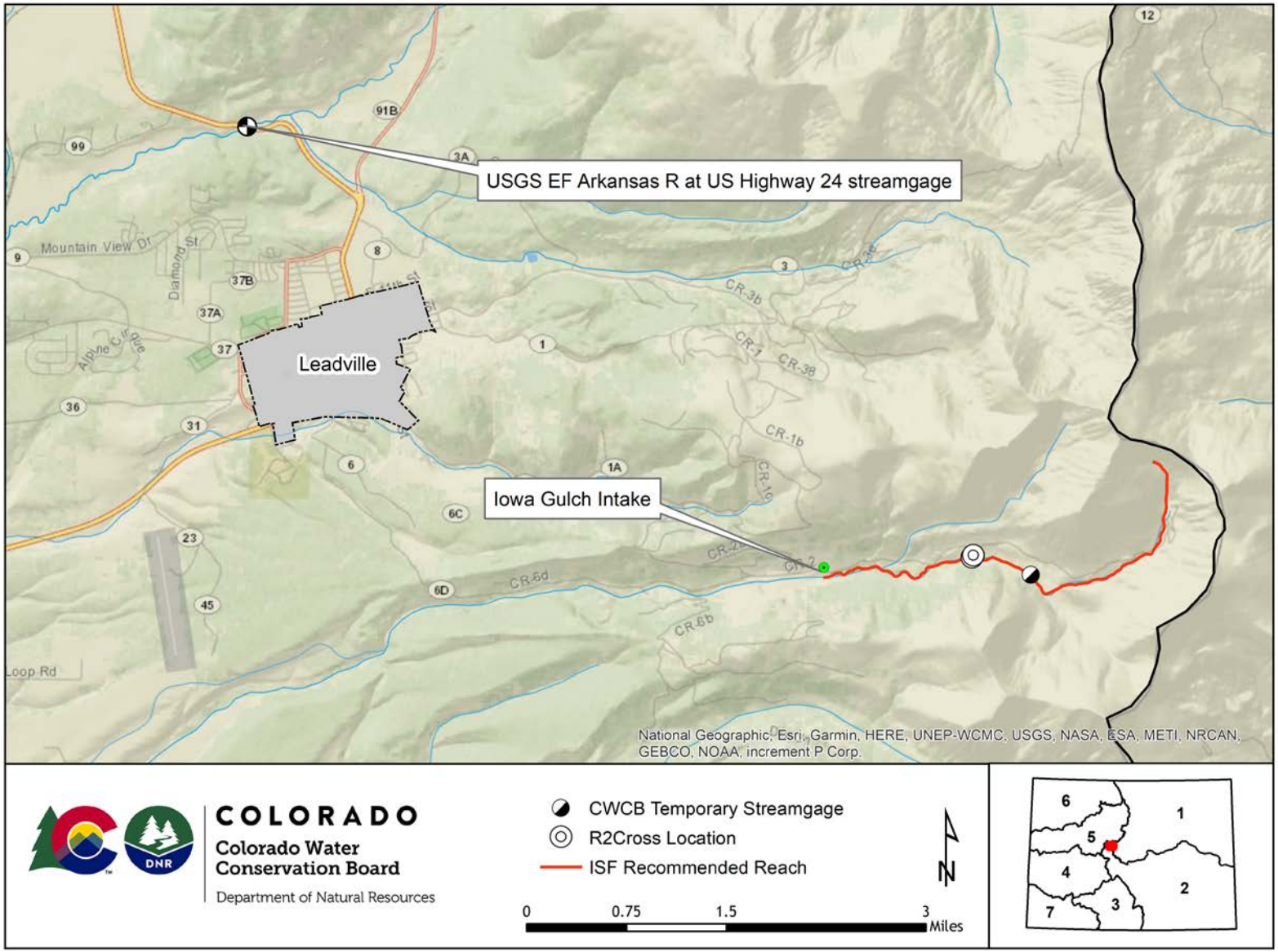
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH