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Colorado Water Conservation Board
Department of Natural Resources

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March 2021 Instream Flow Recommendations

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East Fork Arkansas River Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 10, 2021

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4353749.78 UTM East: 399540.97
LOWER TERMINUS:	confluence Chalk Creek UTM North: 4356126.94 UTM East: 394793.07
WATER DIVISION:	2
WATER DISTRICT:	11
COUNTY:	Lake
WATERSHED:	Arkansas Headwaters
CWCB ID:	20/2/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	6.46 miles
FLOW RECOMMENDATION:	0.25 cfs (12/16 - 04/30) 7 cfs (05/01 - 07/31) 2.8 cfs (08/01 - 09/20) 0.7 cfs (09/21 – 12/15)

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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 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.

Recommended ISF Reach
The Bureau of Land Management (BLM) recommended that the CWCB appropriate an ISF water right on a reach of the East Fork Arkansas River because it has a natural environment that can be preserved to a reasonable degree. The proposed reach extends from the East Fork Arkansas River's headwaters downstream to confluence with Chalk Creek. The CWCB holds an existing ISF on the East Fork Arkansas from the confluence of Chalk Creek down to the confluence with Tennessee Creek. The East Fork Arkansas River is located within Lake County (See Vicinity Map), and originates on the south flank of Mount Arkansas at an elevation of approximately 12,500 feet. It flows 20.5 miles to the confluence with Tennessee Creek at an elevation of approximately 9,740 feet. Fifty-seven percent of the land on the 6.46 mile proposed reach is privately owned, 10% is owned by the BLM and 33% is owned by the U.S. Forest Service (See Land Ownership Map). The largest private landowner is the Climax Molybdenum Company.

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.

The East Fork Arkansas River is a cold water stream that runs through a high elevation mountain valley with a moderate to high gradient. The floor of the valley is approximately half a mile wide with patches of bedrock outcroppings and alluvial deposits. The stream runs through alternating reaches of bedrock and alluvial deposits and has a variety of habitats that are good for aquatic community diversity. Substrate in the reaches with bedrock controls tends to have large boulders up to two feet in diameter. In the reaches running through alluvial deposits, there are more riffles and the substrate consists primarily of gravels and cobbles up to six inches in diameter.

Restoration work has been completed in sections of the East Fork Arkansas, particularly in the vicinity of the Climax Molybdenum mine, which has improved the riparian community and bank

stability. The riparian community includes willow, spruce, river birch, and sedges. There is also good floodplain connectivity supporting wetland communities.

Surveys completed by the BLM and Colorado Parks and Wildlife have found self-supporting populations of brook trout. Fish have been regularly sighted at the location of CWCB's temporary stream gage. Macroinvertebrate populations of mayfly, stonefly, and caddisfly have also been observed.

Table 1. List of species identified in East Fork Arkansas River.

Species Name	Scientific Name	Protection Status
brook trout	*Salvelinus fontinalis*	None
blue-winged olive mayfly	*Baetis spp.*	None
stonefly	*Plecoptera*	None
caddisfly	*Trichoptera*	None
willow	*Salix spp.*	None
spruce	*Picea spp.*	None
river birch	*Betula nigra*	None
sedge	*Carex*	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

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 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). 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

The BLM 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 2.80 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 7.02 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 East Fork Arkansas River.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
09/17/2018, 1	22.77	1.62	0.65 - 4.05	2.80	Out of range
08/08/2017, 1	27.83	17.50	7.00 - 43.75	Out of range	7.02
			Mean	2.80	7.02

ISF Recommendation

The BLM recommended flow rates of 7.0 cfs from May 1 to July 31, 2.8 cfs from August 1 to September 30, and 1.2 cfs from October 1 to April 30 based on R2Cross results and a preliminary water availability analysis. The BLM recommendation was modified by staff as a result of water availability. The final recommended flow rates are as follows:

7.0 cfs from May 1 to July 31. 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 trout that are spawning in riffles during the snowmelt runoff period.

2.8 cfs from August 1 to September 20. This recommendation is driven by the average velocity criteria. This flow rate will maintain sufficient physical habitat in the creek for the fish population to complete important parts of their life cycle before cold temperatures reduce fish activity for the winter.

0.7 cfs from September 21 to December 15. This flow rate was driven by water availability limitations.

0.25 cfs from December 16 to April 30. This flow rate was driven by water availability limitations.

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 East Fork Arkansas River is 7.42 square miles, with an average elevation of 11,956 feet and average annual precipitation of 27.74 inches (See the Hydrologic Features Map). Climax Molybdenum Company (Climax) owns and mines on a portion of the drainage basin and uses East Fork Arkansas River diversions to assist with its operations. There are no other surface water diversions in the proposed reach.

Climax operates three transbasin diversions (Table 3) that divert water from the East Fork Arkansas drainage and release it in the Ten Mile Creek drainage. These transbasin diversions are operated year round. Diversions from each of these rights, which are made from off channel ponds, do not dry up the stream, according to Climax personnel (personal communication, 12/9/20). There are no significant tributaries between the Climax Mine diversions and the

proposed lower terminus. Due to these transbasin diversions, hydrology in this drainage basin does not represent natural flow conditions.

Table 3. Structures located within the proposed ISF reach on East Fork Arkansas Creek.

WDID	Structure Name	Total Decreed Flow Rate, cfs	Appropriation Dates
1101223	Storke Wastewater Pumpstation	10	2012
1100759	Stevens and Leitner	1.086 maximum allowable transbasin use	1873
3604677	Climax Domestic* Pipeline	unknown	

*This structure is listed in Hydrobase and was discussed by personnel from Climax, but Staff has been unable to determine the flow rate associated with this structure.

Staff spoke with Climax personnel (Aaron Hilshorst, Manager of Land and Water Resources and Emmanuel Orilogi, Engineer) regarding the mine's operations in the East Fork Arkansas drainage area in December of 2020. The Storke Wastewater Pumpstation collects impacted snowmelt runoff and stormwater from 93.3 acres of mine land and diverts impaired water into the Ten Mile Creek drainage basin for treatment and release. Due to the junior nature of this right, replacements are made through a number of sources; however, the upstream most replacement location is at the lower terminus of the proposed ISF reach. Additionally, Climax operates the Stevens and Leiter Well, also commonly known as the Arkansas Well, and Climax Domestic Pipeline, which are also transbasin diversions to the Ten Mile Creek drainage basin.

According to accounting for 2017-2020 submitted to the Division of Water Resources, the Storke Wastewater Pumpstation operates year round. During runoff when the pumpstation appears to be running constantly, the peak median diversion was 2.6 AF per day. Starting in July and continuing through the fall, median diversions were less than 0.5 AF per day. Diversions during winter (approximately November through April), are made very infrequently and typically at rates less than 0.1 AF per day.

The Stevens and Leiter Well is allowed a maximum of 1.086 cfs of transbasin diversions according to its decree. Monthly diversion records from 2017-2020 show that this right is exercised year round. The Climax Domestic Pipeline is used for domestic purposes at the mine's mill in the Ten Mile Creek drainage basin. According to monthly diversion records on CDSS, the Climax Domestic Pipeline operates year round with average monthly diversions ranging from 35.8 AF to 20.9 AF.

Available Data and Analysis

CWCB Gage and Staff Measurements

There are no current or historical gages on the proposed ISF reach. Due to limited available data, CWCB staff installed a temporary streamflow gage on the East Fork Arkansas River located approximately 0.1 miles upstream from the proposed lower terminus. The temporary gage has operated since July of 2019. This gage location records the impact from consumptive uses in the basin (in other words, water lost to transbasin use is reflected in the gage data). Due to the short period of record, median streamflow was not calculated on a daily basis. However, median winter flows were calculated from November 1st to April 30th to assess baseflows, which are typically fairly consistent.

Due to the short period of record, staff examined a nearby streamgage to assess how 2019 and 2020 compared hydrologically to a longer record. The East Fork Arkansas River at US HWY 24, near Leadville, CO (USGS 07079300) gage is located approximately 6.9 miles southwest from the lower terminus. The gage record is from 1990 to present. The gage is affected by diversions, including transbasin imports, but because it is not affected by reservoir releases, it is adequate for evaluating annual hydrologic patterns. Based on this analysis, 2019 had the fourth highest total annual streamflow volume on record. 2020 was in the 25th percentile for total annual streamflow. Staff also computed median flows at the East Fork Arkansas gage and compared them to flows from 2019 and 2020. Due to a prolonged and above average snowpack, the 2019 runoff was delayed compared to most years. Runoff did not start until June 1 and the higher than normal peak occurred on June 30. Flows remained above median for the majority of the summer. However, due to a dry summer and fall, 2019 flows quickly dropped back down to median around September. The 2020 runoff and peak flows occurred approximately in line with the median record, but dry conditions caused flows to drop below median starting on June 8.

CWCB staff made eight streamflow measurements to support development of a rating curve for the temporary gage and provide additional information.

Table 4. Summary of Streamflow Measurement Visits and Results for East Fork Arkansas River.

Visit Date	Flow (cfs)	Collector
07/17/2019	72.58	CWCB
08/13/2019	20.11	CWCB
10/09/2019	2.02	CWCB
07/13/2020	18.43	CWCB
08/05/2020	8.79	CWCB
09/23/2020	3.89	CWCB
12/08/2020	0.74	CWCB
02/01/2021	0.42	CWCB

Water Availability Summary

The hydrographs below show streamflow data, streamflow measurements, and the proposed ISF. With the exception of short timeframes during the winter, the temporary gage data demonstrates that the recommended flow rates occur during the proposed timeframes in 2020 (an exceptionally dry year), leading staff to believe that these proposed flow rates are available in most years. In addition, baseflows typically remains consistent from year to year. Staff relied on the 2019-2020 winter baseflows to determine winter water availability. The median daily average flow during the winter recommendation timeframe (December 16 to April 30) was 0.3 cfs, which is higher than the 0.25 cfs recommended flow rate. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on East Fork Arkansas River 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.

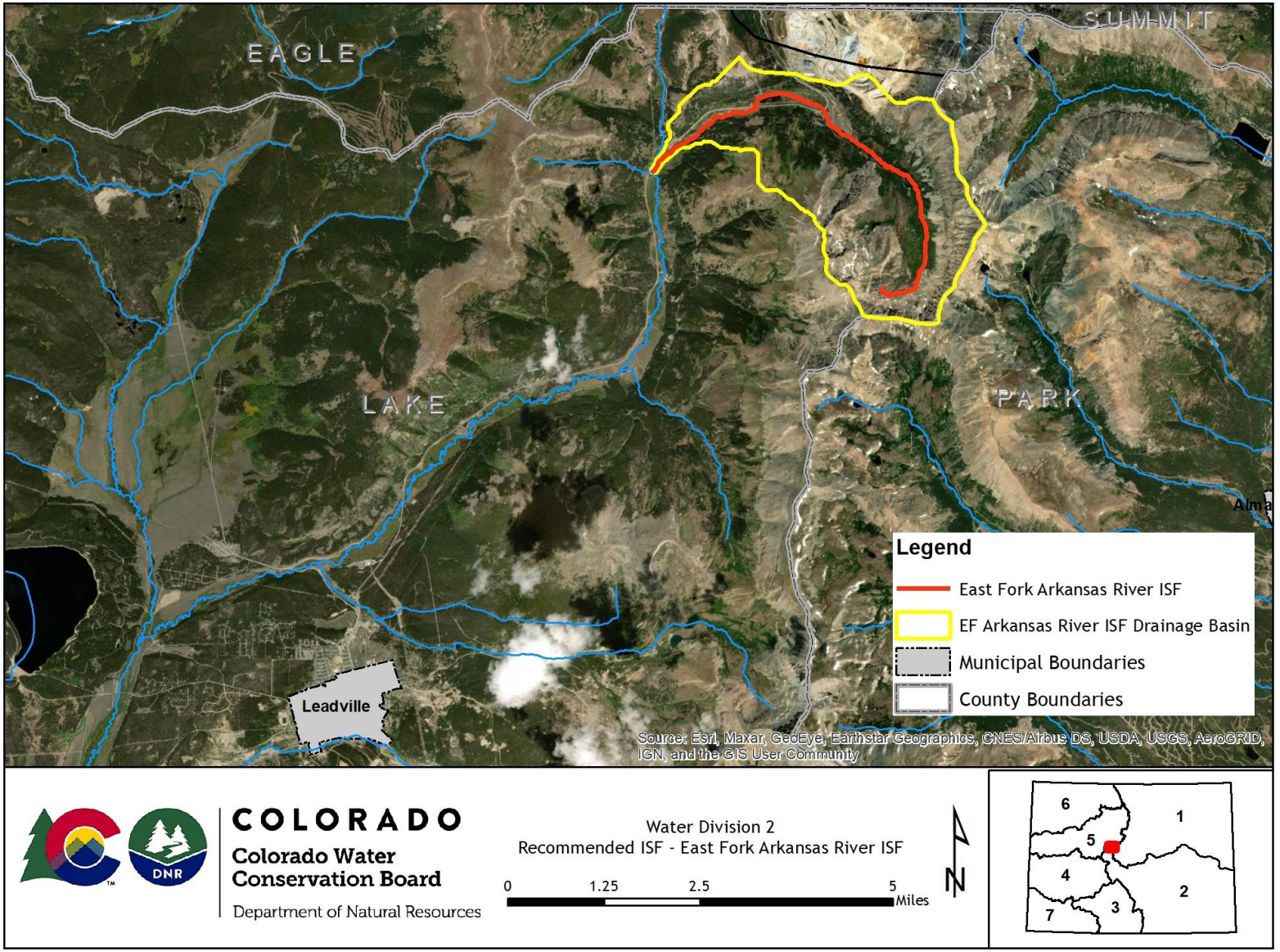
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

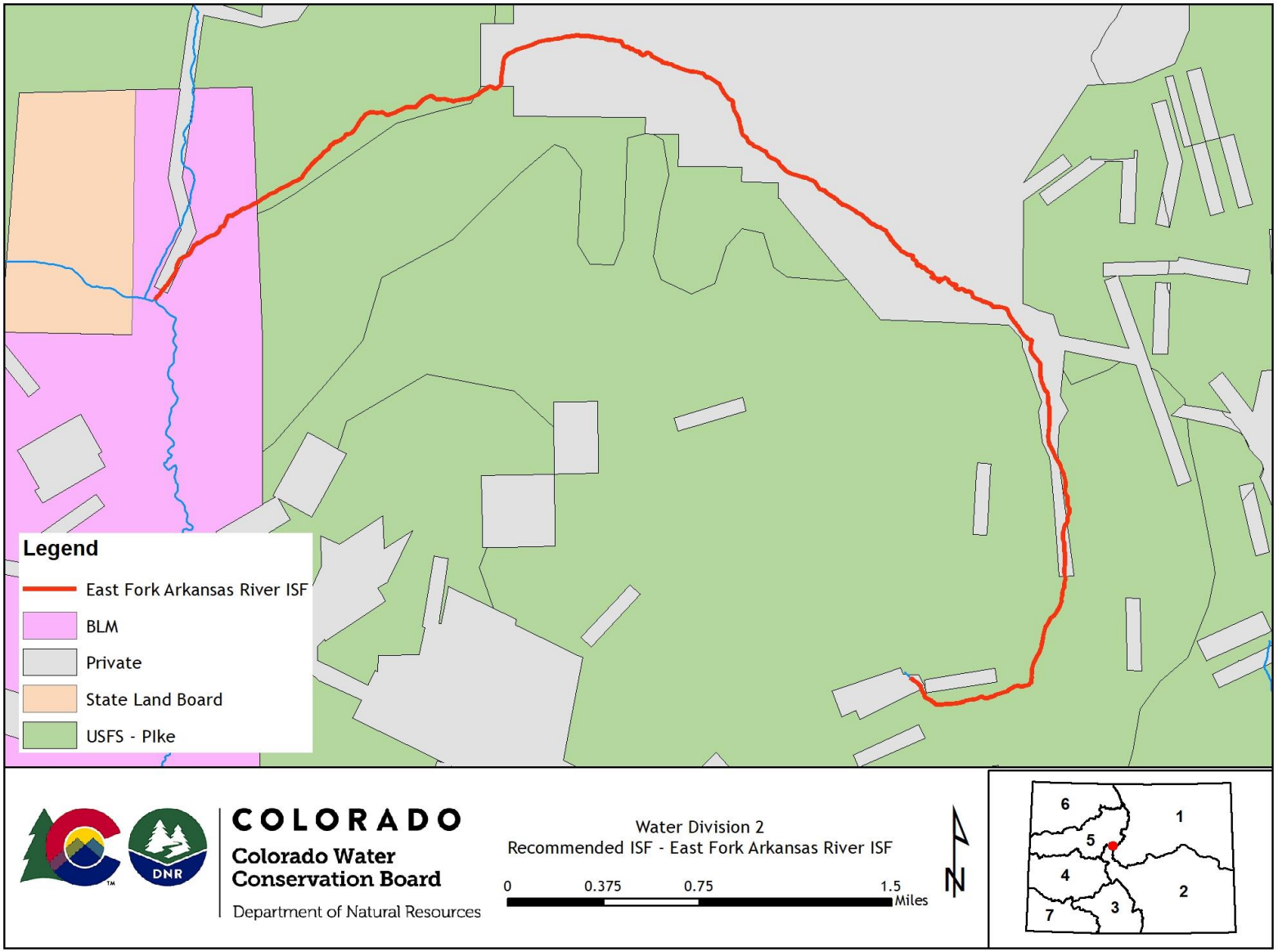
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

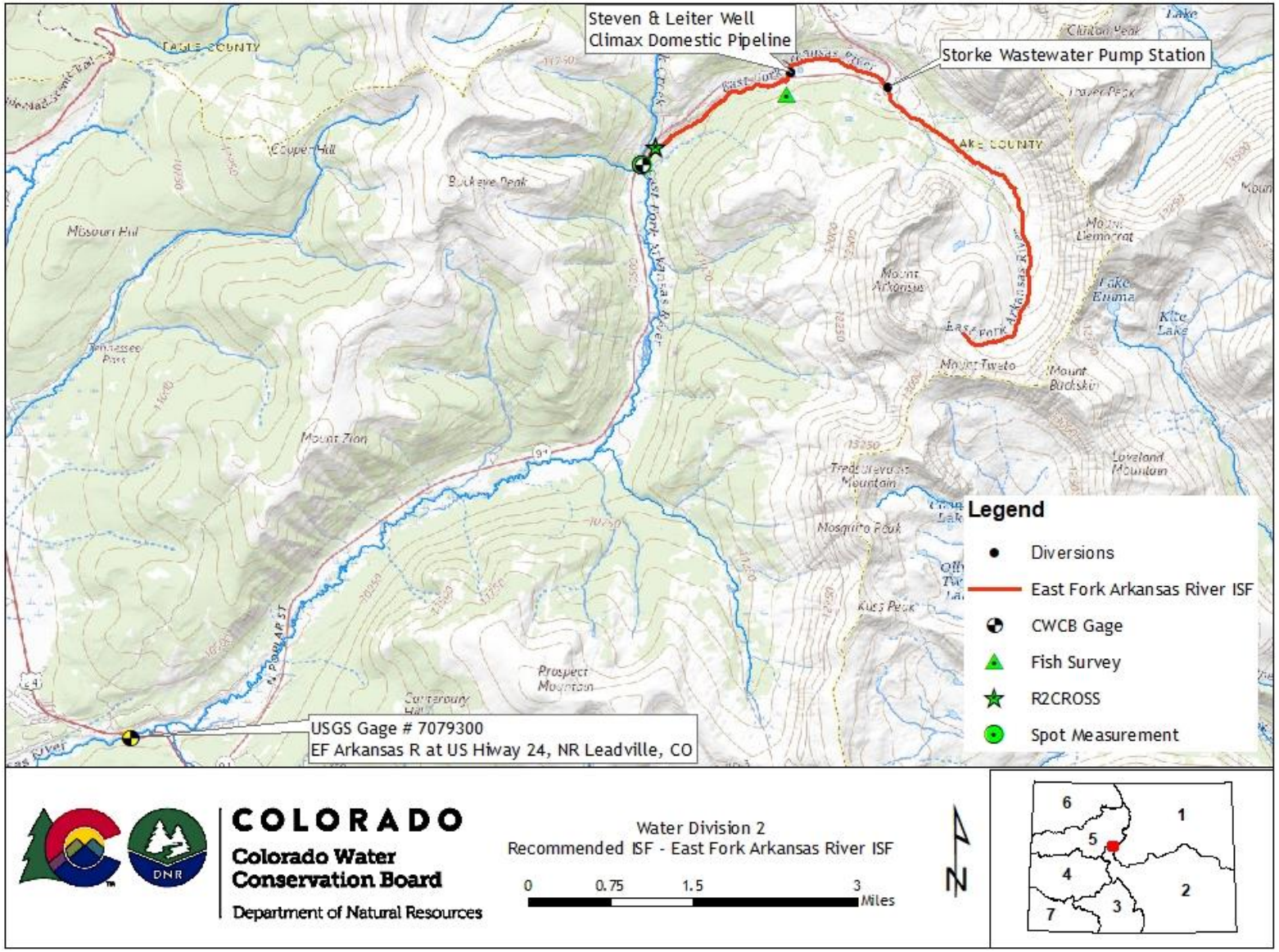
VICINITY MAP



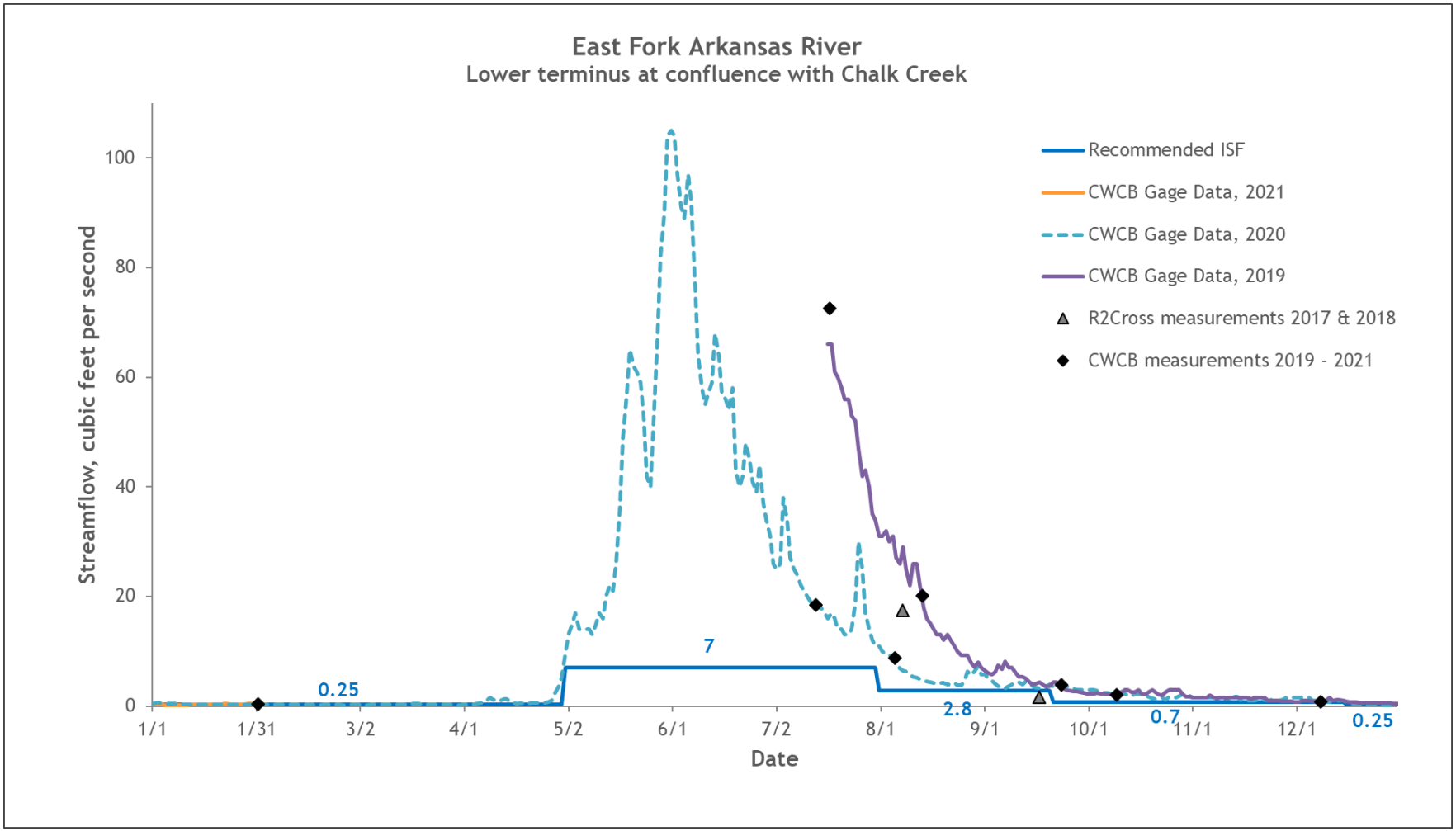
LAND OWNERSHIP MAP



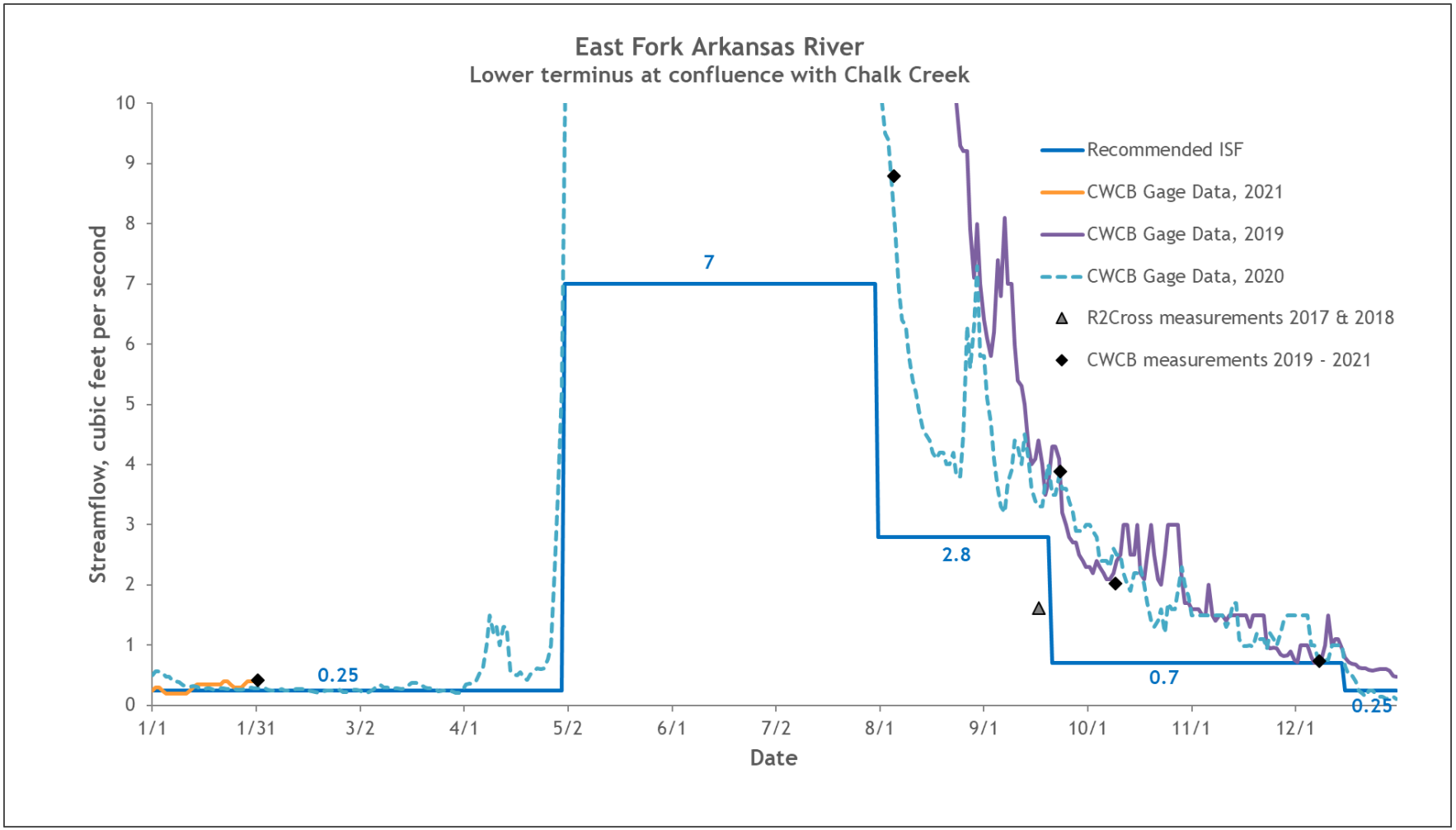
HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH



Cow Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 10, 2021

UPPER TERMINUS:	confluence Lou Creek UTM North: 4231002.60 UTM East: 265665.02
LOWER TERMINUS:	confluence Uncompahgre River UTM North: 4237591.58 UTM East: 258039.02
WATER DIVISION:	4
WATER DISTRICT:	68
COUNTY:	Ouray
WATERSHED:	Uncompahgre
CWCB ID:	16/4/A-001
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
LENGTH:	7.4 miles
FLOW RECOMMENDATION:	7.2 cfs (09/20 - 03/31) 20 cfs (04/01 - 04/30) 53 cfs (05/01 - 06/30) 20 cfs (07/01 - 07/30) 15 cfs (08/01 - 08/15) 7.2 cfs (08/16 - 08/28) 5.9 cfs (08/29 – 09/19)

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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 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.

Background
Colorado Parks and Wildlife (CPW) recommended that the CWCB appropriate an ISF water right on a reach of Cow Creek at the January 2015 ISF workshop. CPW worked on data collection efforts over a number of years. In addition, local stakeholders requested a delay of the appropriation while a study related to water supply was completed. Phase I of the study was completed in 2016 and Phase II was completed in 2020, and both were funded in part by CWCB WSRA grants (WWE, 2016 and WWE, 2020). CPW provided preliminary ISF flow rates on Cow Creek that were included in the final Phase II report. A water court application was filed in water court (Case No. 2019CW3098) by the Board of County Commissioners of Ouray County, Ouray County Water Users Association, Tri County Water Conservancy District and the Colorado River Water Conservation District for a new surface water diversion, alternative points of diversion, Ram's Horn Reservoir use enlargement, appropriative rights of exchange, and storage of water diverted from Cow Creek in Ridgway Reservoir. Ram's Horn Reservoir is a conditional 25,349 AF reservoir on Cow Creek that was decreed in 1961 (Case No. CA2440). CWCB has filed a statement of opposition in the 2019 case due to potential impacts to ISFs on Dallas Creek and the Uncompahgre River above Ridgway. CWCB, CPW and the applicants are working together on concepts that may address biological and physical impacts and enhance multi-purpose benefits if the full project or aspects of the project are constructed.

Recommended ISF Reach
Cow Creek is located within Ouray County (See Vicinity Map) approximately 6 miles north and east from the town of Ridgway. Cow Creek originates at around 12,500 feet in elevation on the west side of Cimarron Ridge in the Uncompaghre Wilderness and flows northwest to the confluence with the Uncompaghre River at around 6,500 feet in elevation. The proposed reach is 7.4 miles long and extends from confluence with Lou Creek downstream to confluence with the Uncompahgre River. Seventy-seven percent of the land on the proposed reach is private land, 4% is on Bureau of Land Management lands, and 19% near the confluence with the Uncompahgre River is part of the Billy Creek State Wildlife Area and Ridgway State Park (See Land Ownership Map). CPW is interested in protecting this reach of Cow Creek to support the fish, wildlife, and biotic communities, which are important natural resources along Billy Creek State Wildlife Area (Beckett Tract). The fishery includes self-sustaining trout species and native

species, including the last known remnant population of bluehead sucker residing in the Upper Uncompahgre River basin. Additionally, this reach provides sediment and water that help sustain a very popular fishery on the Uncompahgre River below Ridgway Reservoir.

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.

Cow Creek is a third order stream that runs down the west side of Cimarron Ridge in the northern San Juan Mountain Range. The average elevation of the watershed is 9,586 feet and its hydrology is snowmelt dominated. This stream is dynamic, with significant sediment transport, diurnal temperature, and streamflow cycles. Many sections of the reach are braided, especially at the confluences, with a variety of riffles, runs, pools, and slow-velocity side channels. The typical substrate consists of gravel and cobble, with boulders up to a foot in diameter.

The complexity of the channel and its dynamic nature, along with the woody debris of Cow Creek, provides good habitat for fish and macroinvertebrates. The CPW has documented a diverse fish community with bluehead sucker, mottled sculpin, speckled dace, brown trout, rainbow trout, and cutthroat/rainbow trout hybrid. Cow Creek's bluehead sucker population is the last known remnant of the population that historically inhabited the upper Uncompahgre River basin, and a Tier 1 Species of Greatest Conservation Need (State Wildlife Action Plan, 2015).

As the first tributary input into the Uncompahgre River below the Ridgway Reservoir, Cow Creek plays as important role in this reach of the Uncompahgre's ecosystem. Cow Creek aids the Uncompahgre River by providing natural seasonal temperature fluctuations and transporting fresh gravels and cobbles to support fish and macroinvertebrate habitat. Woodling (2012) found a more diverse and robust macroinvertebrate community, including species that are sensitive to pollution, in the Uncompahgre River below the Cow Creek confluence in comparison to upstream from the confluence.

Table 1. List of species identified in Cow Creek.

Species Name	Scientific Name	Protection Status
bluehead sucker*	*Catostomus discobolus*	State- Tier 1 Species of Greatest Conservation Need Federal- Sensitive Species
rainbow trout	*Oncorhynchus mykiss*	None
brown trout	*Salmo trutta*	None
speckled dace*	*Rhinichthys osculus*	None
mottled sculpin*	*Cottus bairdii*	None

*Indicates native fish 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 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 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 by CPW at four 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 7.19 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 53.23 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 Cow Creek.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
08/07/2019, 1	56.86	90.70	36.28 - 226.75	Out of range	53.23
09/11/2019, 1	44.71	3.50	1.40 - 8.75	7.43	Out of range
08/06/2020, 1	51.80	5.73	2.29 - 14.33	8.63	Out of range
08/06/2020, 2	36.04	5.97	2.39 - 14.93	5.52	Out of range
			Mean	7.19	53.23

ISF Recommendation

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

53.0 cfs from May 1 to June 30 to maintain adequate depth, velocity, and wetted perimeter in the early summer months when fish are active and may move throughout the reach.

20.0 cfs from July 1 to July 31 to maintain adequate velocity and wetted perimeter and sufficient depths that allow fish to move to more stable habitat as flows begin to recede. This flow rate is reduced due to limited water availability.

15.0 cfs from August 1 to August 15 to maintain adequate velocity and wetted perimeter and sufficient depths that allow fish to move to more stable habitat as flows begin to recede and water temperatures are high. This flow rate is reduced due to limited water availability.

7.2 cfs from August 16 through August 28 to maintain adequate velocity and wetted perimeter supporting available habitat for fish in the late summer period when temperatures are high.

5.9 cfs from August 29 through September 19 to maintain sufficient wetted perimeter to provide habitat for fish during the late irrigation season. Larger-bodied fish may be limited to pools and deeper glides during this time period and flow conditions supporting the desired thermal regime may not be met when ambient air temperatures are high. This rate was reduced based on results from the point flow model (please see the water availability section for more information).

7.2 cfs from September 20 through March 31 to maintain adequate velocity and wetted perimeter supporting available habitat for fish in pools and deep glides over the overwintering period.

20.0 cfs from April 1 through April 30 to maintain adequate velocity and wetted perimeter and sufficient depths to allow fish to move as spring runoff approaches. This flow rate is reduced due to limited water availability.

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 Cow Creek is 108 square miles, with an average elevation of 9,586 feet and average annual precipitation of 27.34 inches (See the Hydrologic Features Map). Hydrology in the basin is primarily based on snow-melt runoff, with relatively high peak flows compared to baseflows. This system can experience large daily changes in streamflow. Diurnal changes can be as much as 100 to 300 cfs during runoff, but generally reduce in size as streamflow decreases to baseflows and can be non-existent during some times.

There are substantial water uses in the basin tributary to the proposed ISF, including 275 cfs in decreed absolute surface water diversions, 261 AF in storage, and numerous springs and other small water rights. Three water rights divert water from Cow Creek and are used primarily to irrigate lands that are tributary to the Uncompahgre River above Ridgway Reservoir (Sneva Ditch, Alkali Ditch D No 80, and Alkali No 2 Ditch). These water rights are decreed for approximately 112 cfs and with the exception of a few smaller fields, return flows from these ditches do not accrue to Cow Creek. In addition, the Cimarron Feeder Garden Ditch imports water from the Cimarron Basin for use on irrigated lands in the Oak Creek and Nate Creek drainage basins. These imports are typically a maximum of 30-40 cfs and average 2,800 AF per year (1995 to 2020). There are five structures in the proposed ISF reach that divert more than

1 cfs and have diversion records; these divert a decreed total of up to 33.6 cfs (Table 3). Due to surface water diversions and transbasin imports, hydrology in this drainage basin does not represent natural flow conditions.

Table 3. Diversion structures located within the proposed ISF reach on Cow Creek. These structure are active surface water rights with diversion records and more than 1 cfs in decreed water rights. The structures are listed in order from bottom to top of the reach.

WDID	Structure Name	Decreed Flow Rate, cfs	Appropriation Dates	Location
6800523	Chaffee Ditich	4.934	1881	Between Burro Creek & gage
6800601	Hayes Teague Ditch	3.667	1882 & 1883	Between Burro Creek & gage
6800565	East Side Ditch	7. 0	1884 & 1887	Between Martin & Deer Creek
6800729	Shortline D Ditch	14.0	1883, 1886, 1889	Between Martin & Deer Creek
6800624	Jolly Ditch	4.0	1882, 1884, 1887	Between Lou & Martin Creek
	Total Diversions	**33.6**		

The diversion structures located within the proposed reach typically do not sweep the stream. The only diversion known to sweep the stream is the Sneva Ditch, which is located upstream from the proposed ISF reach (Division Engineer Bob Hurford, personal communication 11/18/2020).

Available Data and Analysis

Gage Analysis

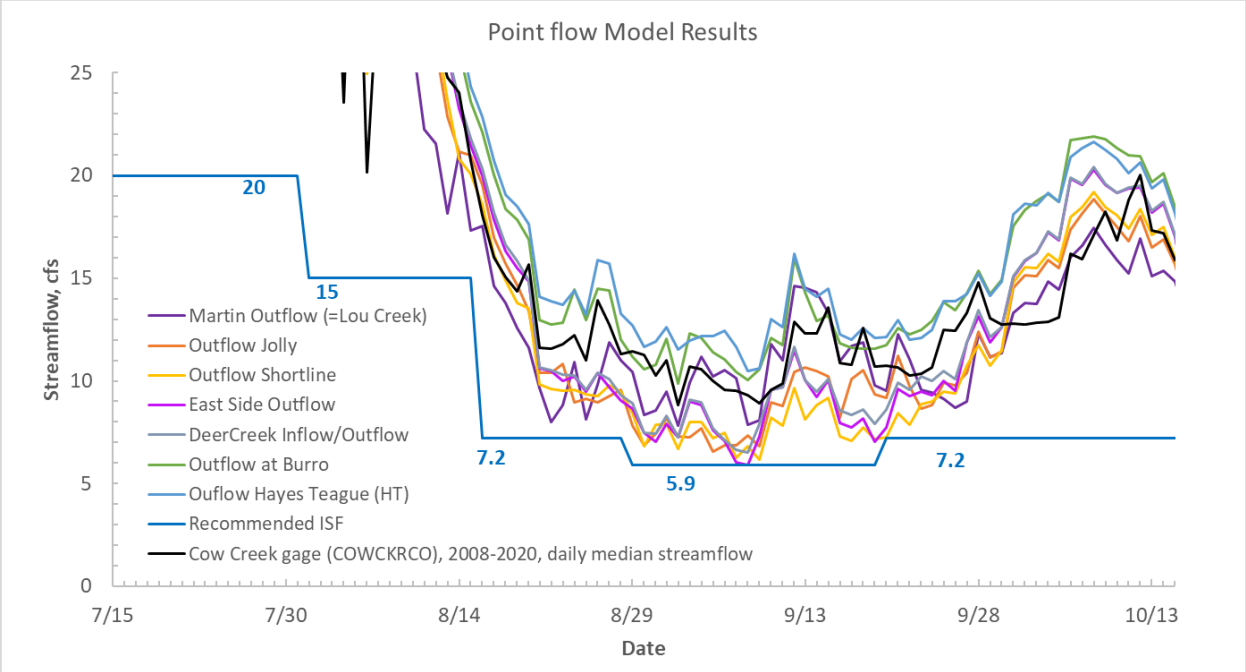
DWR maintains the Cow Creek near Ridgway Reservoir gage (COWCRKCO) which is located approximately one mile upstream from the proposed lower terminus. This gage has operated year round from 2008 to present. The drainage basin of the Cow Creek gage has similar characteristics to the lower terminus; the drainage basin is 108 square miles, with an average elevation of 9,596 feet and average annual precipitation of 27.36 inches. In addition, the USGS operated the Cow Creek near Ridgway, CO gage (USGS 09147100) from 1955 to 1973. This gage was located approximately 3.9 miles upstream from the proposed upper terminus. The USGS gage is not used in further analysis because it is located upstream from the proposed reach.

The Cow Creek gage has 12 to 13 years of record depending on the date being reviewed. Staff examined a nearby gage to evaluate how this period of time compared to a longer period of record. The Uncompahgre River near Ridgway gage (USGS 09146200 or DWR UNCRIDCO) is located approximately 4.1 miles south from the Cow Creek gage and has records from 1985 to present. The average annual flow between 2008 and 2020 at the Uncompahgre gage was slightly less than the long term average. According to this analysis, that time period includes both high water years (2008, 2011, and 2019) and low water years (2012, 2018, and 2020). Based on this assessment, the Cow Creek gage record from 2008 to 2020 appears to be representative of long term conditions.

No adjustments were made between the Cow Creek gage record and the lower terminus due to the small difference in drainage basin characteristics. Median streamflow was calculated using data between 4/1/2008 and 10/31/2020, but 95% confidence intervals for median streamflow were not calculated. The Cow Creek gage shows that water is available for the proposed appropriation at all times.

Point Flow Model

The proposed reach of Cow Creek is fairly complex due to the number of mainstem diversion structures and return flows from adjacent irrigated lands. The availability of diversion records, previous modeling efforts, and the existence of the Cow Creek gage at the bottom of the reach made it possible for staff to develop a point flow model to better understand streamflow throughout the reach. This model used monthly average system efficiencies from the Gunnison StateCU and StateMod models to estimate return flows from irrigated lands. Return flows were lagged using the same west slope delay tables applied in the Gunnison Statemod model. The model simulates streamflow from 2008 to 2019 based on the availability of diversion records at the time of analysis. Streamflow was modeled at each mainstem diversion and a number of tributary confluences. Additional information about the model is provided in the appendix. The results of this analysis showed that on a median basis, water is available at all times and all modeled locations. The only exception was 3 to 7 days that were below 7.2 cfs in August or September at four locations. The final recommended ISF flow rate was reduced from 7.2 cfs to 5.9 cfs from August 29th to September 19th to address these locations.



Graph showing point flow model results at times when estimated streamflow at various locations was less than 7.2 cfs in August and September.

CWCB Measurements

CWCB staff made one streamflow measurement on the proposed reach of Cow Creek as summarized in Table 4. This measurement was made early in the investigation process and was located approximately 3.8 miles upstream from the final proposed ISF reach. Staff also visited the site on 7/16/2019, but streamflow was too high to safely make a wading streamflow measurement.

Table 4. Summary of Streamflow Measurement Visits and Results for Cow Creek.

Visit Date	Flow (cfs)	Collector
05/20/2015	96.99	CWCB

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows median streamflow based on the Cow Creek gage between 2008 and 2020, and the proposed ISF flow rates. The proposed ISF flow rates are less than median streamflow at the gage at all times. Two additional hydrographs show the median streamflow based on the Cow Creek gage and median streamflow based on estimates from the point flow model at various locations. This analysis of streamflow throughout the reach indicates that 7.2 cfs, which meets two of three hydraulic criteria, may be available less than 50% of the time for 3-7 days in August and September at certain locations. The ISF rate was reduced to 5.9 cfs from August 28 to September 20 to address this. Staff has concluded that water is available for proposed ISF appropriation.

Material Injury
Because the proposed ISF on Cow 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
Colorado Parks and Wildlife, 2015, State Wildlife Action Plan: A Strategy for Conserving Wildlife in Colorado. State of Colorado, Department of Natural Resources.

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.

Woodling, J., 2012, Uncompahgre River Water Quality Report. Written on behalf of the Uncompahgre Watershed Partnership.

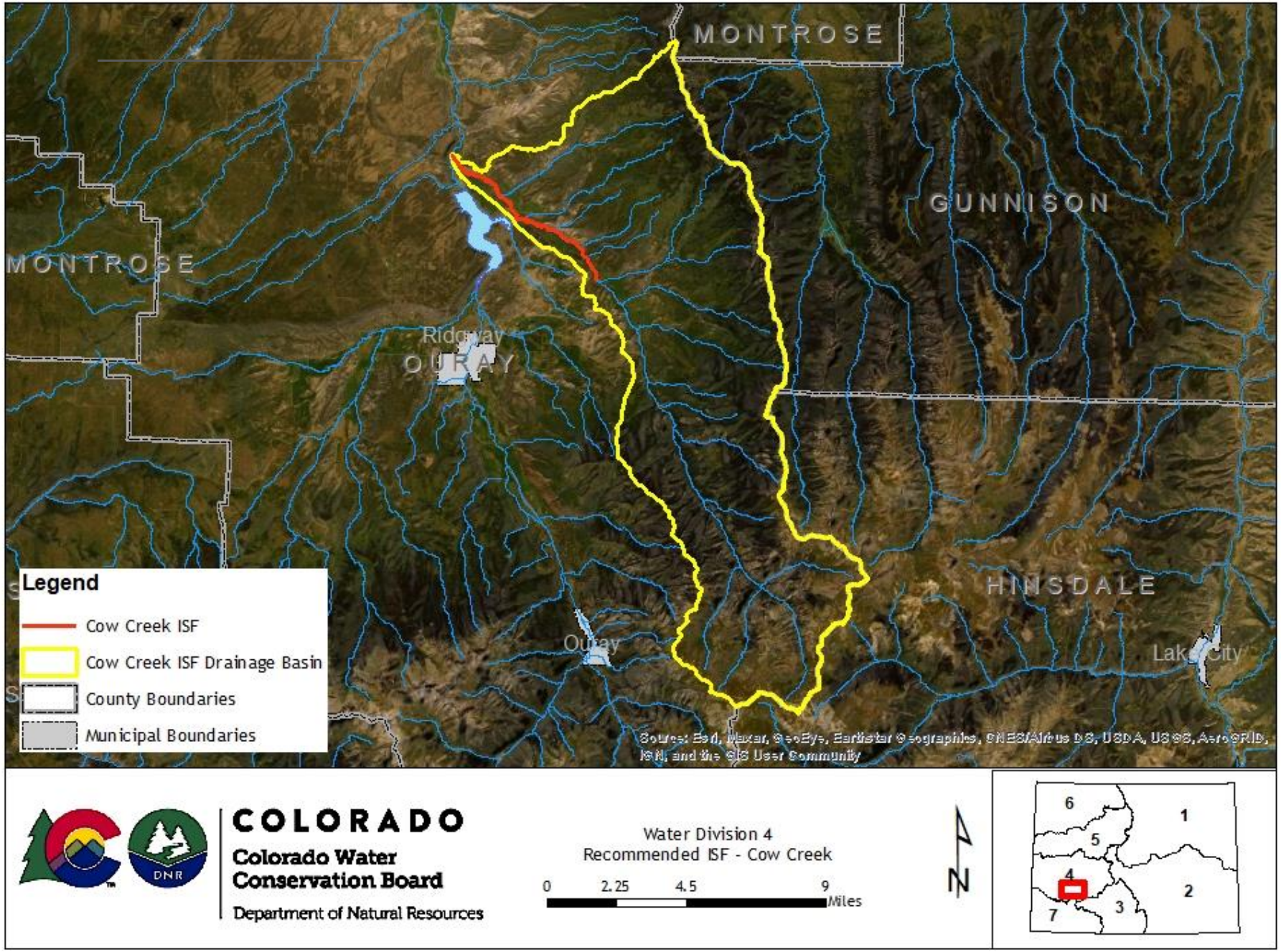
Wright Water Engineers, Inc., 2016, Upper Uncompahgre Basin Water Supply Protection and Enhancement Project.

Wright Water Engineers, Inc., 2020, Upper Uncompahgre River Basin Water Supply Protection and Enhancement Plan Phase II.

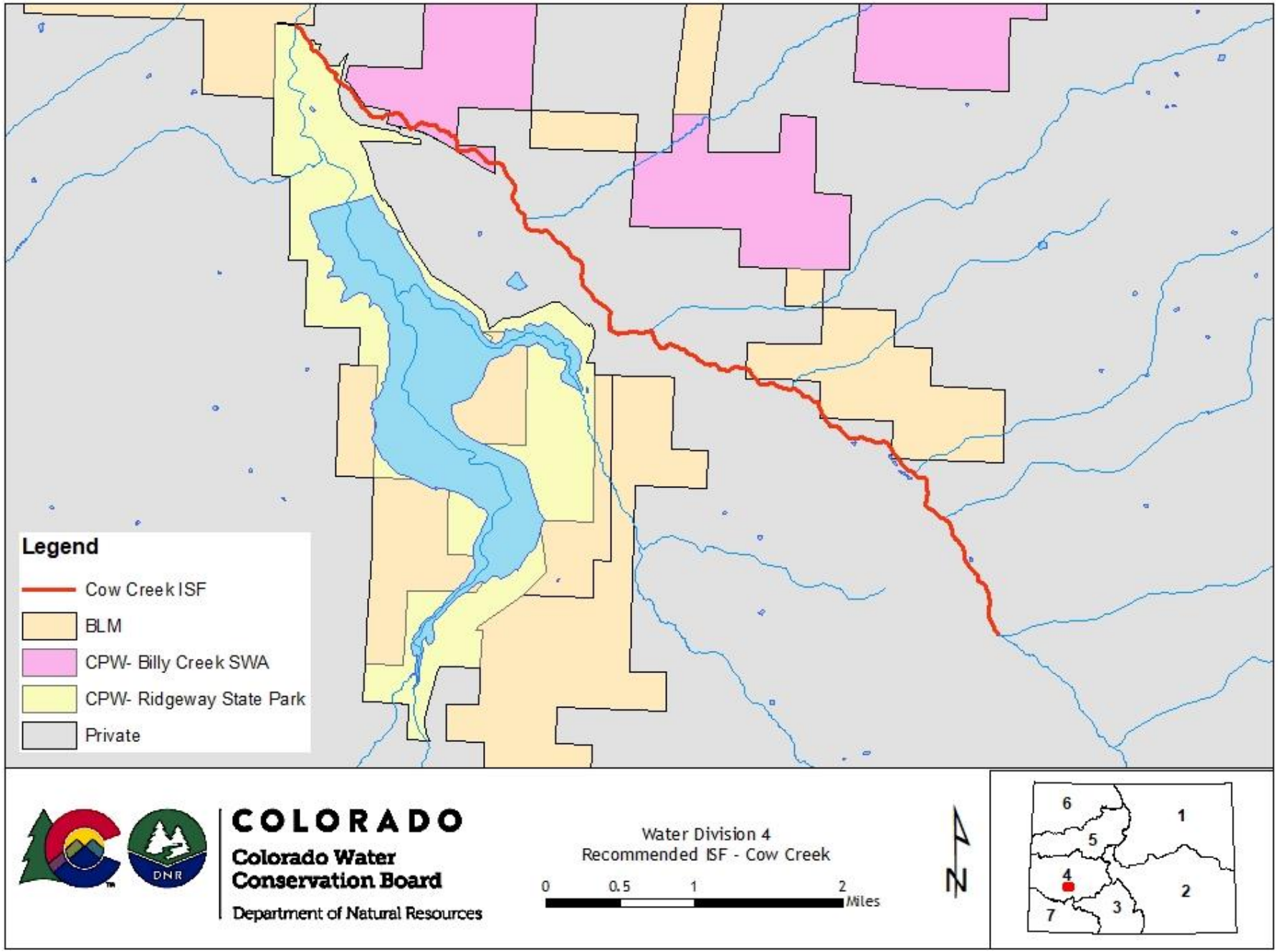
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

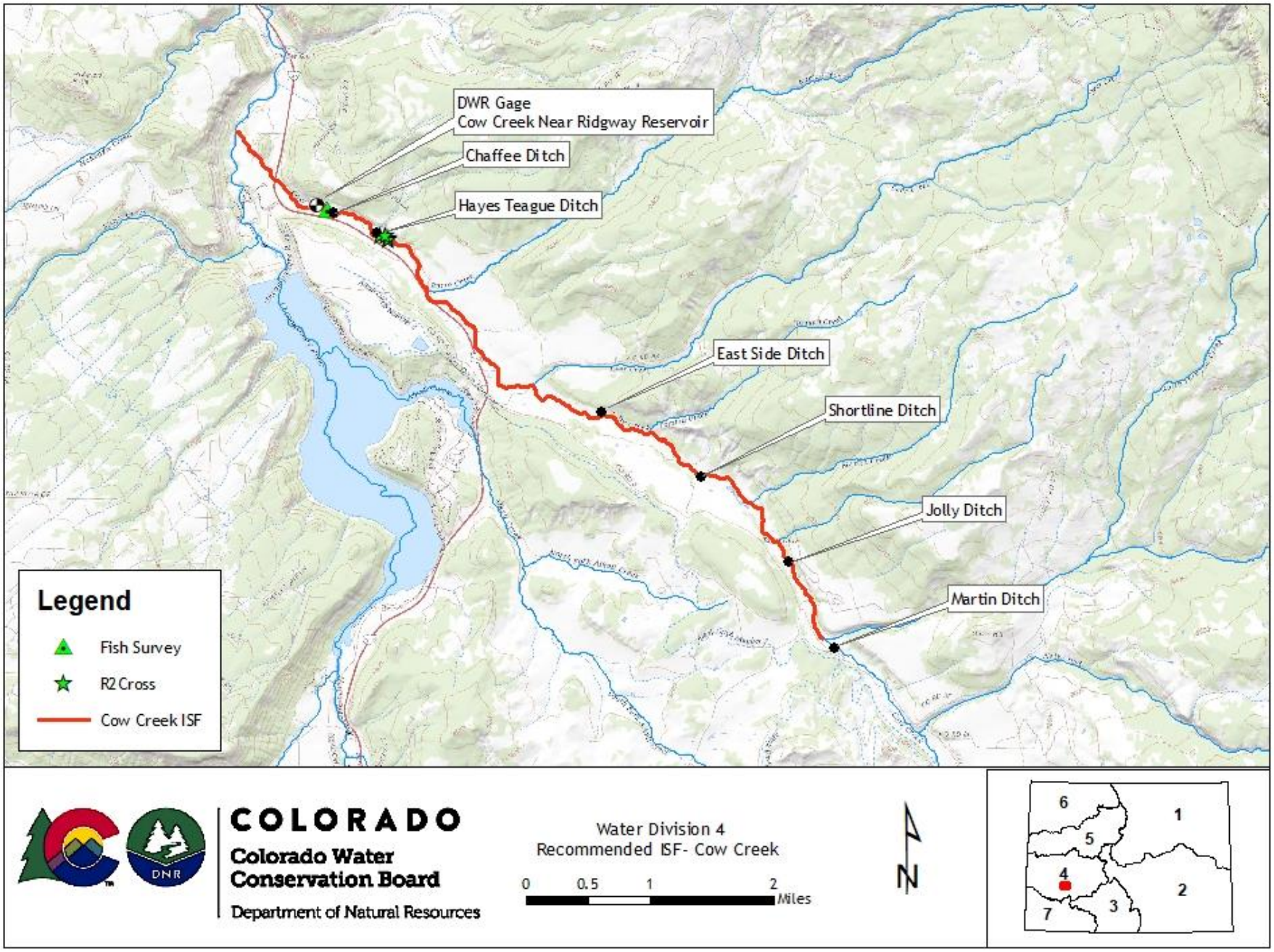
VICINITY MAP



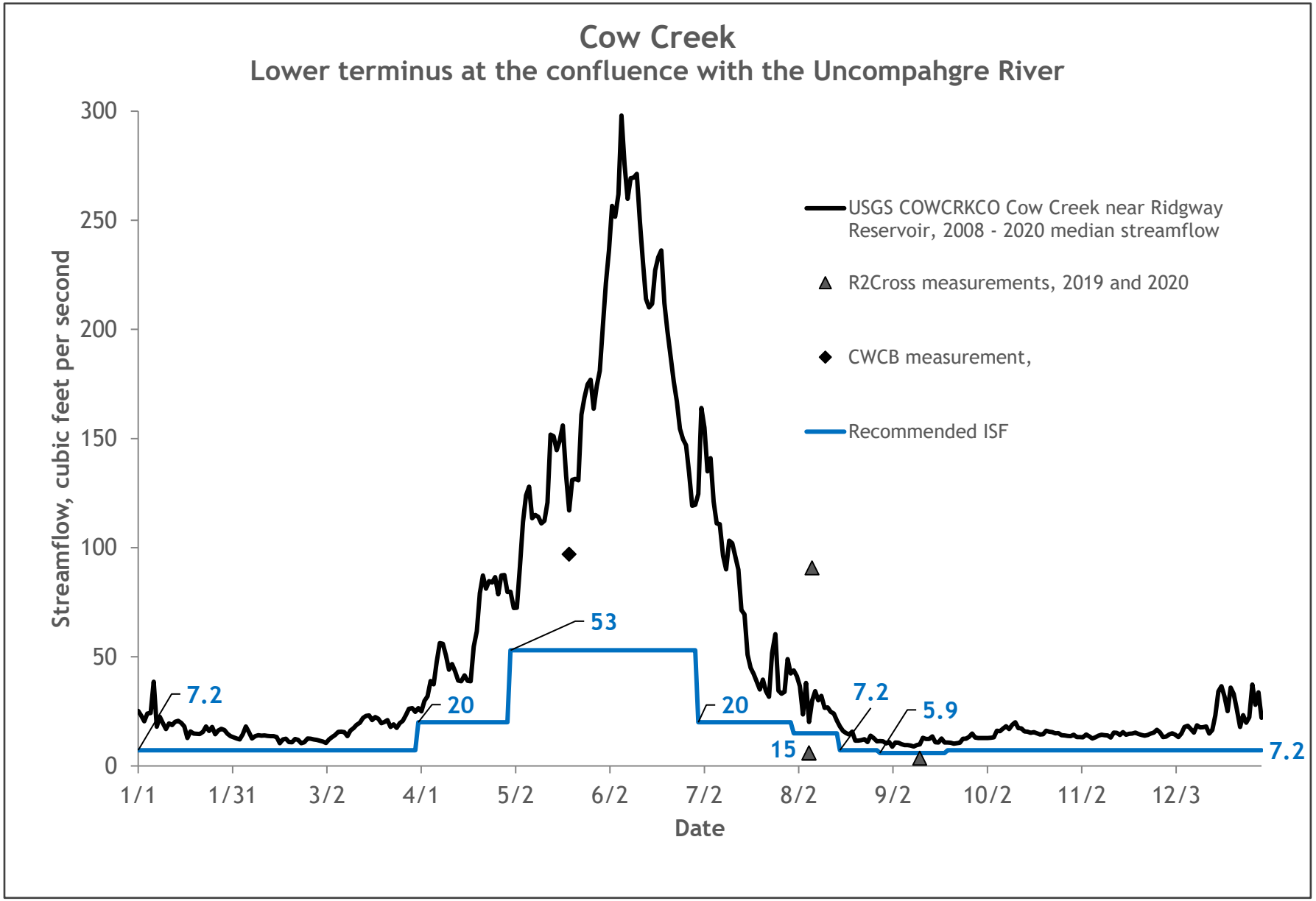
LAND OWNERSHIP MAP



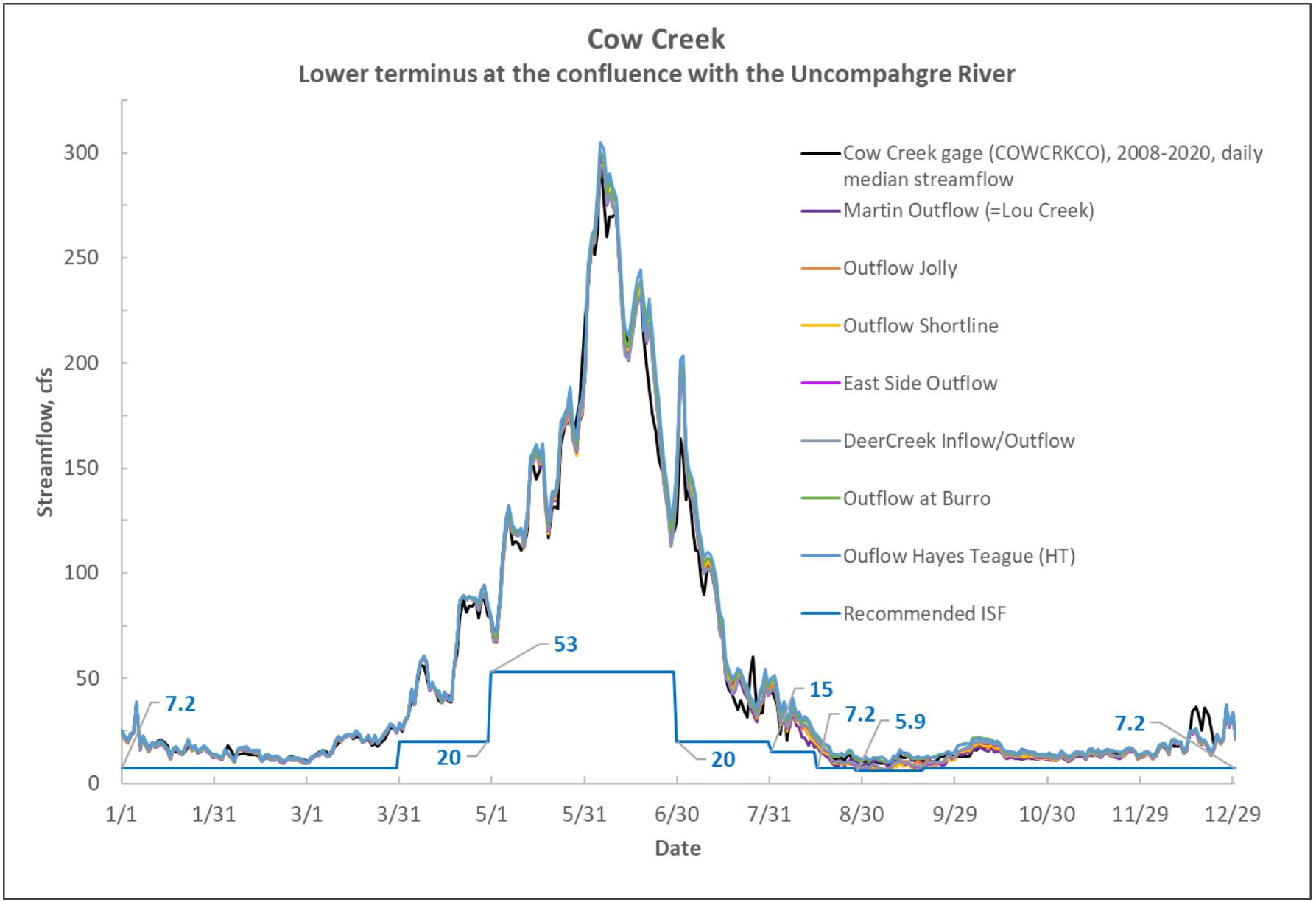
HYDROLOGIC FEATURES MAP



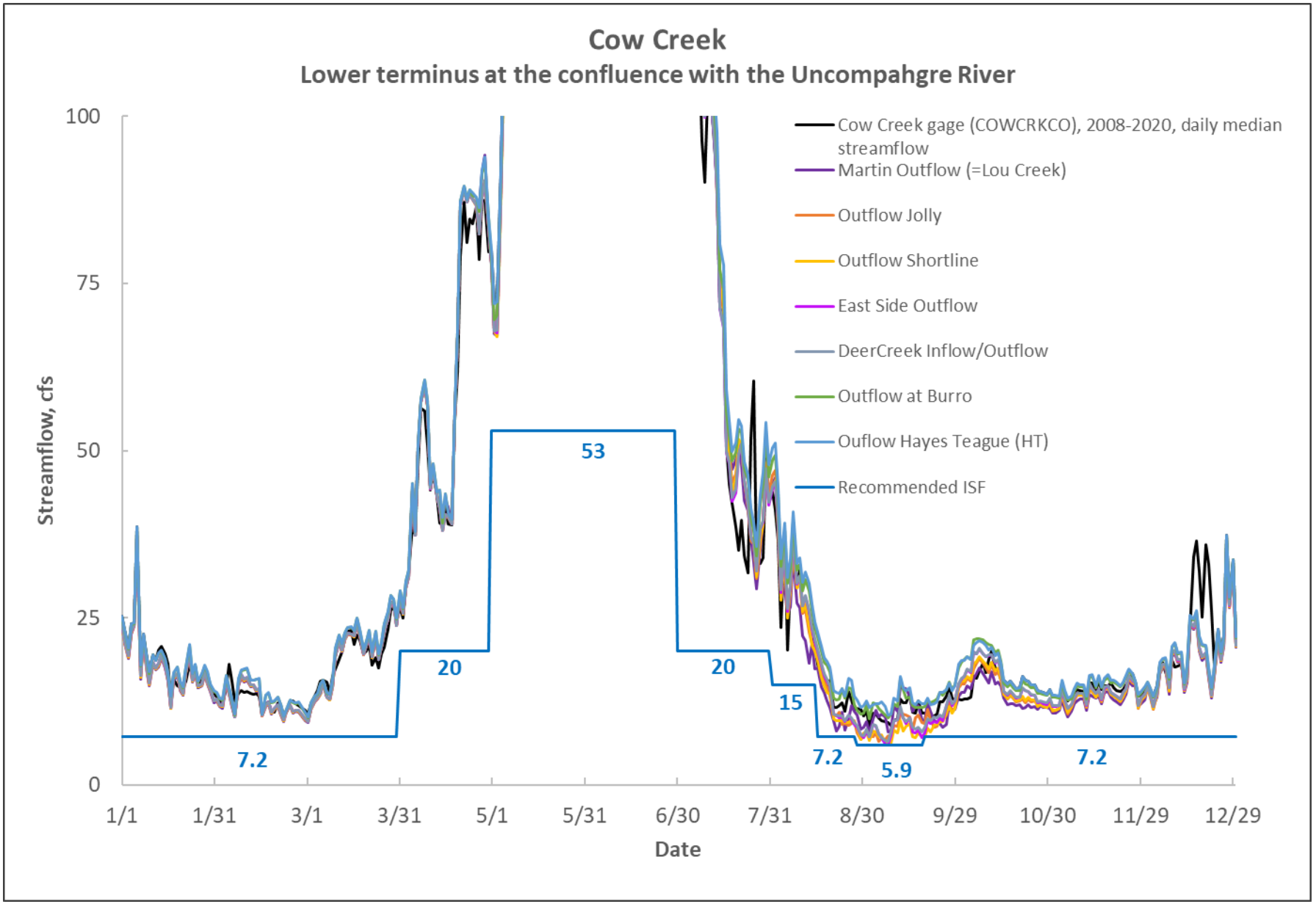
COMPLETE HYDROGRAPH



HYDROGRAPH WITH POINT FLOW MODEL RESULTS



DETAILED HYDROGRAPH WITH POINT FLOW MODEL RESULTS



Wildcat Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 25-26, 2021

UPPER TERMINUS:	outlet of Green Lake UTM North: 4301420.95 UTM East: 323800.20
LOWER TERMINUS:	confluence Coal Creek UTM North: 4304206.95 UTM East: 325687.24
WATER DIVISION:	4
WATER DISTRICT:	59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
CWCB ID:	21/4/A-013
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	2.48 miles
FLOW RECOMMENDATION:	0.35 cfs (12/1 - 03/31) 0.65 cfs (04/01 - 04/30) 2.1 cfs (05/01 - 08/31) 0.6 cfs (09/01 - 11/30)

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 Wildcat Creek because it has a natural environment that can be preserved to a reasonable degree. The proposed reach extends downstream from the outlet of Green Lake to the confluence with Coal Creek. Wildcat Creek is located within Gunnison County (See Vicinity Map), and originates in the Gunnison National Forest about 2.5 miles southwest of the Town of Crested Butte at an elevation of approximately 10,600 feet. It flows in a northeasterly direction for 2.48 miles before it joins Coal Creek at an elevation of 9,100 feet. Forty-five percent of the land on the proposed reach is privately owned, 30% is owned by the U.S. Forest Service, and 25% is owned by the Bureau of Land Management (BLM) (See Land Ownership Map). The BLM formally submitted a letter of support of HCCA's ISF recommendation on Wildcat Creek to the CWCB.

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.

Wildcat Creek is a cold-water stream that runs through a primarily pine-spruce forest at a high gradient. The stream's low water temperatures are protected by the north-facing aspect of the watershed. The substrate of Wildcat Creek ranges from small gravel to large cobble and some boulders. Pool-drop features are frequent in the channel due its steep nature and substantial woody debris forms a mixture of riffles and small pools. The riparian community along the recommended reach has been described by BLM and HCCA as robust and in very good condition. The spruce and pine provide ample shade for the aquatic ecosystem and findings of BLM's land health analysis indicate good water quality in this reach of stream.

The riparian community and variety of habitat in Wildcat Creek supports a healthy aquatic ecosystem. Colorado Park and Wildlife identified a substantial cutthroat trout population in 2008, though it has yet to identify their lineage. The BLM identified a diverse and robust

community of macroinvertebrate species in August of 2019. In addition, an abundance and variety of wildlife tracks were found along the stream banks during site visits.

Table 1. List of species identified in Wildcat Creek.

Species Name	Scientific Name	Protection Status
cutthroat trout- unknown lineage	*Oncorhynchus clarkii*	None
ameletus mayfly	*Ameletus Spp.*	None
blue quill mayfly	*Paraleptophlebia spp.*	None
blue-winged olive mayfly	*Baetis spp.*	None
dark red quills mayfly	*Cinygmula spp.*	None
spiny crawler mayfly	*Drunella doddsi*	None
western march brown mayfly	*Rhithrogena spp.*	None
capniidae stonefly	*Capniidae*	None
golden stonefly	*Hesperoperla pacifica*	None
green stonefly	*Choroperlidae*	None
sallfly stonefly	*Sweltsa spp.*	None
zapada stonefly	*Zapada spp.*	None
common forestfly stonefly	*Zapada cinctipes*	None
oregon forestfly stonefly	*Zapada oregonensis*	None
free-living caddisfly	*Rhyacophila brunnea-vemna*	None
neothremma caddisfly	*Neothremma spp.*	None
netspinning caddisfly	*Parapsyche elsis*	None
snow sedge caddisfly	*Psychoglypha spp.*	None
riffle beetle	*Heterlimnius corpulentus*	None
non-biting midge	*Chironomidae*	None
meringodixa midge larve	*Meringodixa spp.*	None
black fly larve	*Diptera*	None
pericoma moth fly larvae	*Pericoma spp.*	None
simulium black fly larvae	*Simulium spp.*	None
dance fly larvae	*Wiedemannia spp.*	None
lerbertia water mite	*Lebertia spp.*	None
sperchon mite	*Sperchon spp.*	None
springtail	*Collembola*	None
fingernail clam	*Pisidium spp.*	None
trombidiformes	*Trombidiformes*	None
worm	*Oligochaeta*	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 3 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 0.87 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 2.12 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 Wildcat Creek.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
10/09/2019, 1	10.40	0.28	0.11 - 0.70	0.36	Out of range
06/24/2020, 2	8.20	2.71	1.08 - 6.78	Out of range	2.44
06/24/2020, 3	11.45	2.77	1.11 - 6.93	1.38	1.79
			Mean	0.87	2.12

ISF Recommendation

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

0.35 cfs is recommended from December 1 through March 31. This flow rate was reduced due to water availability limitations, but will still protect base flows.

0.65 cfs is recommended from April 1 through April 30. This flow rate was reduced due to water availability limitations.

2.1 cfs is recommended from May 1 through August 31. This flow rate meets all 3 of the R2Cross criteria.

0.60 cfs is recommended from September 1 through November 30. This flow rate was reduced due to water availability limitations.

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 Wildcat Creek is 2.0 square miles, with an average elevation of 10,370 feet and average annual precipitation of 31.12 inches (See the Hydrologic Features Map). The proposed upper terminus is Green Lake, which is a the CWCB decreed a NLL water right on in Case No. 77W3358 with an appropriation date of May 12, 1976.

The Town of Crested Butte has a water supply intake on Coal Creek located approximately 0.8 miles west of the proposed lower terminus. This structure, the Crested Butte Water Ditch and Wildcat Pipeline (WDID 5900842, 6 cfs, appropriation date 1893), has a decreed alternative point pipeline on Wildcat Creek that mostly serves as a backup intake for the system. The pipeline is located approximately 0.1 miles upstream from the proposed lower terminus. The intake to the system is continuously open, but the system does not have the ability to take the full decreed rate due to the size of the pipeline. The diversion structure currently does not have the ability to sweep the stream, but in an emergency, a temporary structure may be put in place to do so.

Data Analysis

StreamStats

There are no current or historic streamgages on the proposed ISF reach. The nearest gage is the Elk Creek at Coal Creek above Crested Butte, CO gage (USGS 9110990) located approximately 2.8 miles southwest from the proposed lower terminus. The gage is a seasonal gage, which operates from April to November in most years. The period of record for the gage is 2017 to 2020. Due to the short period of seasonal records, this gage was not used in this analysis. StreamStats provides the best available estimate of streamflow on Wildcat Creek. In addition, CWCB staff made one streamflow measurement on the proposed reach of Wildcat Creek as summarized in Table 3.

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

Visit Date	Flow (cfs)	Collector
09/30/2020	0.05	CWCB

Diversion Adjustment
Staff spoke with the Director of Public Works from the Town of Crested Butte, who estimated that the Crested Butte Water Ditch and Wildcat Pipeline diverts approximately 5% of the water in the creek at low flows (Shea Early, personal communication, 12/9/2020). To account for diversions made at the Wildcat Pipeline, StreamStats estimates were adjusted down by approximately 5%.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows the StreamStats results for mean-monthly streamflow. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Wildcat 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.

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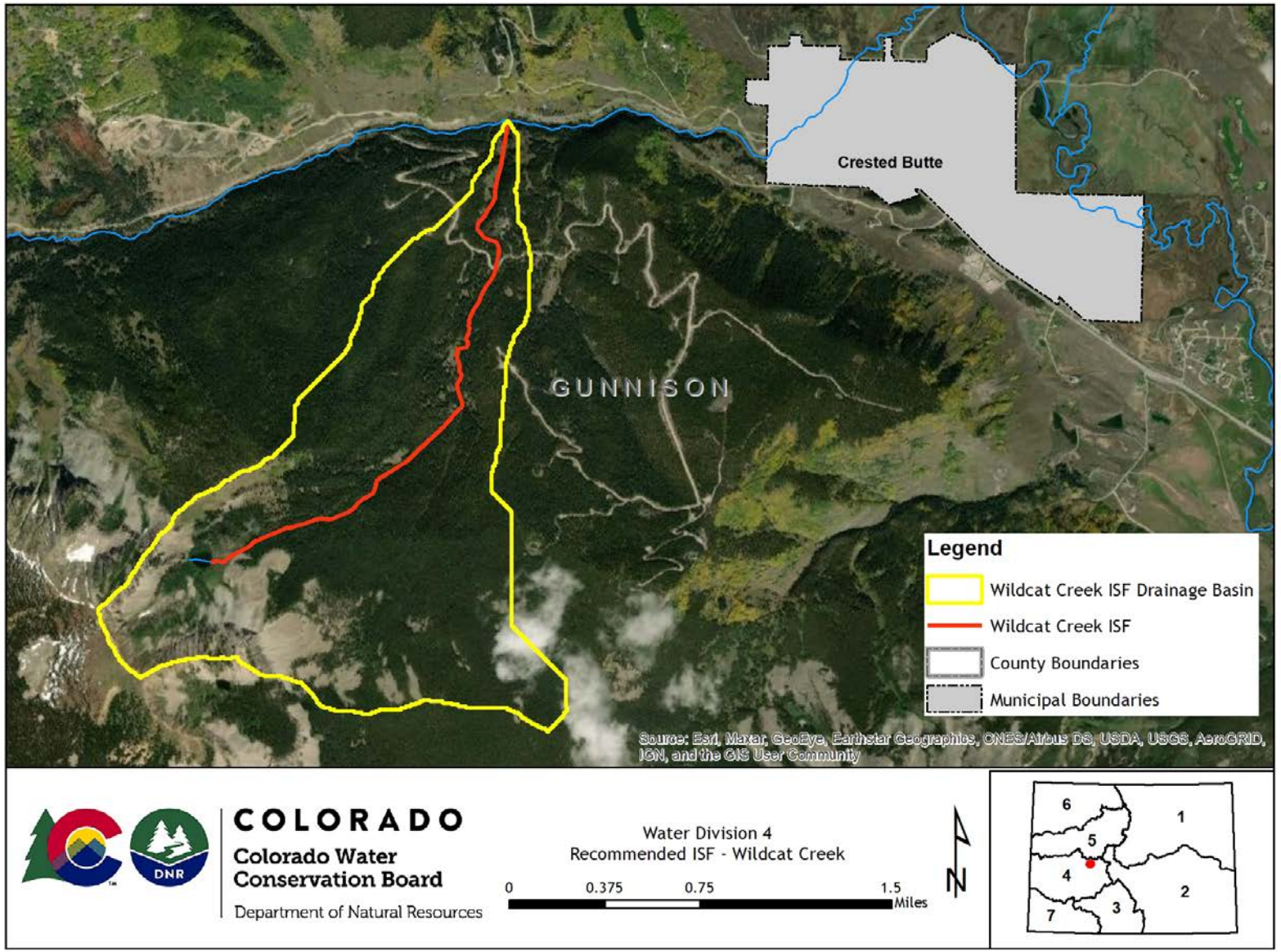
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

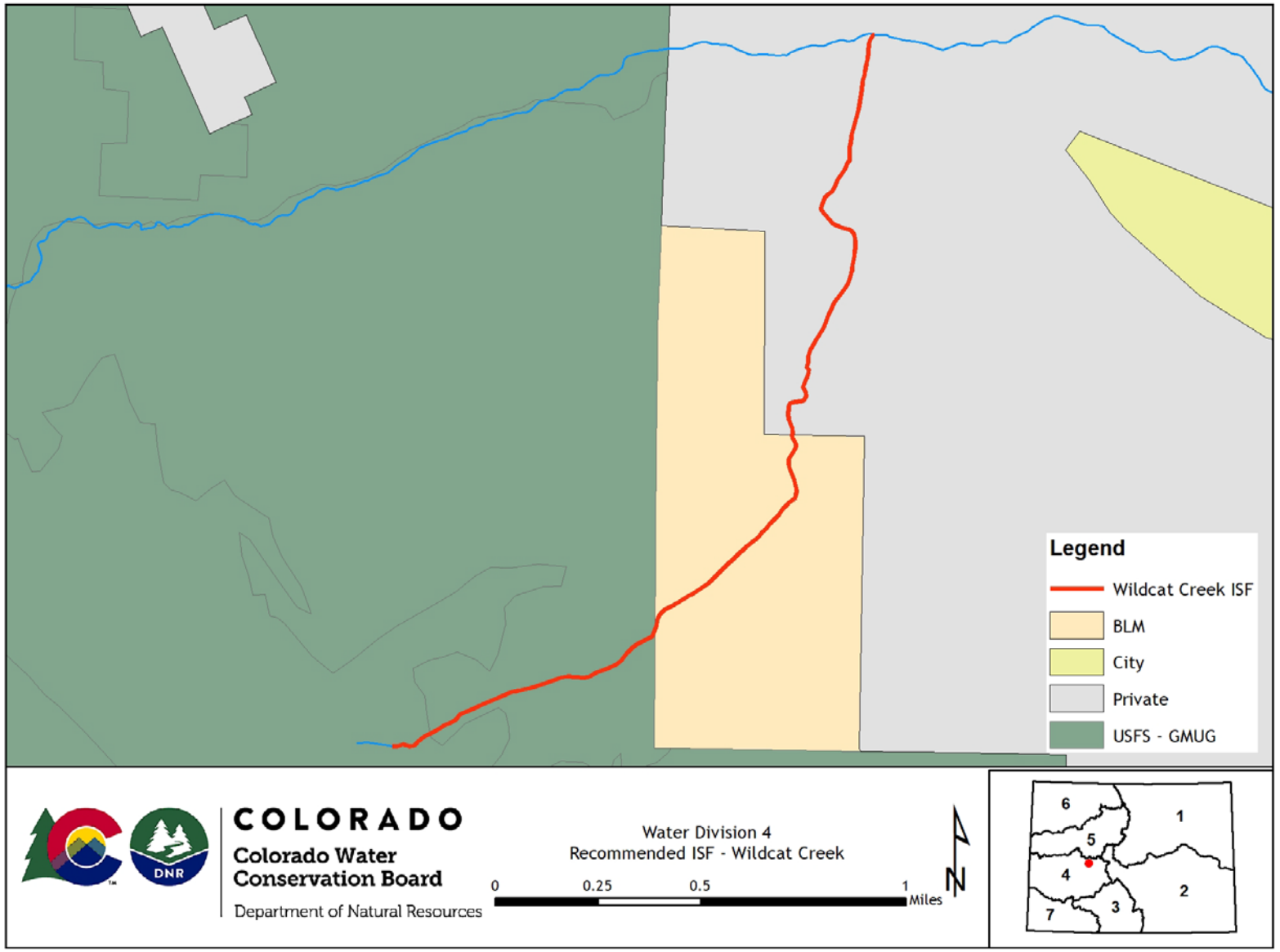
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP

COMPLETE HYDROGRAPH